Mollusca

Molluscs probably form the second largest phylum in the animal kingdom. The phylum comprises eight individual classes: Caudofoveata, Solenogastra, Monoplacophora, Polyplacophora (chitons), Gastropoda (snails and slugs), Scaphopoda (tusk shells), Bivalvia (clams, mussels and relatives) and Cephalopoda (octopuses, squid and cuttlefishes). Each of these classes has its own variation on the general molluscan body plan. Molluscs range in size from less than 1 millimetre to over 8 metres body size (giant squid). Molluscs are characterized by a hard, calcareous shell, although this shell is absent or highly rudimentary in some classes and families. The body is bilaterally symmetrical and unsegmented, and largely made up of soft tissues. Characteristic features are the head (except for the Bivalvia), the large, muscular foot, the mantle and the mantle cavity.

Most molluscs are restricted to water and most species live in the marine environment. Representatives of the marine Mollusca have been found from the high tide mark down to depths of over 10 km. Molluscs inhabit all kinds of habitats. Free-swimming, sessile as well as burrowing species occur. During the surveys for this atlas, a total of 77 mollusc species have been identified, including 18 gastropod species and 57 bivalve species. The species dealt with in this atlas all belong to one of the two classes described below.

Gastropoda

The shell of snails is open at one end and exists of one or more whorls, which are normally coiled clockwise. In most marine snails the shell is closed by an operculum when the snail retreats into the shell. The snail carries this calcareous operculum on the dorsal side of the foot.

The soft body is divided in a visceral hump, a head, a foot and a mantle. The visceral hump, which holds most of the vital organs, is always entirely enclosed in the shell. In most species this mantle is partly modified into a siphon for respiration. The mouth holds a ribbon-like structure, the radula, which is often set with numerous teeth. The radula is used for scraping food off the substrate. In marine animals the eyes are mostly located at the base of the tentacles.

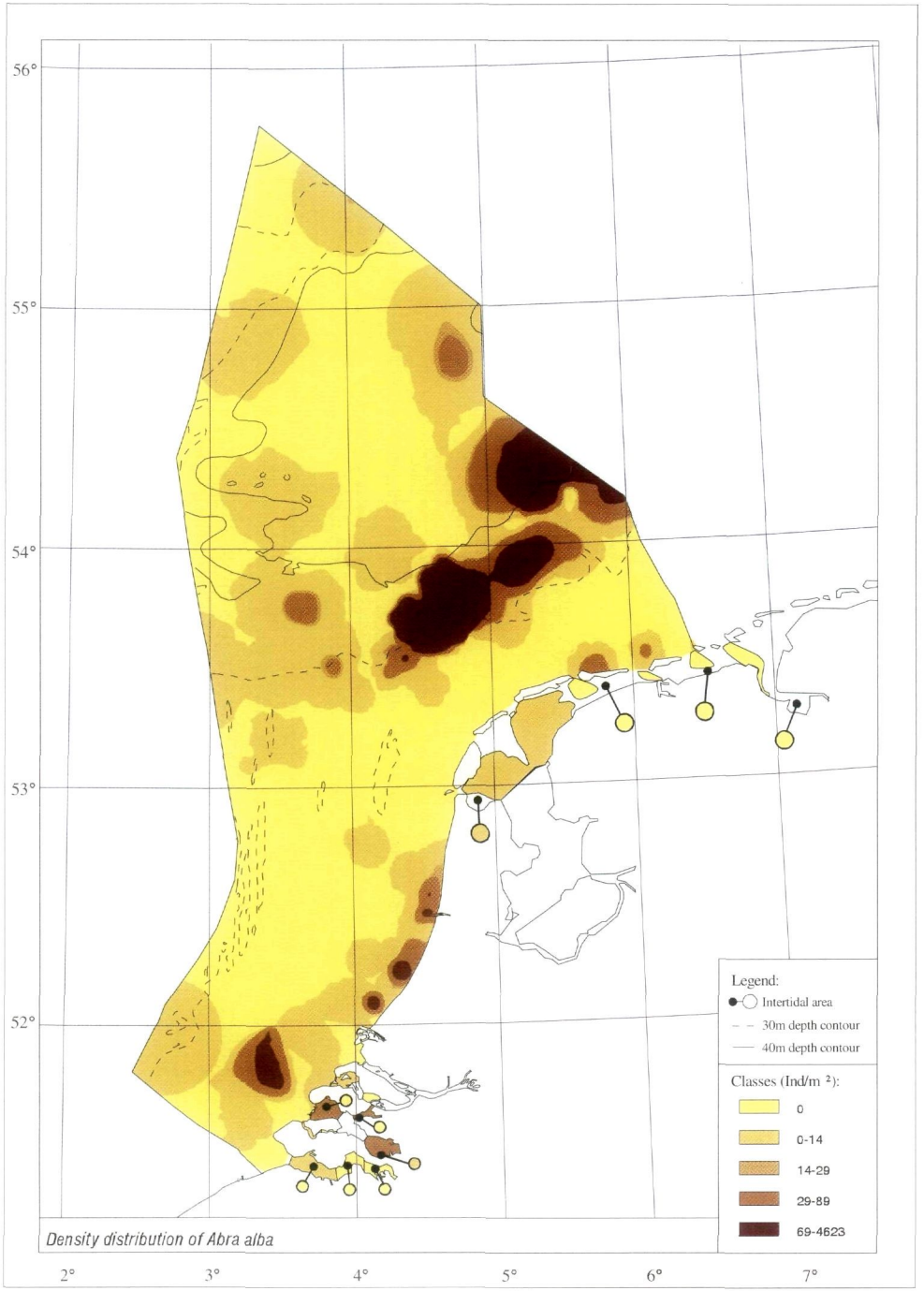
The typical gastropod larva is called a veliger. The veliger larva has a tiny shell and feeds on diatoms and small plankton.

Bivalvia

Bivalves have a laterally compressed shell, composed of two halves. The shell is opened passively by an elastic ligament near the top of the shell. Closing occurs actively by one or two transverse muscles. The animal, which lacks a head, is totally enclosed by the shell.

The gills, located in the mantle cavity, are also used for collecting food. Water passed through the cavity by the working of cilia is filtered by the gills. In burrowing species parts of the mantle are modified into an inhalant and an exhalant siphon for the transport of water.

Sexes are normally separate and fertilization external. The typical bivalve larva is called a rotiger. Most bivalves are suspension or deposit feeders. Only a few are carnivorous.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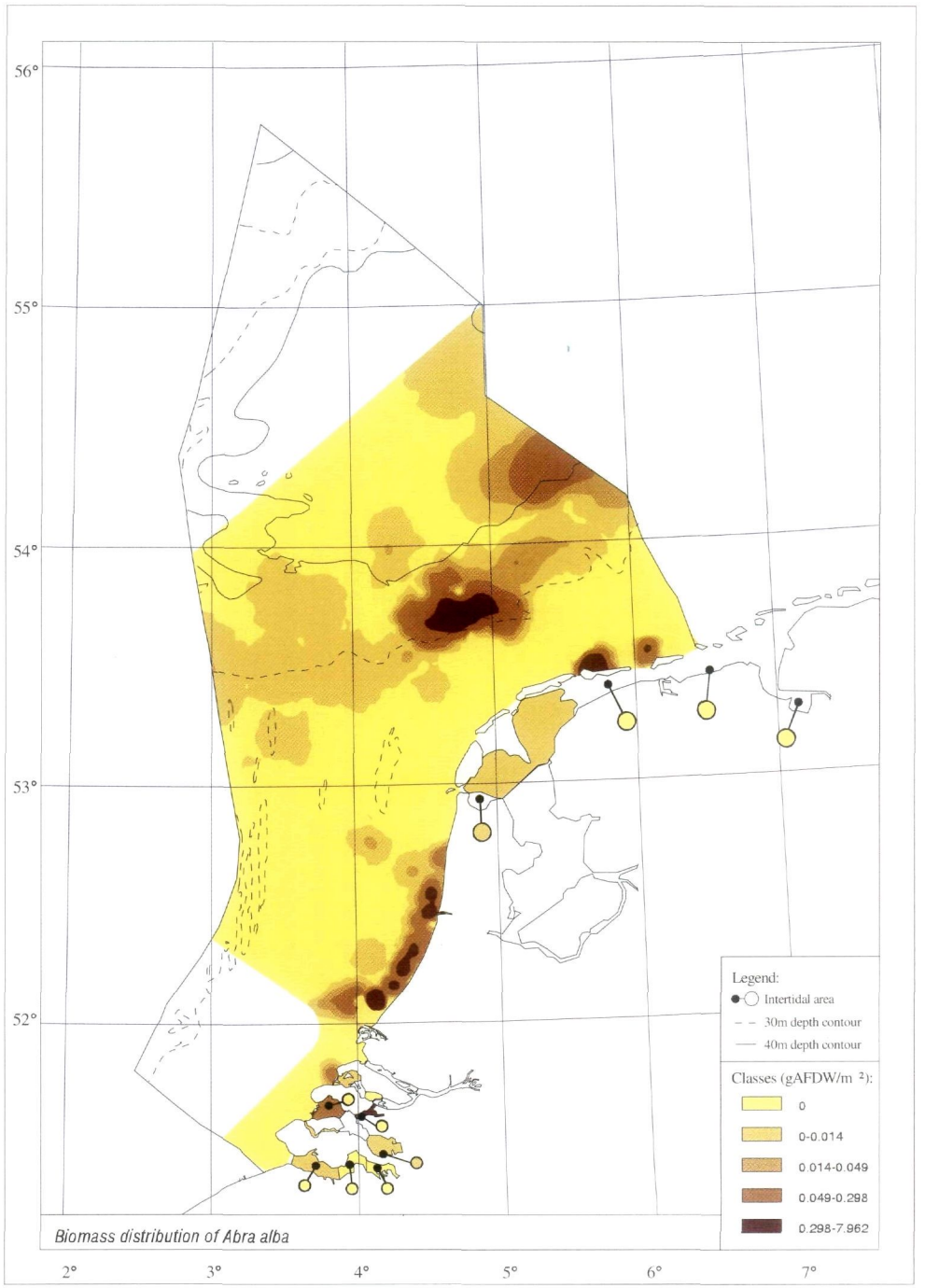
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-14
14-29
29-89
69-4623
Density distribution of Abra alba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Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-0.014
0.014-0.049
0.049-0.298
0.298-7.962
Biomass distribution of Abra alba

A. GMELIG MEYLING SR. / FOTO ARCHIEF STICHTING 'ANEMOON'

Abra alba

WOOD / 1802

English
White furrow shell
Dutch
Witte dunschaal
German
Kleine Pfeffermuschel
Weiße Pfeffermuschel

Synonym(s)
Syndosmya alba

Morphology

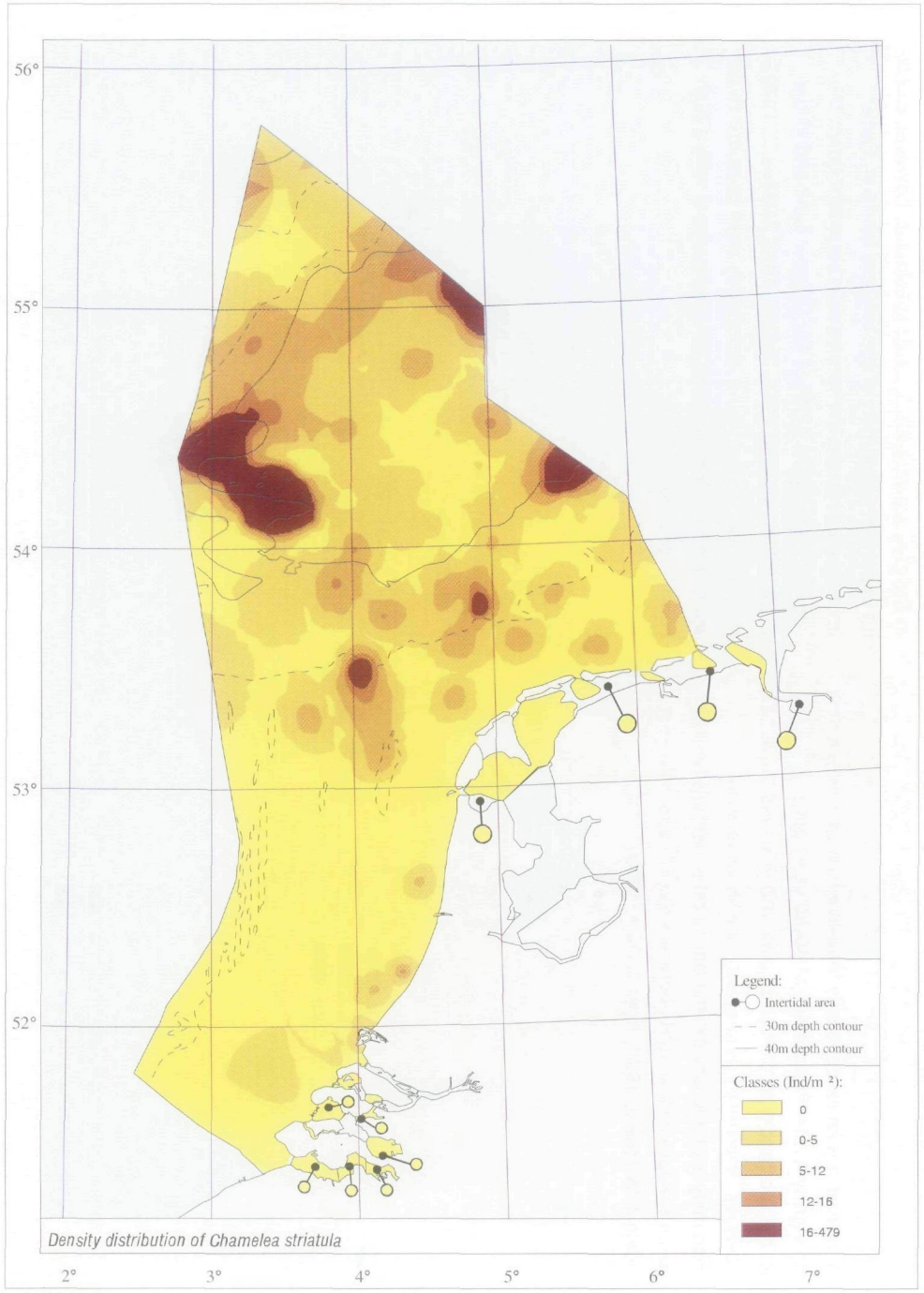
A. alba has a thin and brittle shell, broadly oval in outline. It is up to 25 mm long and has a sculpture of fine concentric lines. The growth stages are clear. The shell is white in colour, covered with a light brown periostracum. The interior of the shell is white (Tebble, 1966; Hayward & Ryland, 1990).

Biology

The production of a large number of small-sized eggs suggests that *A. alba* has a larval development with a long pelagic life. The optimal spawning period of the bivalve lies between May and August. The first postlarvae have a shell length of between 200 and 300 µm. Specimens that settle in early summer grow rapidly, while another spatfall in late summer or autumn apparently does not grow until the following spring (Wolff, 1973; Nott, 1980; Bachelet & Cornet, 1981). Most specimens of *A. alba* live only one year, reaching modal lengths of 12-14 mm. Specimens that live for two years grow to 13-16 mm and the maximum length reached is 20-25 mm. The abundance of *A. alba* typically fluctuates widely from year to year due to variation in recruitment success or adult mortality. *A. alba* is capable of rapidly exploiting any new disturbed substratum suitable for colonization, either through larval recruitment, secondary settlement of post-metamorphosis juveniles or re-distribution of adults following storms (Bosselmann, 1991; Rees & Dare, 1993).
A thin-shelled selective deposit feeder, *A. alba* is typically found in the top 1-2 cm of the sediment, feeding on the organic matter present on or in the sediment. It is a common food item for *Asterias rubens* and bottom fish, especially plaice (Ziegelmeier, 1957; Wolff, 1973; Rees & Dare, 1993).
A. alba and *Tellina fabula* are two species occupying the same feeding niche since both can feed on deposited as well as suspended material. Competition between the species may result in the slow growth of the later settling *T. fabula* (Bosselmann, 1991).

Distribution

In the investigated area *A. alba* is very abundant in the south-eastern part of the Oyster Ground and the Frisian Front area. The bivalve is also present near the Dutch coast and in the Voordelta area, where its distribution extends into the Westerschelde and the Grevelingenmeer. The highest densities in the Delta area are found in the Oosterschelde. In the western part of the Wadden Sea and at the Balgzand the species is present in low densities. Highest biomass is found along the Dutch coast and in the central part of the Frisian Front area. Other investigations found the species to be confined to a more or less narrow strip of sea bottom near the shore (Eisma, 1966; Tebble, 1966; Wolff, 1973; Hayward & Ryland, 1990; Rees & Dare, 1993).
A. alba is a characteristic inhabitant of muddy deposits in the study area. Its absence in more offshore parts of the North Sea is most probably due to the grain size of the sediment (Tebble, 1966; Wolff, 1973; Mulder *et al.*, 1988; Rees & Dare, 1993).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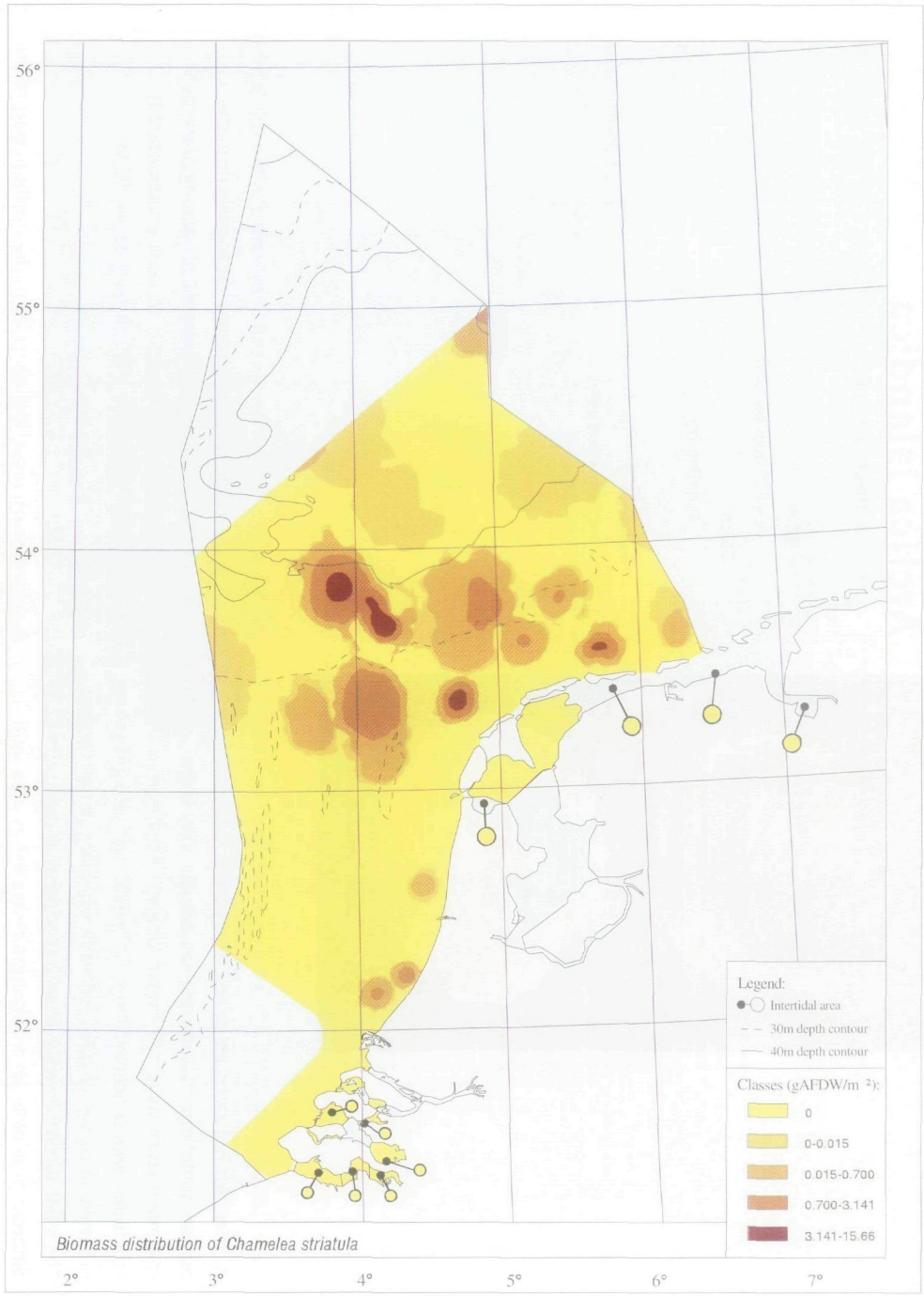
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-5
5-12
12-16
16-479
Density distribution of Chamelea striatula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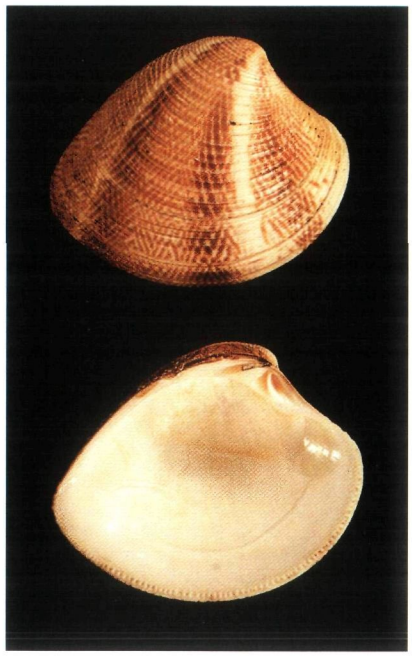
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-0.015
0.015-0.700
0.700-3.141
3.141-15.66
Biomass distribution of Chamelea striatula



A. GMELIG MEYLING SR / FOTO ARCHIEF STICHTING 'ANEMOON'

Chamelea striatula

DA COSTA / 1778

English
Striped Venus

Dutch
Venusschelp

German
Gestreifte Venusmuschel

Synonym(s)
Chamelea gallina
Venus gallina
Venus striatula

Morphology

C. striatula has a solid, thick shell, broadly triangular in outline. Large specimens measure 45 mm in length. A sculpture of numerous fine, concentric ridges covers the shell. The growth stages are clear. The shell is dirty white, cream or pale yellow in colour, usually with 3 broad, reddish-brown rays running from the umbo to the edge. It frequently has numerous, very fine chestnut or pinkish streaks. The inside of the shell is coloured like the outside, but normally fainter (Tebble, 1966; Fish & Fish, 1989; Hayward & Ryland, 1990).

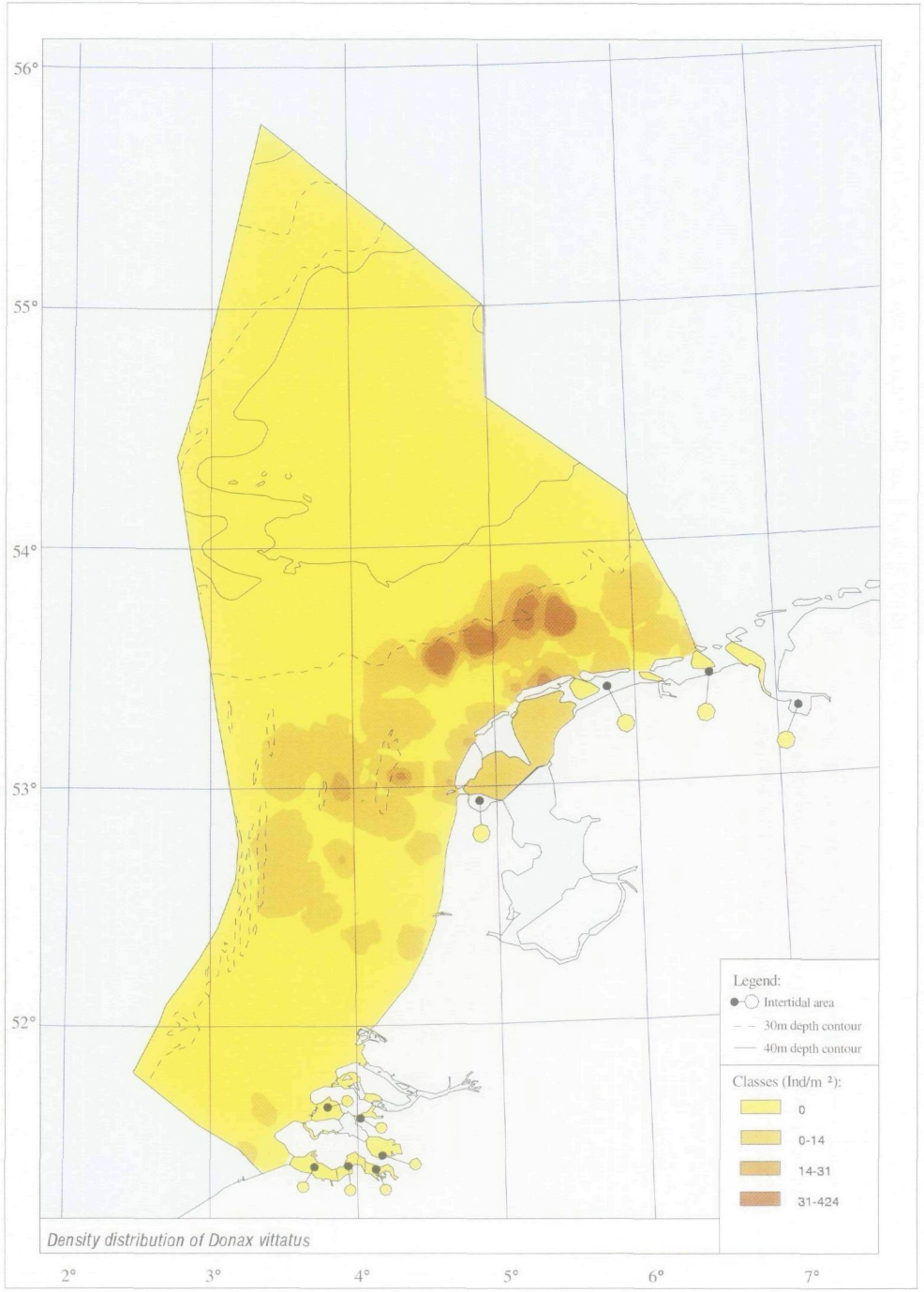
Biology

C. striatula has separate sexes. Breeding takes place during spring and summer. Free-swimming larvae are common in the plankton during autumn. Longevity is believed to be about 10 years (Wolff, 1973; Fish & Fish, 1989; Bosselmann, 1991). Because of its short siphons *C. striatula* is confined to the upper layer of the sediment. This species is a suspension-feeder (Wolff, 1973).

Distribution

C. striatula mainly lives in the northern part of the area. The highest densities are found south of the Dogger Bank and in the northern part of the Cleaver Bank. The species also occurs at some locations in the Southern Bight, mainly near the shore, but is absent from the Brown Bank, the Broad Fourteens and the brackish waters.

C. striatula generally occurs in muddy, fine sand bottoms, but is also found in clean sand (Ziegelmeier, 1957; Tebble, 1966; Wolff, 1973; Fish & Fish, 1989; Hayward & Ryland, 1990).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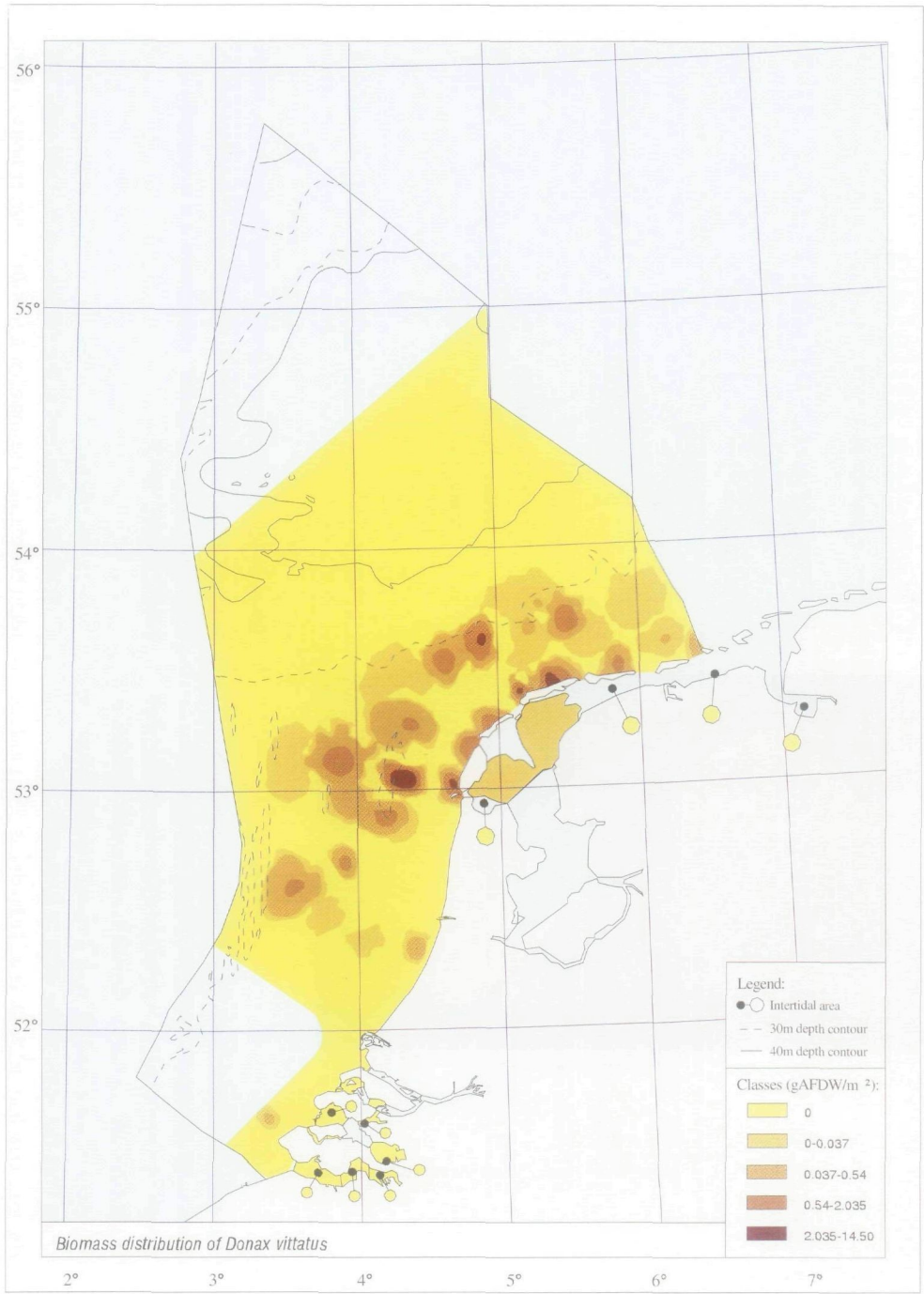
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-14
14-31
31-424
Density distribution of Donax vittatus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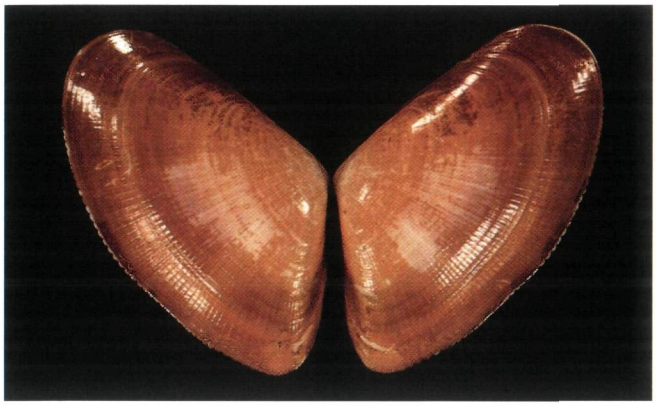
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-0.037
0.037-0.54
0.54-2.035
2.035-14.50
Biomass distribution of Donax vittatus



A. GMELIG MEYLING SR / FOTO ARCHIEF STICHTING 'ANEMOON'

Donax vittatus

DA COSTA / 1778

English

Banded wedge-shel

Dutch

Zaagje

German

Gebänderte Dreiecksmuschel

Gebänderte Sägemuschel

Morphology

D. vittatus has a solid, wedge-shaped shell, somewhat triangular in outline. It is rarely larger than 38 mm. A sculpture of fine concentric grooves and numerous fine radiating striations covers the shell. The inner ventral margin is toothed. The growth stages are clear. The shell is coloured white, yellow, brown or purple, or various shades of these. The interior of the shell is white or stained purple, sometimes tinted yellow or orange (Tebble, 1966; Fish & Fish, 1989; Hayward & Ryland, 1990).

Biology

Breeding occurs during the summer months. *D. vittatus* probably has pelagic larvae. When growth is rapid, it lives for two to three years. Otherwise, the life span may be up to seven years.

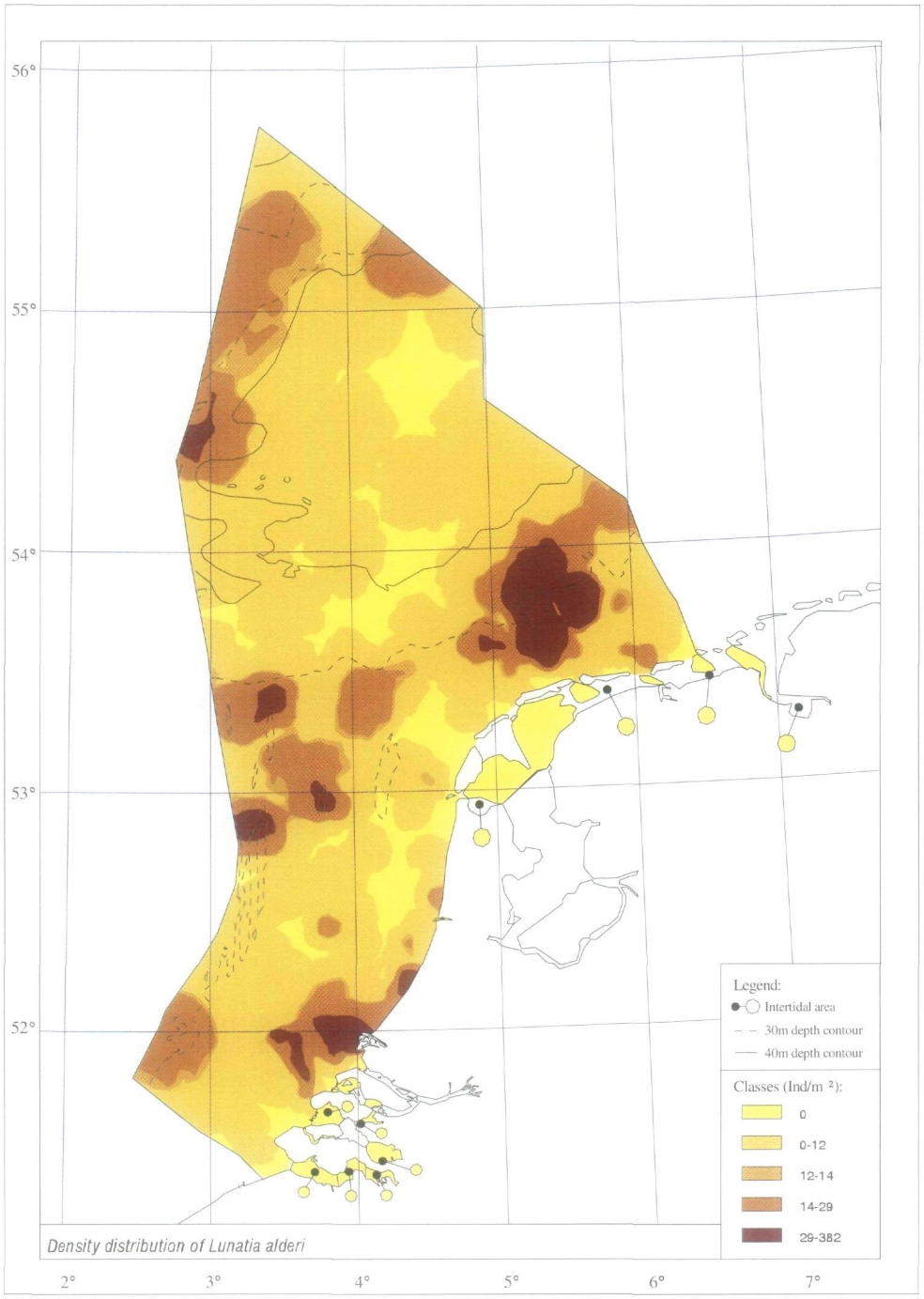
D. vittatus lives just below the sediment surface and is often dislodged by wave action. Its large, powerful foot enables it to reburrow immediately and so reduce the danger of predation (Fish & Fish, 1989).

This species is a suspension feeder (Wolff, 1973).

Distribution

D. vittatus is found exclusively in the southern part of the North Sea, at depths of less than 30 m. It furthermore occurs in low densities in the western part of the Dutch Wadden Sea. Highest densities are found south of the Frisian Front area. The corresponding low biomass in this area indicates that this concerns juvenile specimens. The highest biomasses are found north of Terschelling and west of Texel. Several other studies report the species from the lower shore to a depth of about 20 m, with a more or less regular distribution and only a few specimens per m^2 (Eisma, 1966; Tebble, 1966; Hayward & Ryland, 1990).

In the Dutch part of the North Sea *D. vittatus* prefers clean fine sand (cf. Ziegelmeier, 1957).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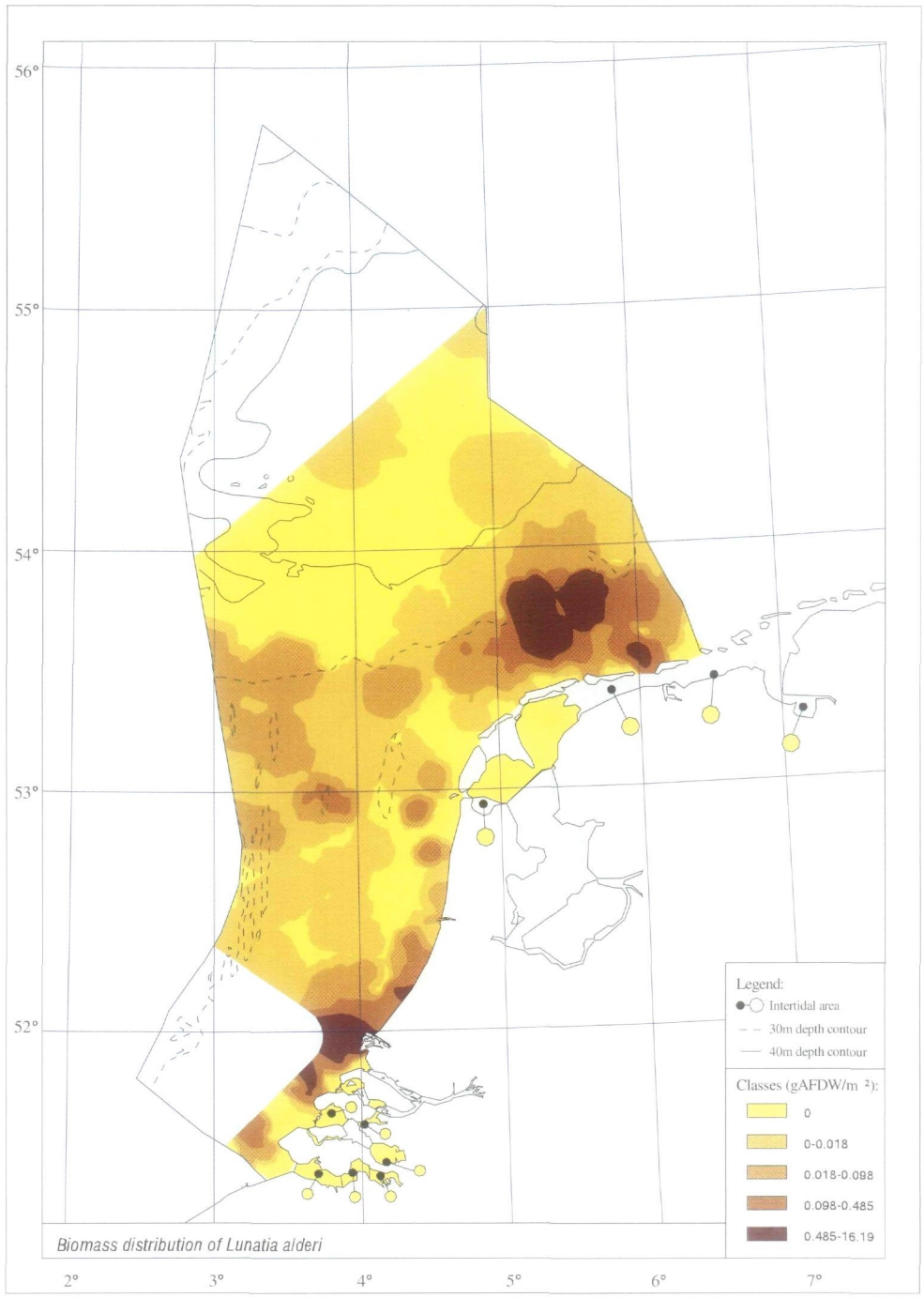
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-12
12-14
14-29
29-382
Density distribution of Lunatia alderi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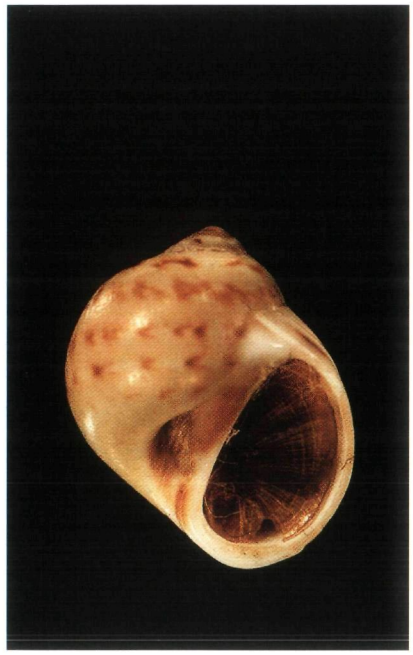
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-0.018
0.018-0.098
0.098-0.485
0.485-16.19
Biomass distribution of Lunatia alderi



A. GMELIG MEYLING SR / FOTO ARCHIEF STICHTING 'ANEMOON'

Lunatia alderi

FORBES / 1838

English
Common necklace shell

Dutch
Glanzende tepelhoren

German
Glänzende Nabelschnecke

Synonym(s)
Euspira poliana
Euspira nitida
Natica poliana
Natica alderi
Lunatia intermedia
Lunatia poliana

Morphology

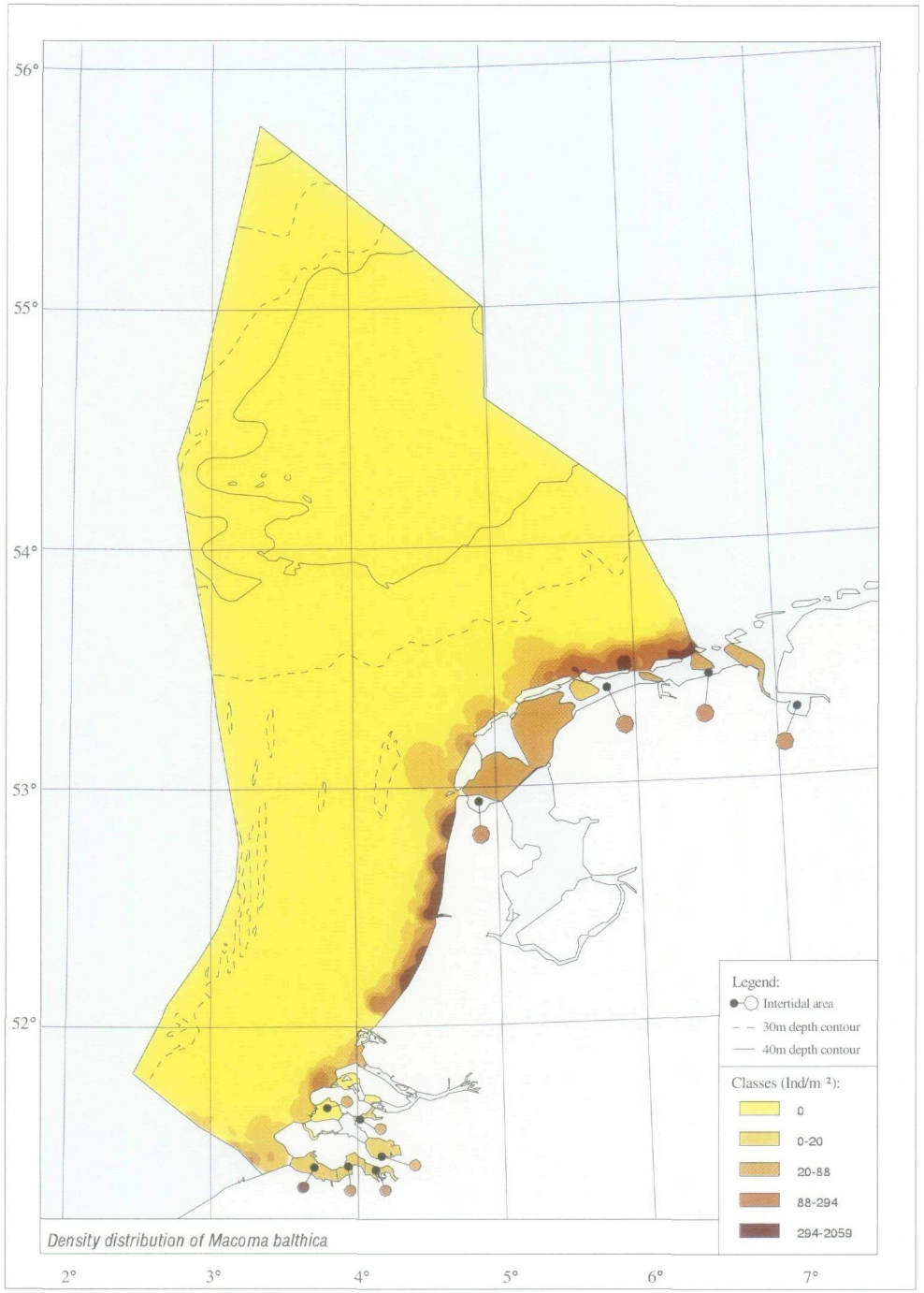
This gastropod has a glossy, globose shell with six or seven slightly tumid whorls. It measures up to 16 mm in height. The shell is sculptured with numerous fine growth lines, but appears smooth to the naked eye. It is buff or light horn-coloured, with the columella and the base paler. The body whorl is decorated with five spiral rows of brown marks (Hayward & Ryland, 1990).

Biology

L. alderi is a predator. It attacks its prey, mainly bivalve molluscs, in the sediment, breaking through the shell using its radula (Eisma, 1966; Ziegelmeier, 1966).

Distribution

L. alderi occurs in the whole area, but is relatively abundant along the coast and south of the Frisian Front, where maximum biomass values were observed.
L. alderi lives in a variety of habitats. It is found on muddy, sandy as well as gravel deposits (Ziegelmeier, 1966; Entrop, 1976; Hayward & Ryland, 1990).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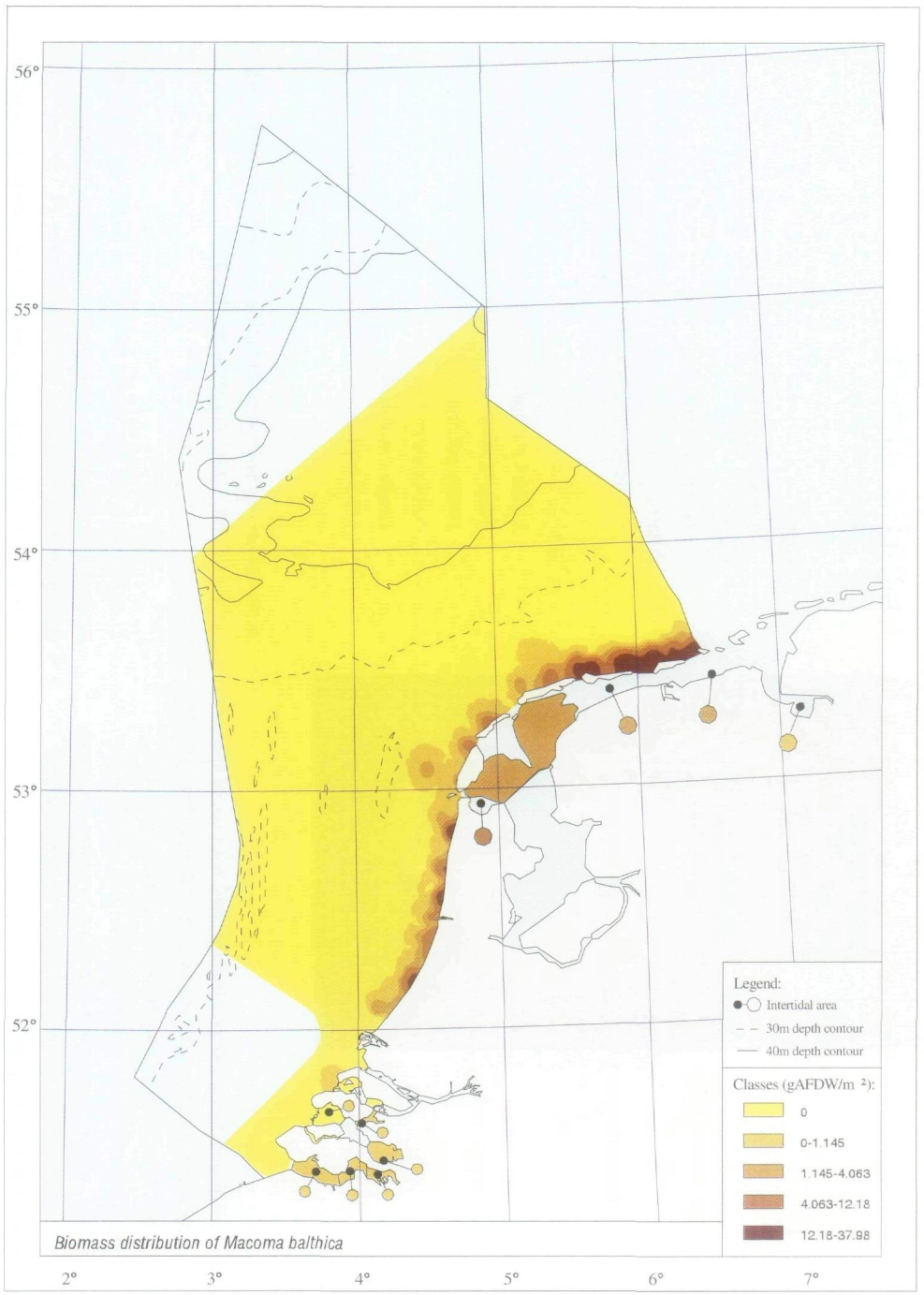
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-20
20-88
88-294
294-2059
Density distribution of Macoma balthica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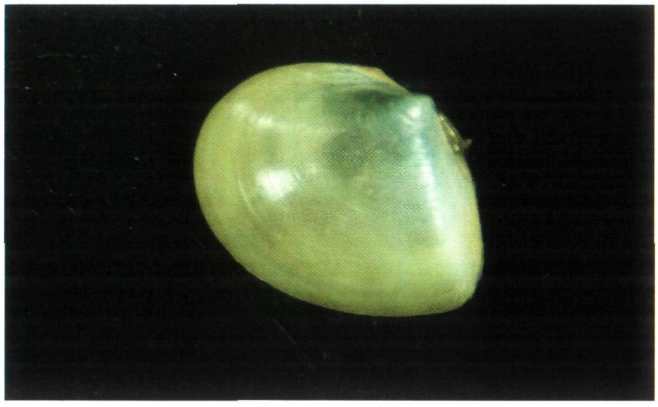
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-1.145
1.145-4.063
4.063-12.18
12.18-37.98
Biomass distribution of Macoma balthica



A. ENGELBERTS

Macoma balthica

LINNEAUS / 1758

English

Baltic tellin

Dutch

Nonnetje

German

Baltische Tellmuschel

Rote Bohne

Plattmuschel

Morphology

M. balthica has a broadly oval shell, somewhat inflated anteriorly. It is up to 25 mm in length. The shell surface is smooth, sculptured with very fine concentric lines. The growth stages are clearly visible, usually marked by bands of colour. It is very variable in colour, with shades of white, yellow, pink or purple, often drawn out in concentric bands. The interior of the shell is white or purple, or a shade of the external colour (Tebble, 1966; Fish & Fish, 1989; Hayward & Ryland, 1990).

Biology

M. balthica has separate sexes. The main breeding period lies between February and May, with a second spawning in autumn. The free-swimming veliger larva has a pelagic life of up to seven or eight weeks. When growth is fast, longevity is about three years, but in slow growing populations specimens live for six or seven years (Fish & Fish, 1989; Zwarts *et al.*, 1992).

The bivalve lives buried below the surface, maintaining contact with the overlying water by means of the inhalant and exhalant siphons (Brafield & Newell, 1961; Fish & Fish, 1989).

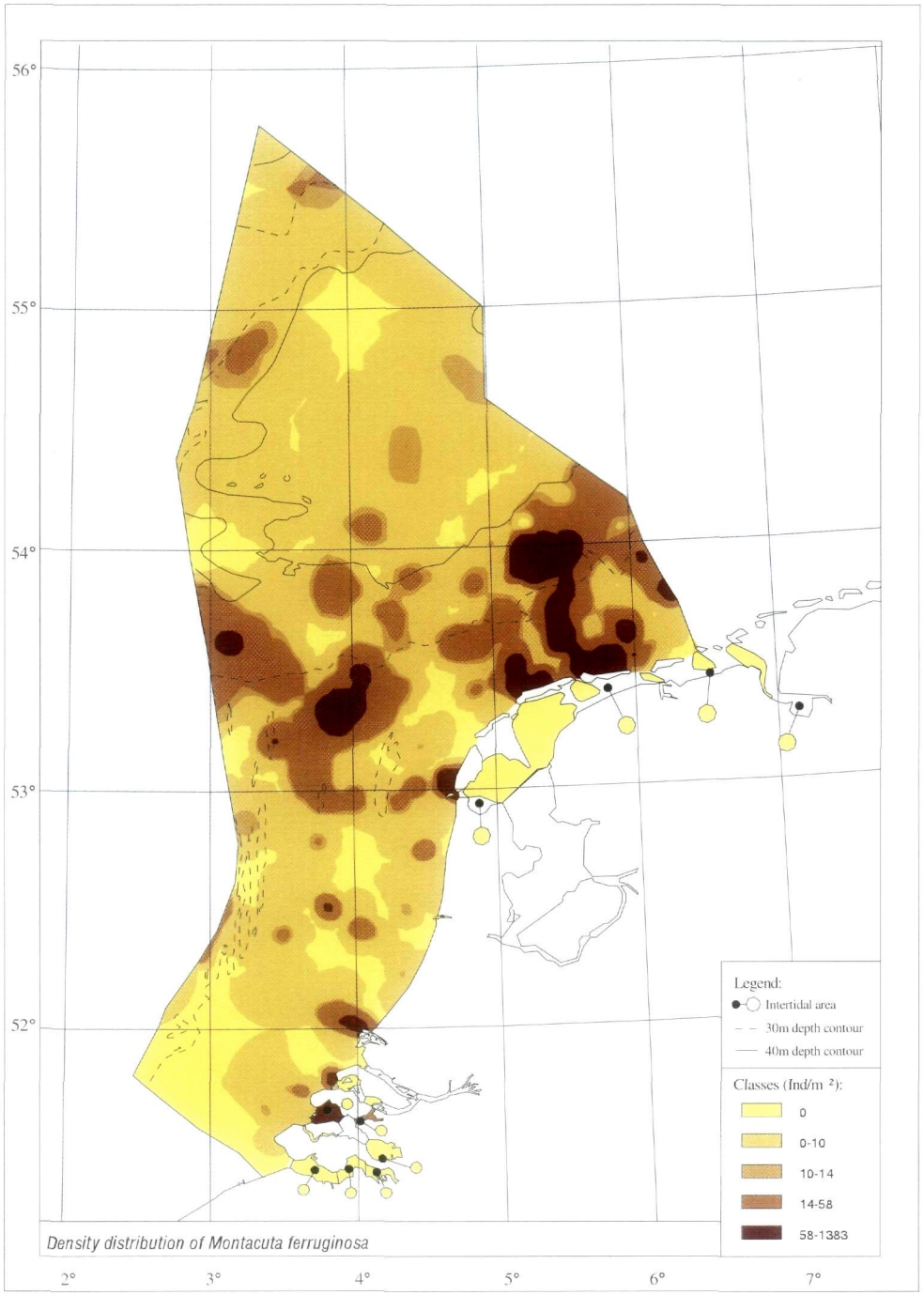
M. balthica is capable of deposit- as well as suspension feeding (Brafield & Newell, 1961; Wolff, 1973; Fish & Fish, 1989). *M. balthica* is able to withstand low winter temperatures. In the Dutch Wadden Sea its abundance increases after cold winters (Beukema, 1979; Beukema & Essink, 1986).

The species is an important prey item for birds such as the knot (Zwarts & Blomert, 1992; Zwarts *et al.*, 1992).

Distribution

M. balthica occurs from the upper part of the intertidal down to the shallow subtidal zone. In the study area it is confined to the Wadden Sea, the Delta estuaries and a narrow zone along the coast. It has not been recorded from depths over 25 m in the open North Sea. The highest biomasses are found along the Dutch coast and north of Ameland and Schiermonnikoog. A comparable distribution pattern has been recorded during an earlier investigation in 1964 (Eisma, 1966).

M. balthica occurs in muddy sediments with a preference for relatively high silt-clay percentages.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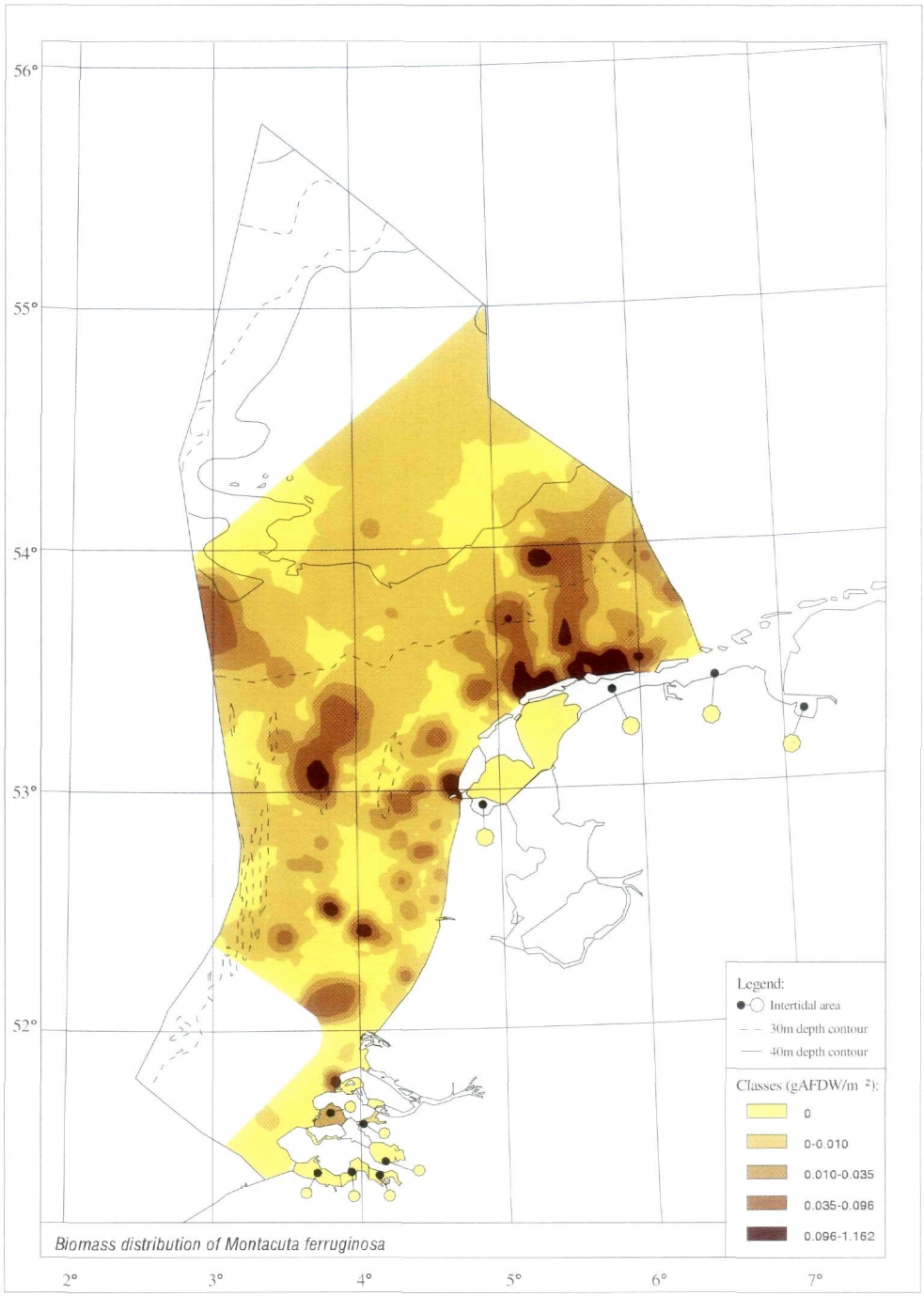
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-10
10-14
14-58
58-1383
Density distribution of Montacuta ferruginosa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Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-0.010
0.010-0.035
0.035-0.096
0.096-1.162
Biomass distribution of Montacuta ferruginosa

A. GMELIG MEYLING SR / FOTO ARCHIEF STICHTING 'ANEMOON'

Montacuta ferruginosa

MONTAGU / 1808

Dutch

Ovale zeeklitschelp

Zeeklitmosseltje

German

Rostrote Mondmuschel

Synonym(s)

Tellimya ferruginosa

Morphology

M. ferruginosa has a thin and fragile shell, regularly oval in outline. Large specimens reach 9 mm in length. The sculpture, when visible, consists of fine concentric lines and few radiating striae. The shell is white to light yellowish in colour and usually covered with a thick, granular, rusty red deposit. The inside of the shell is white, sometimes tinted light purple (Tebble, 1966; Fish & Fish, 1989; Hayward & Ryland, 1990).

Biology

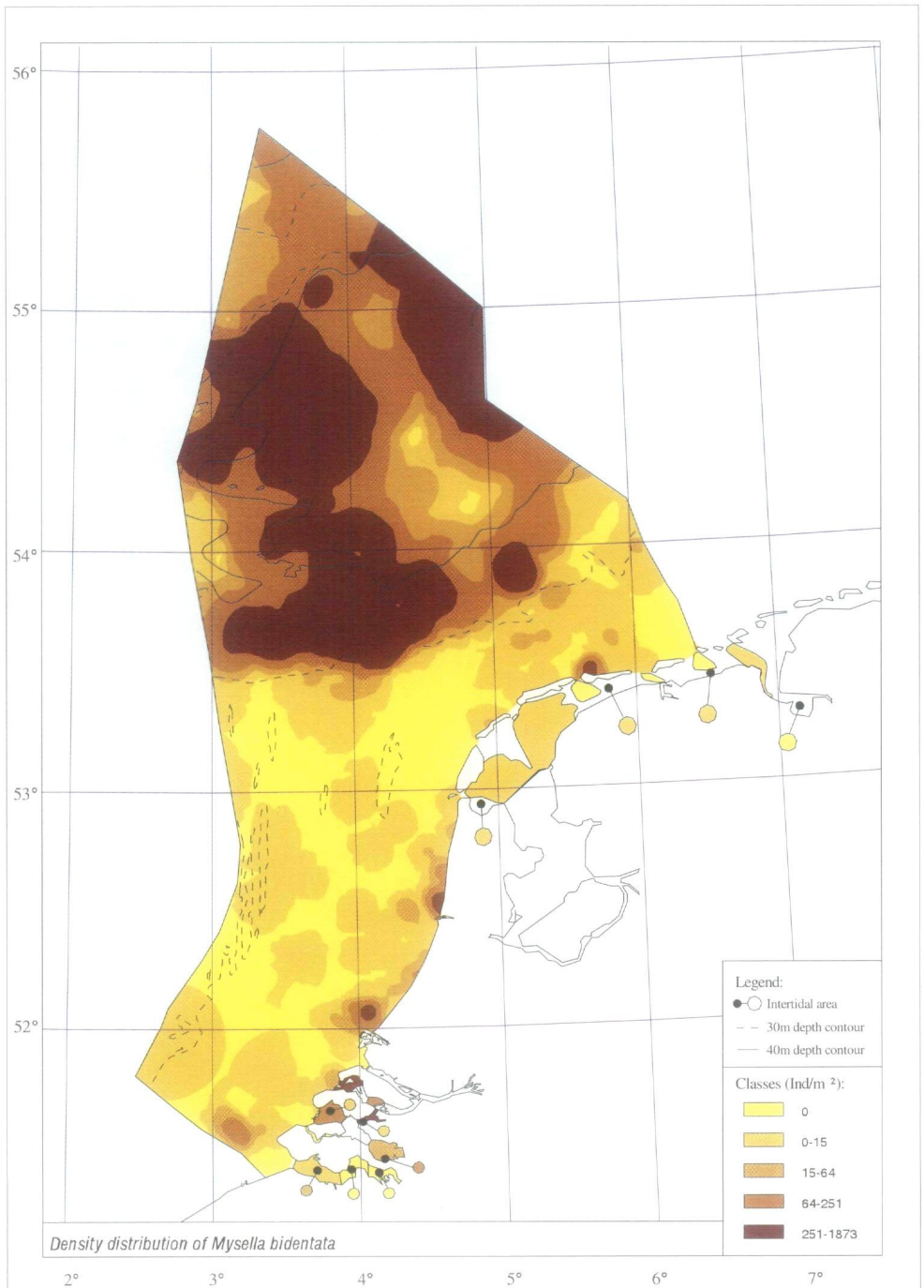
Breeding occurs during the summer months. The eggs are incubated on the gills of the adults. When released, the veliger larvae are believed to have a life span of several months in the plankton before settlement and metamorphosis. The species first matures as a female, later changing into a male (Wolff, 1973; Fish & Fish, 1990).

M. ferruginosa is a commensal of the heart urchin *Echinocardium cordatum* and as many as over 14 specimens have been recorded with a single echinoderm. Adult specimens live freely in the burrow of *E. cordatum*, while the young are attached to the spines of the urchin by byssus threads. Free-living juveniles are able to survive on the sediment for long periods (months) without growing substantially (Tebble, 1966; Fish & Fish, 1989; Hayward & Ryland, 1990; Bosselmann, 1991).

The species is a suspension feeder and presumably has an enriched food supply through its association with *Echinocardium* (Wolff, 1973; Fish & Fish, 1989).

Distribution

M. ferruginosa occurs in the North Sea proper and in the Oosterschelde. The species is particularly abundant along the north coast of the Wadden islands and at some offshore locations. Highest density values are found north of Ameland. The biomass distribution closely resembles the density pattern.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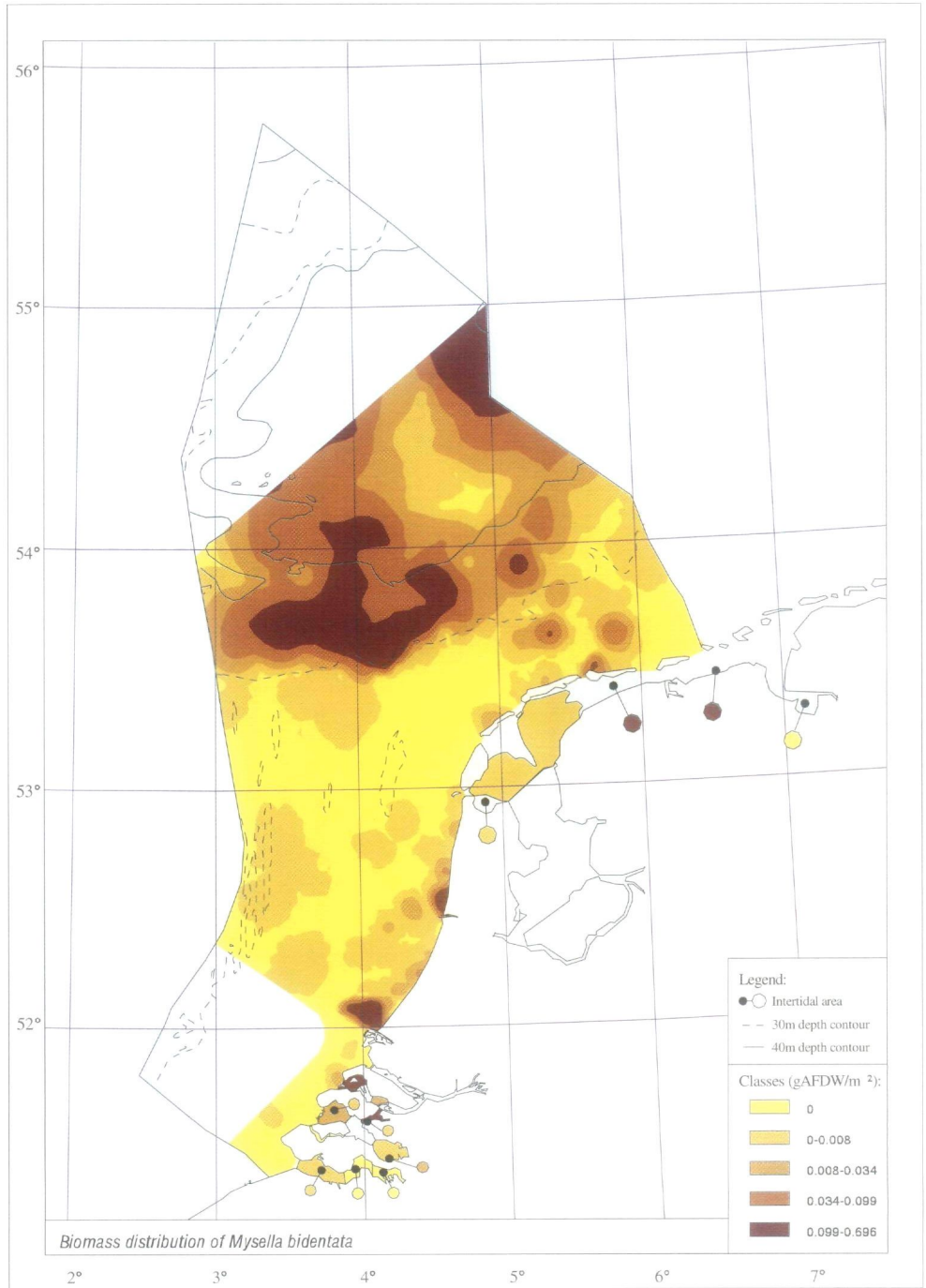
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-15
15-64
64-251
251-1873
Density distribution of Mysella bidentata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Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-0.008
0.008-0.034
0.034-0.099
0.099-0.696
Biomass distribution of Mysella bidentata

A. GMELIG MEYLING SR / FOTO ARCHIEF STICHTING 'ANEMOON'

Mysella bidentata

MONTAGU / 1803

Dutch

Tweetandschelp
Tweetandmosseltje
Dwergmosseltje

German

Kleine Linsenmuschel

Morphology

The shell is thin and fragile, oval in outline. Large specimens reach only 3 mm in length. A sculpture of fine, closely spaced, concentric lines covers the shell. Growth stages are clearly visible. The colour of the shell varies from yellowish white to dark reddish brown and is darkest in the region of the umbo. The inside of the shell is white or translucent (Popham, 1940; Ockelmann & Muus, 1978; Hayward & Ryland, 1990).

Biology

The larvae occur in the plankton from June-July to September-November, often in large quantities. The planktonic stage lasts for about 4 weeks. *M. bidentata* has a maximum life span of 7 years (Wolff, 1973; Ockelmann & Muus, 1978; O'Foighil *et al.*, 1984).

M. bidentata is a commensal of a number of hosts. It has been found together with the brittle stars *Acrocnida brachiata* and *Amphiura filiformis* and in the burrows of the sipunculid *Golfingia*. However, the species seems to be able to live without any host (Popham, 1940; Tebble, 1966; Wolff, 1973; O'Foighil *et al.*, 1984; Hayward & Ryland, 1990).

M. bidentata is a suspension feeder (Wolff, 1973).

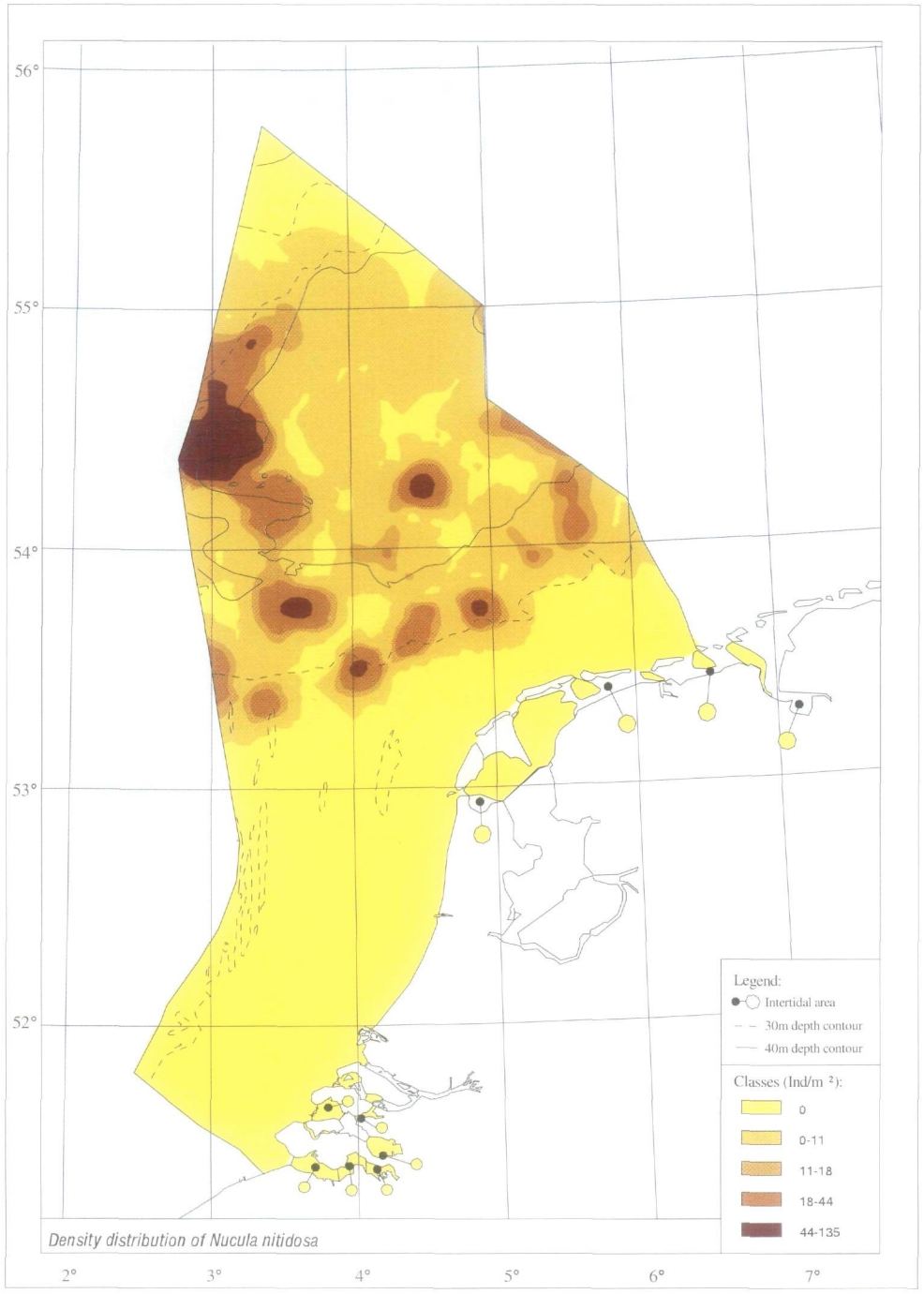
Various infaunal invertebrates, e.g. the polychaetes *Nephtys* and *Lumbrineris,* prey on the juveniles. Small individuals have moreover been found in the gut of *Echinocardium cordatum* (Ockelmann & Muus, 1978).

In the Dutch Wadden Sea the species does not survive extremely cold winters (like in 1962/1963 and 1979). Both winter survival and subsequent spring density are higher when the preceding winter has been warmer (Wolff, 1973; Beukema, 1979).

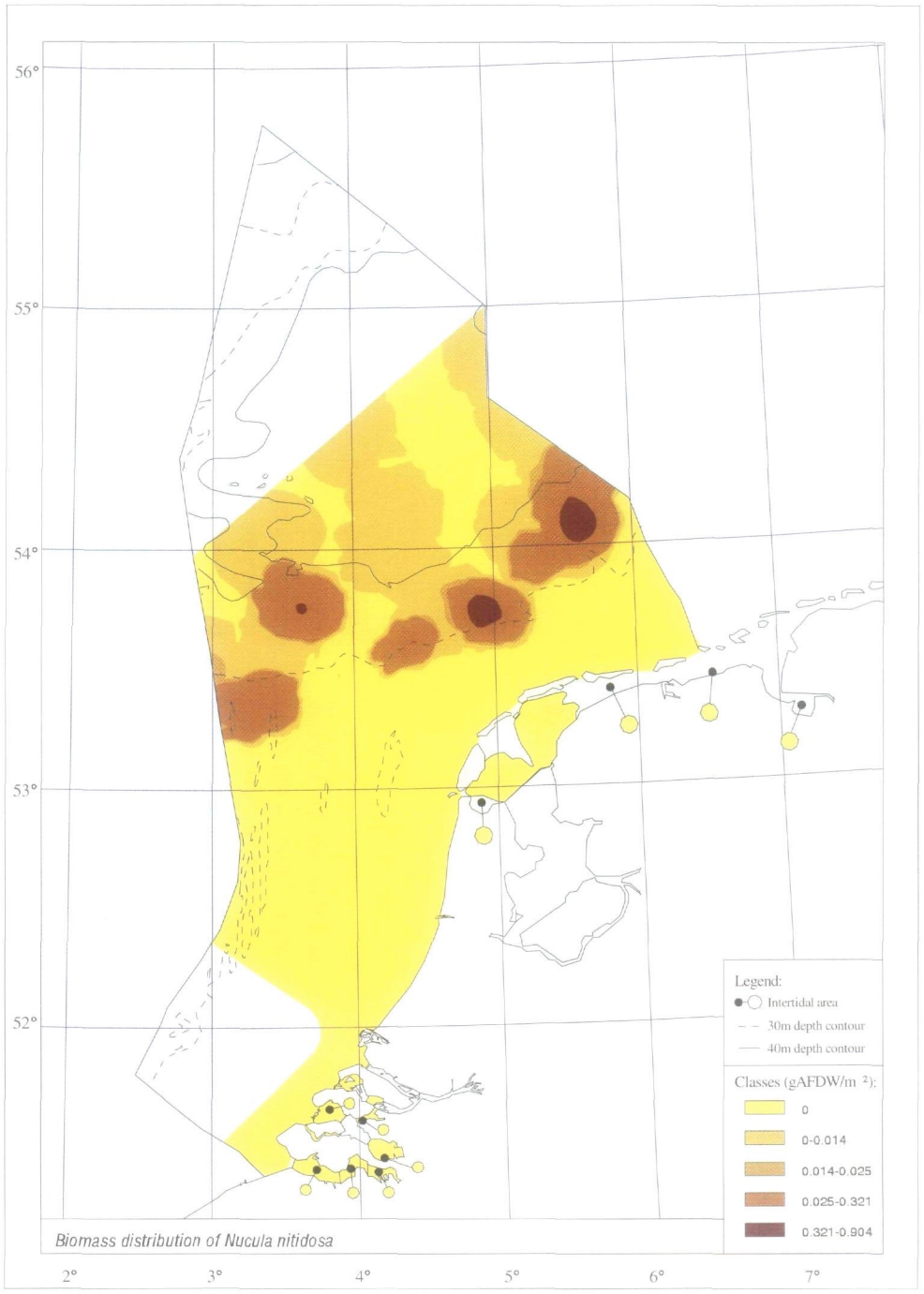
Distribution

M. bidentata is very abundant at the Oyster Ground, where high densities of *A. filiformis* (q.v.) occur, but is also found in the Southern Bight and in the Delta area. In the latter area it is present in high numbers in the Grevelingenmeer and the northern part of the Oosterschelde. In the Dutch Wadden Sea, *M. bidentata* is present from the Balgzand in the western part up to the entrance of river Ems. Due to its small size biomass values are modest with maxima at the Frisian Front.

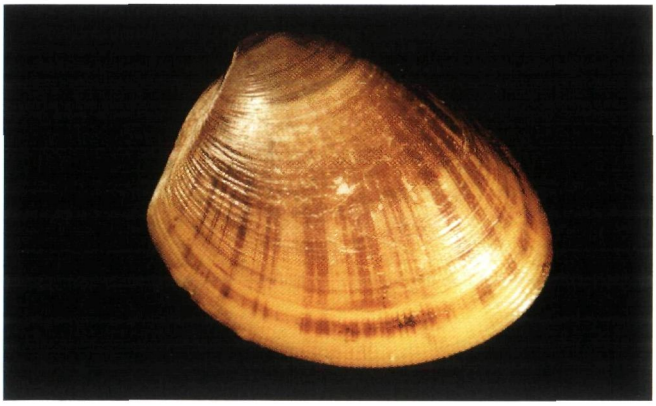
The distribution pattern of *M. bidentata* suggests a preference for muddy fine sand, although the species is also found in clean sand.



Density distribution of Nucula nitidosa



Biomass distribution of Nucula nitidosa



A. GMELIG MEYLING SR / FOTO ARCHIEF STICHTING 'ANEMOON'

Nucula nitidosa

WINCKWORTH / 1930

Dutch

Driehoekige parelmoerneut

Glanzende parelmoerneut

German

Glänzende Nußmuschel

Synonym(s)

Nucula turgida

Nucula nitida

Morphology

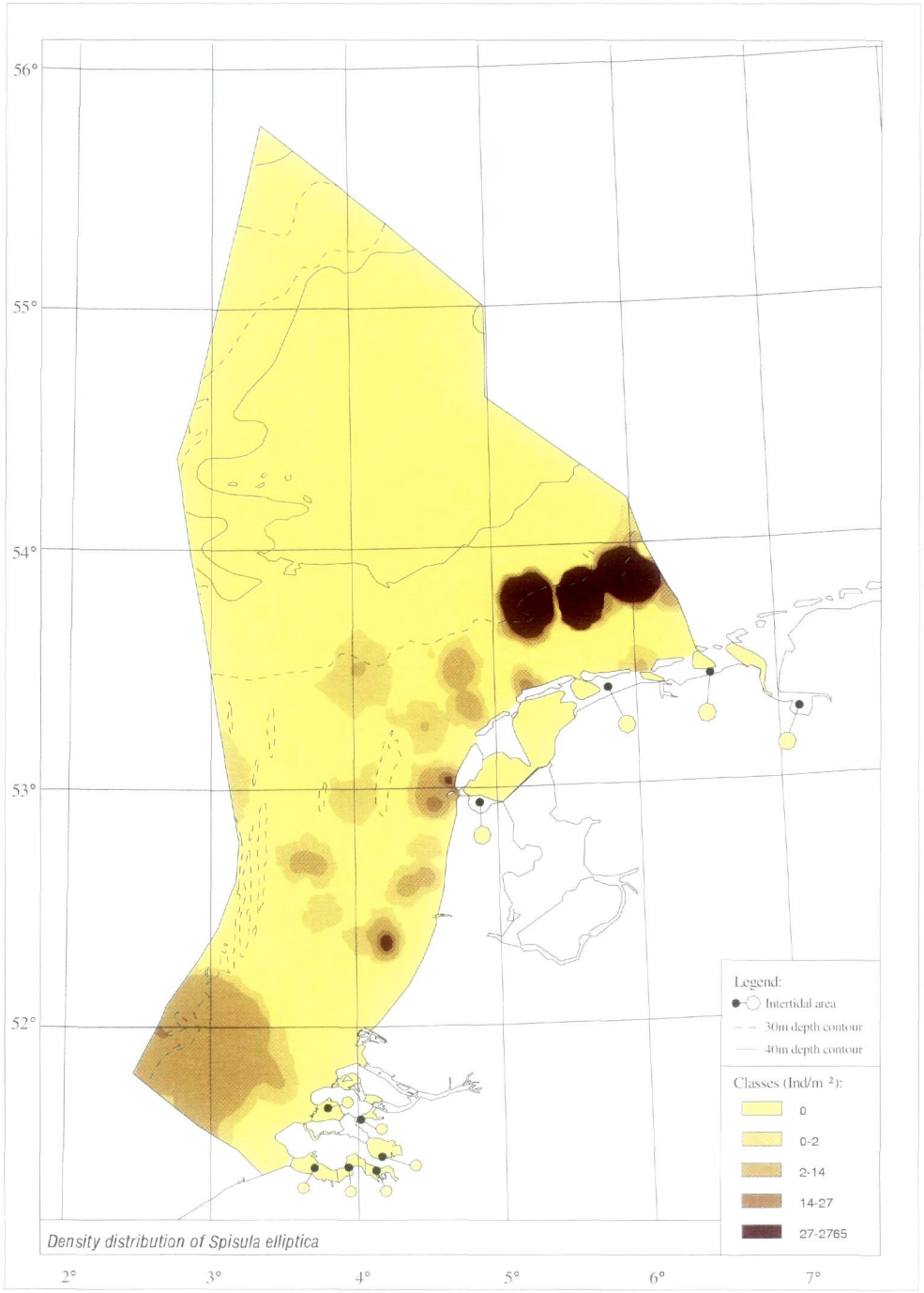
N. nitidosa has a solid shell, triangular in outline. It rarely measures over 13 mm in length. The shell is sculptured with fine radiating ribs and a few concentric lines. The inner ventral margin is crenulate. The growth stages are clear. The hinge line is set with 20-30 teeth anteriorly and 10-14 posteriorly. The shell is white to grey in colour, with blue-grey waves around the growth lines. The periostracum is glossy and coloured olive-yellow. Specimens occasionally have purple-grey rays radiating from the umbones (Tebble, 1966; Hayward & Ryland, 1990).

Biology

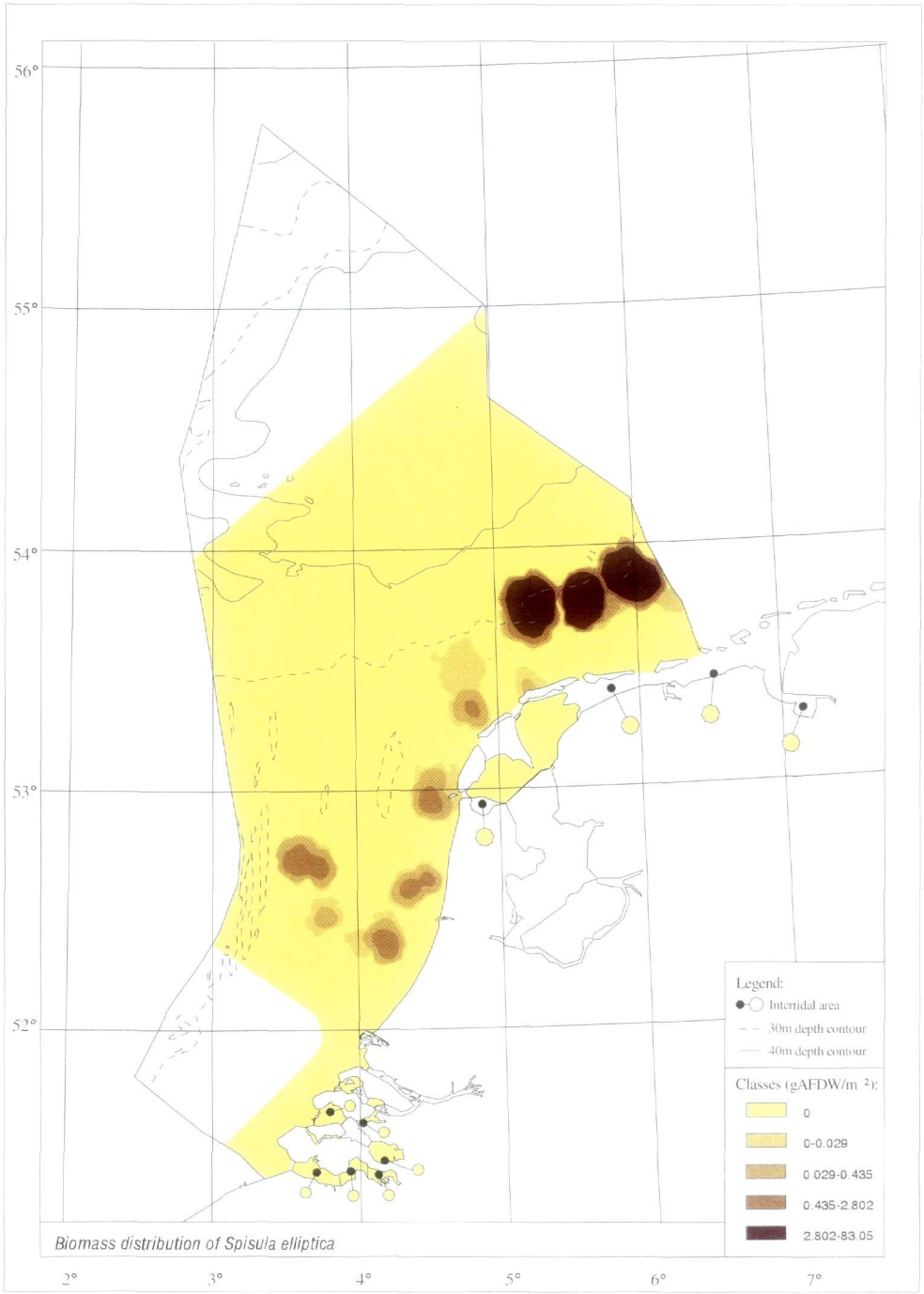
N. nitidosa settles in spring or early summer. It is a slow growing species during the summer and autumn months (Bosselmann, 1991).

Distribution

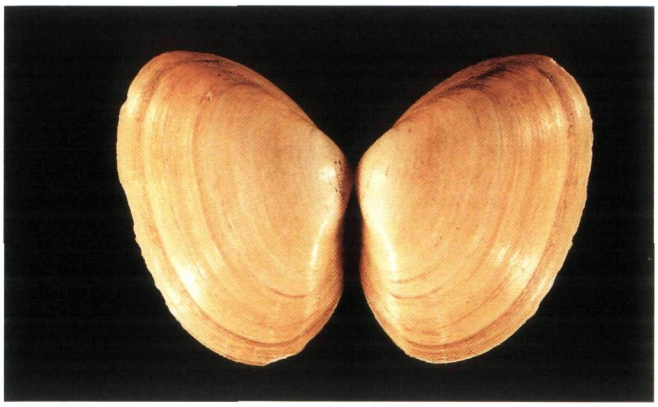
N. nitidosa does not occur in the Southern Bight south of 53°N and apparently prefers fine (muddy) sediment. In the literature however, it is also reported from coarse sand (Tebble, 1966).



Density distribution of Spisula elliptica



Biomass distribution of Spisula elliptica



A. GMELIG MEYLING SR / FOTO ARCHIEF STICHTING 'ANEMOON'

Spisula elliptica

BROWN / 1827

English

Elliptic trough shell

Dutch

Ovale strandschelp

Elliptische strandschelp

German

Elliptische Trogmuschel

Morphology

S. elliptica has a thick and strong shell, subtriangular but distinctly asymmetrical in outline. Large specimens reach up to 32 mm in length. The sculpture consists of fine concentric lines and grooves. The growth stages are clear. The shell is dirty white to cream in colour, with a glossy, white inner surface (Tebble, 1966; Wolff, 1973; Hayward & Ryland, 1990).

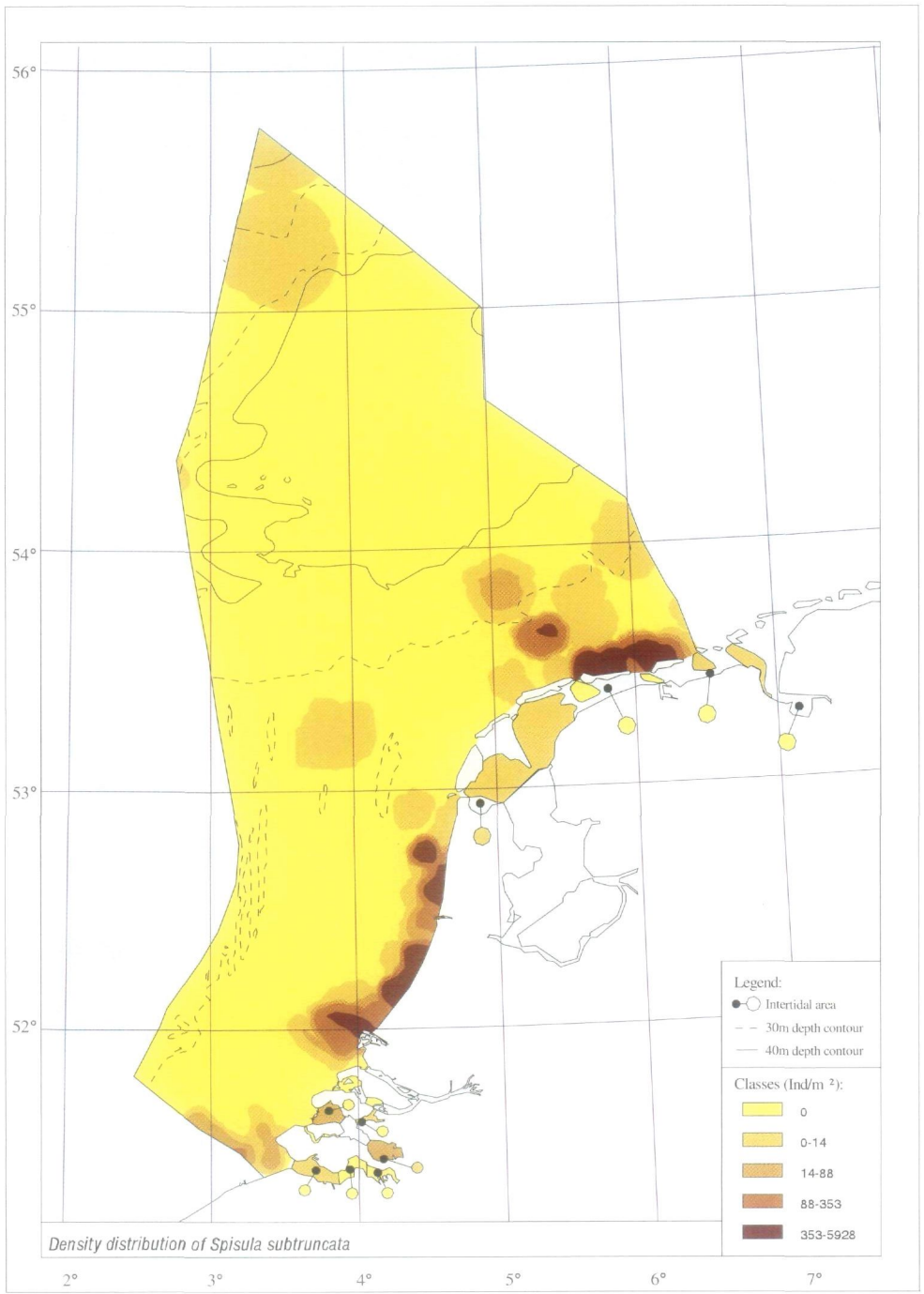
Biology

Because it has been confused with *S. subtruncata* for a long time, little is known about the reproduction of *S. elliptica*. It has a planktonic larval development and is a suspension feeder (Wolff, 1973).

Distribution

S. elliptica has only been found at some locations south of 54°N in the Southern Bight and shows a marked concentration in big patches. The species is not present in the brackish waters. While the closely resembling species *S. subtruncata* is more common near the shore, *S. elliptica* also lives in more offshore parts. This distribution pattern has also been reported in an earlier investigation in 1964 (Eisma, 1966).

S. elliptica occurs in various types of sediment, *viz.* gravel, medium to fine sand and muddy sand (Tebble, 1966; Wolff, 1973).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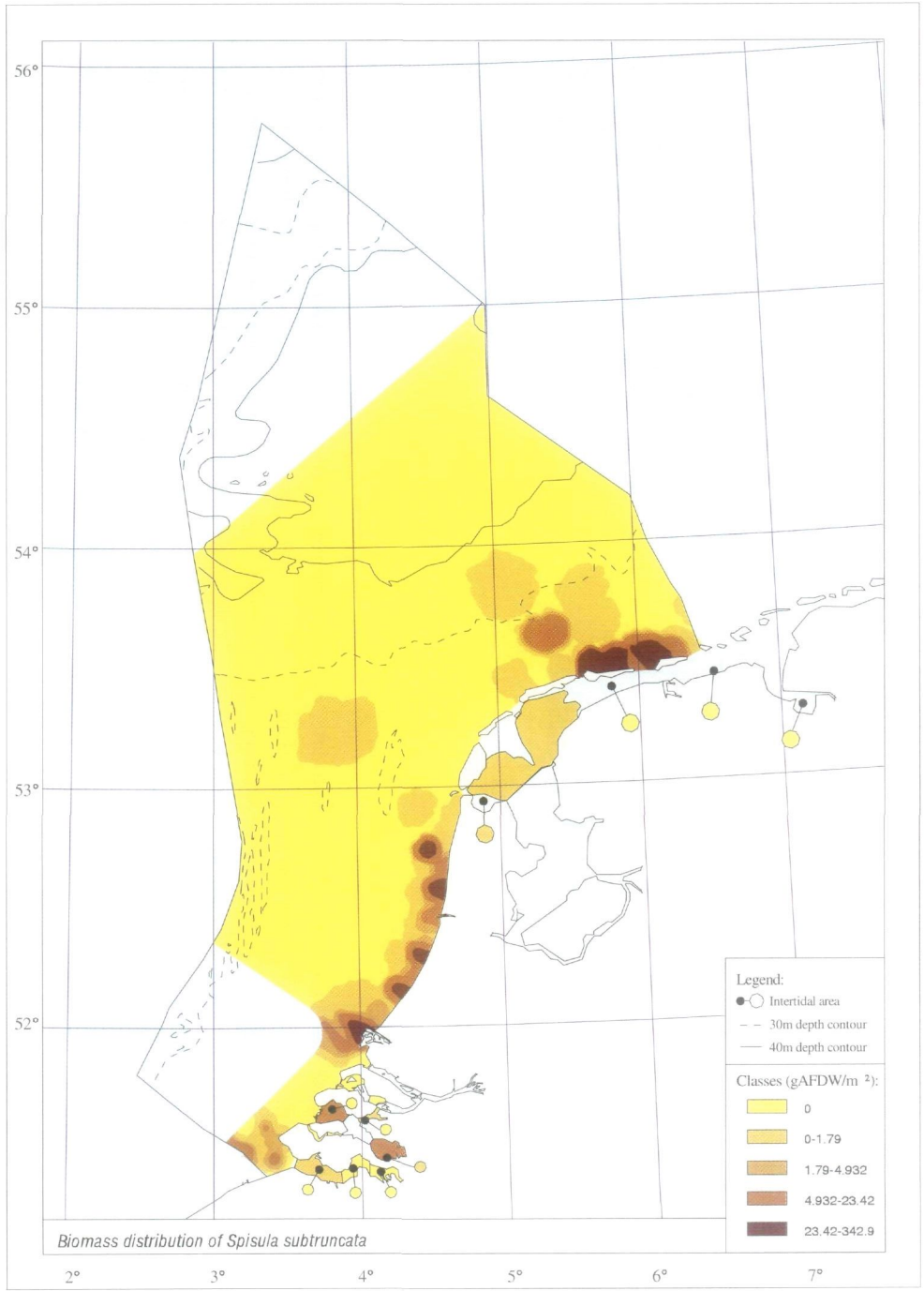
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-14
14-88
88-353
353-5928
Density distribution of Spisula subtruncata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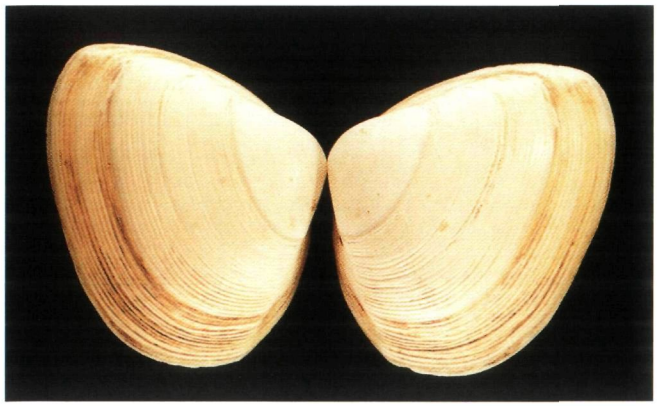
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-1.79
1.79-4.932
4.932-23.42
23.42-342.9
Biomass distribution of Spisula subtruncata



A. GMELIG MEYLING SR / FOTO ARCHIEF STICHTING 'ANEMOON'

Spisula subtruncata

DA COSTA / 1778

English

Cut trough shell

Dutch

Halfgeknotte strandschelp

German

Gedrungene Trogmuschel

Morphology

A solid shell, somewhat triangular in outline with rounded corners. Large specimens reach 25 mm in length. A sculpture of fine concentric lines and grooves covers the shell. The growth stages are clear. It is dirty white in colour, with a greenish or greyish brown periostracum. The inside of the shell is white (Tebble, 1966; Wolff, 1973; Hayward & Ryland, 1990).

Biology

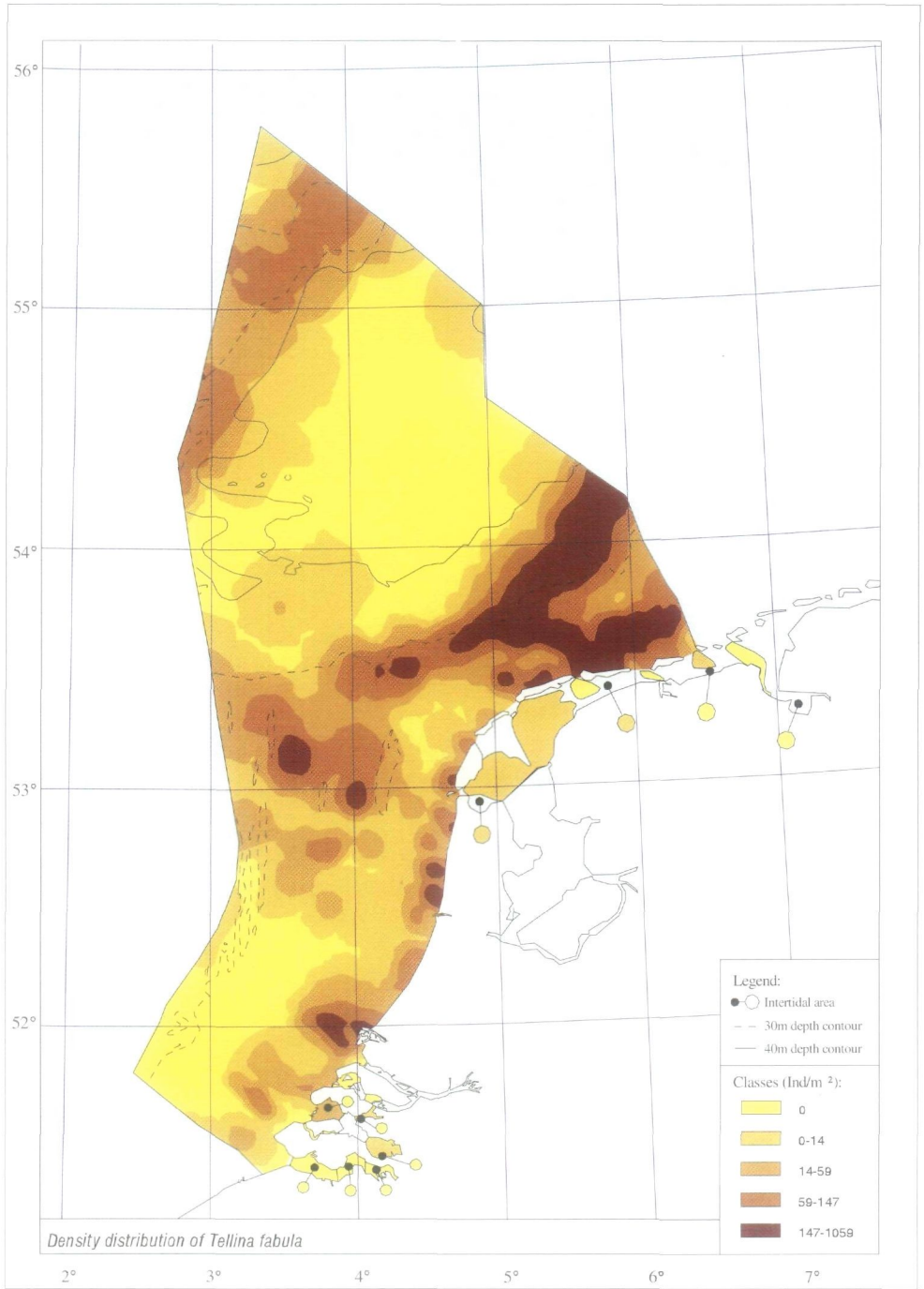
This species probably spawns in winter and early spring. The pelagic larval stage seems to last fairly long.

S. subtruncata is a suspension feeder and forms an important food item for diving birds like the Common Scooter that overwinter along the Dutch coast (Ziegelmeier, 1957; Wolff, 1973).

Distribution

S. subtruncata is very abundant north of the Wadden islands (Terschelling and Ameland), along the Dutch coast including parts of the Wadden Sea, and in the Delta estuaries. It is typically found in dense patches near the coast. These 'beds', which contain one to a few age classes, (dis)appear from time to time, when a cohort dies of or settlement occurs. The distribution of the species is comparable with the findings of an earlier study (Eisma, 1966).

S. subtruncata lives in bottoms consisting of sand and muddy fine sand (Ziegelmeier, 1957; Tebble, 1966).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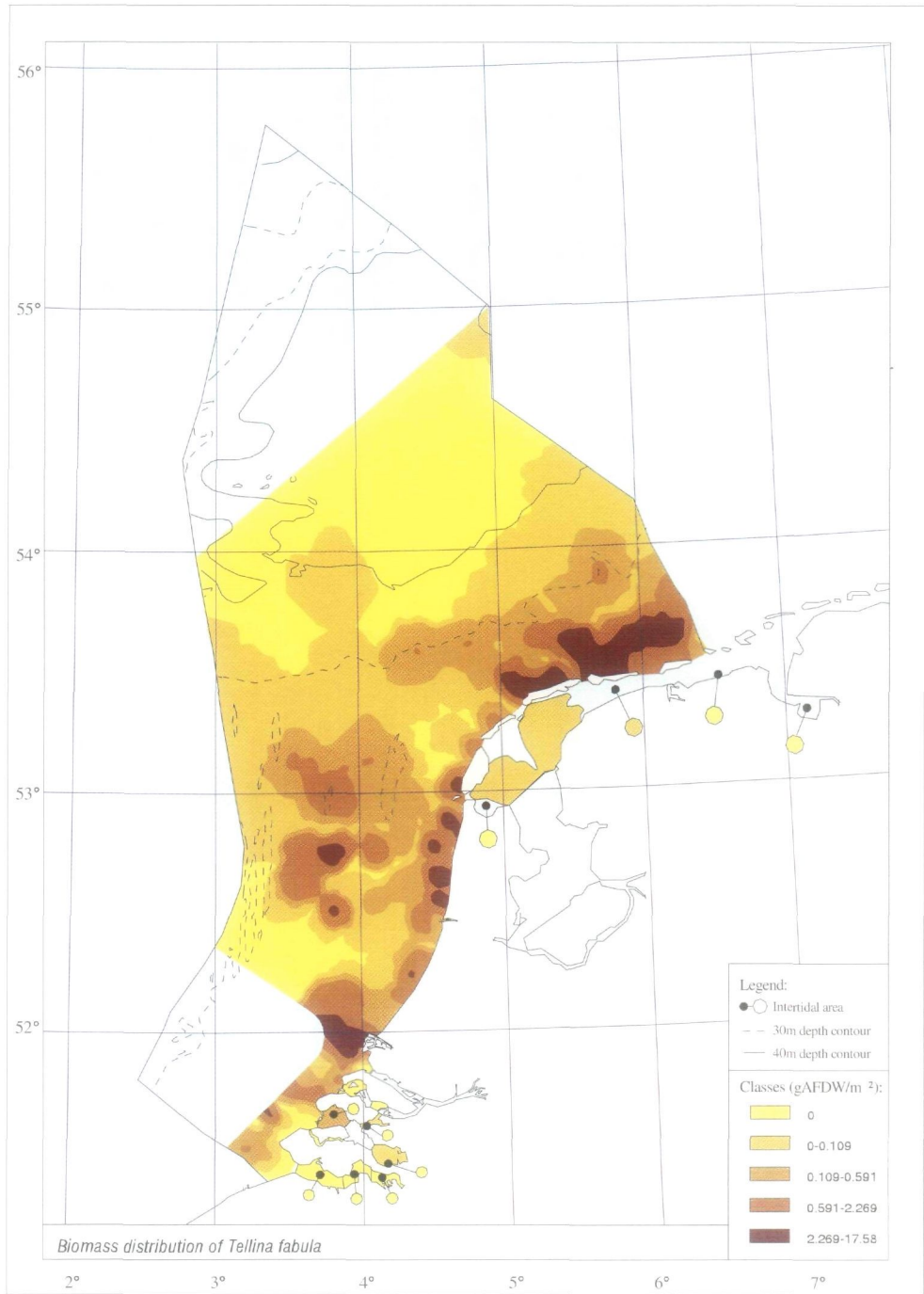
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-14
14-59
59-147
147-1059
Density distribution of Tellina fabula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Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-0.109
0.109-0.591
0.591-2.269
2.269-17.58
Biomass distribution of Tellina fabula

A. GMELIG MEYLING SR / FOTO ARCHIEF STICHTING 'ANEMOON'

Tellina fabula

GMELIN / 1791

Dutch

Rechtsgestreepte platschelp

German

Bohnen-Plattmuschel

Gerippte Tellmuschel

Synonym(s)

Angulus fabulus

Fabulina fabula

Morphology

A thin and brittle, somewhat flattened shell, approximately oval in outline. The right valve is a little more convex than the left one. It rarely reaches over 20 mm in length. The sculpture consists of very fine concentric lines and small radiating ribs on the right valve.

The growth stages are clear. The shell is white, pale yellow, or orange in colour. The inner surface is white, or tinted with yellow and orange (Tebble, 1966; Fish & Fish, 1989; Hayward & Ryland, 1990).

Biology

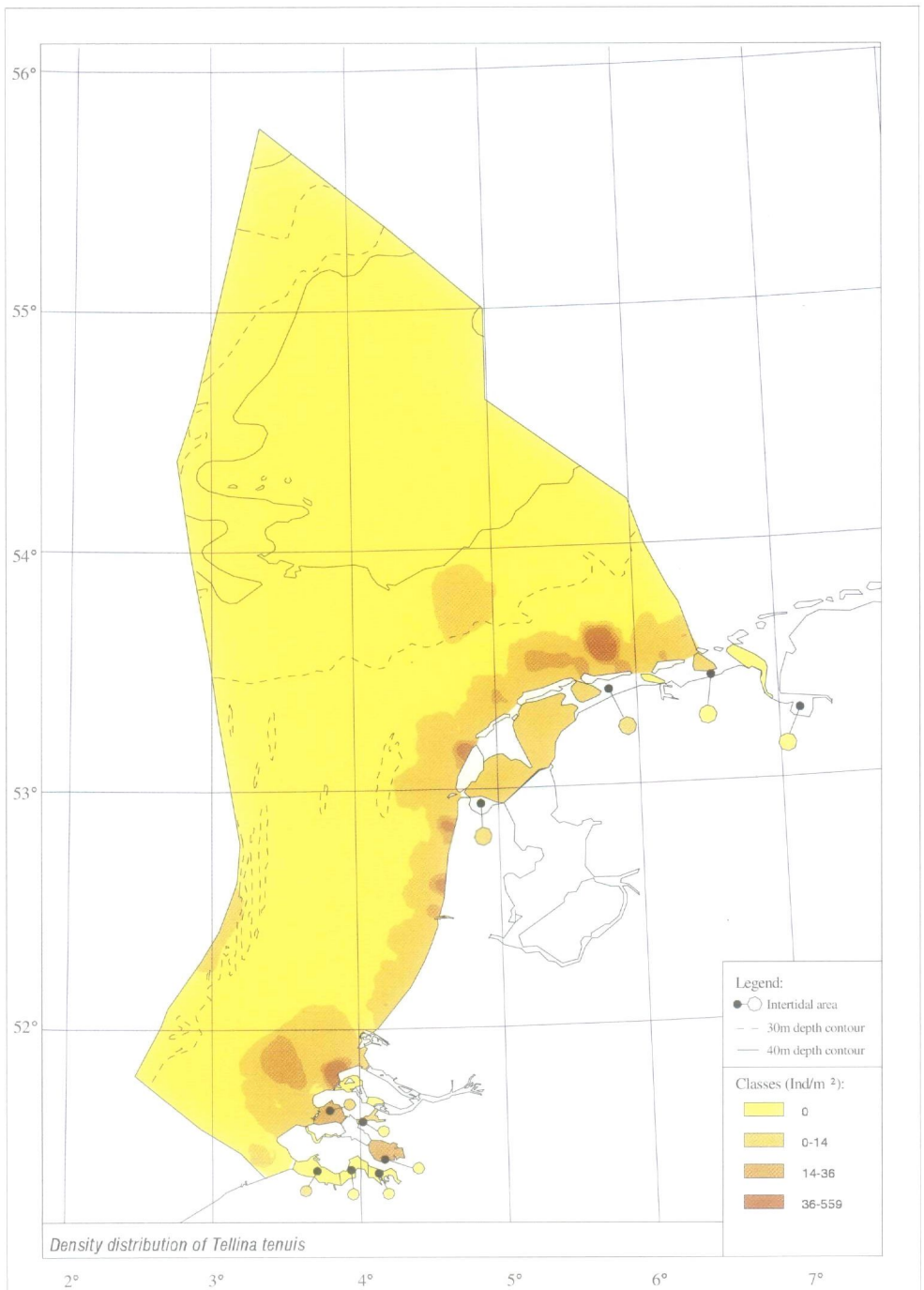
The species has separate sexes and breeding occurs from March to September. It has a planktonic veliger larva. Longevity is believed to be four or five years.

At constant food conditions growth is found to be partly correlated with temperature (Salzwedel, 1979).

T. fabula lives up to 10 cm deep in the sediment and lies in a more or less horizontal position on the left valve. It is a selective deposit as well as a suspension feeder. Its feeding behaviour probably changes with age and season (Salzwedel, 1979; Fish & Fish, 1989).

Distribution

Except for the Oyster Ground, where it is almost absent, *T. fabula* is found in all other parts of the area. This is unlike *T. tenuis*, which only occurs close to the coast. Markedly high numbers of *T. fabula* are found north of the Wadden islands, along the southern border of the Frisian Front and along the coast where the sediment consists of fine (muddy) sand.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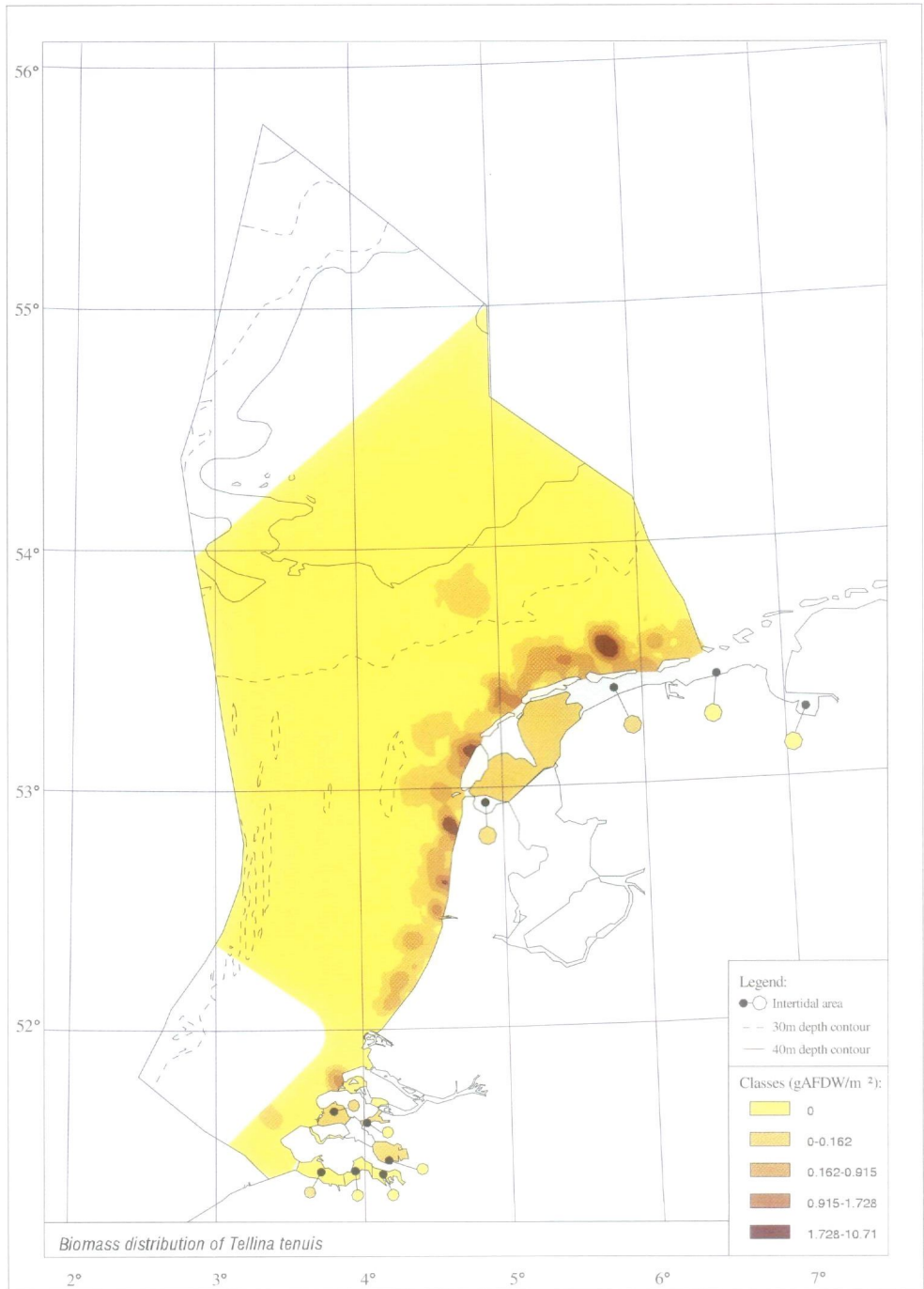
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-14
14-36
36-559
Density distribution of Tellina tenuis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Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-0.162
0.162-0.915
0.915-1.728
1.728-10.71
Biomass distribution of Tellina tenuis

A. GMELIG MEYLING SR / FOTO ARCHIEF STICHTING 'ANEMOON'

Tellina tenuis

DA COSTA / 1778

English

Thin tellin

Dutch

Tere platschelp

German

Dünne Plattmuschel

Platte Tellmuschel

Synonym(s)

Angulus tenuis

Morphology

A brittle, somewhat flattened shell. The right valve is slightly larger than the left one. It is nearly oval in outline and measures up to 25 mm in length. The shell is covered with fine concentric lines. The growth stages are clear. The colour is very variable, including white, shades of pink, yellow, and orange, often arranged in distinct bands. The inside of the shell is coloured like the outside, but normally fainter (Tebble, 1966; Fish & Fish, 1989; Hayward & Ryland, 1990).

Biology

Spawning occurs in June-August. *T. tenuis* most probably has a pelagic larval stage. Longevity is reported to be about five years.

The species usually lies on the left valve, a few centimetres below the sediment-surface. Its burrowing depth depends on the tide and exceeds 10 cm at low tide (Tebble, 1966; Wolff, 1973; Fish & Fish, 1989). *T. tenuis* is a suspension feeder with tendencies to selective deposit-feeding. It takes vegetable detritus, but diatoms may also occur in the gut. Young flatfish often feed on the tips of the protruding siphons, which are subsequently regenerated (Wolff, 1973; Fish & Fish, 1989).

T. tenuis is sensitive to low winter temperatures and therefore shows low numbers after cold winters (Beukema, 1979; Beukema & Essink, 1986).

Distribution

T. tenuis does not occur in the offshore parts of the North Sea, but is restricted to a narrow zone along the coast, the Wadden Sea, the Oosterschelde and part of the Westerschelde.

T. tenuis generally inhabits fine, clean sand, with low percentages of silt.

Polychaeta

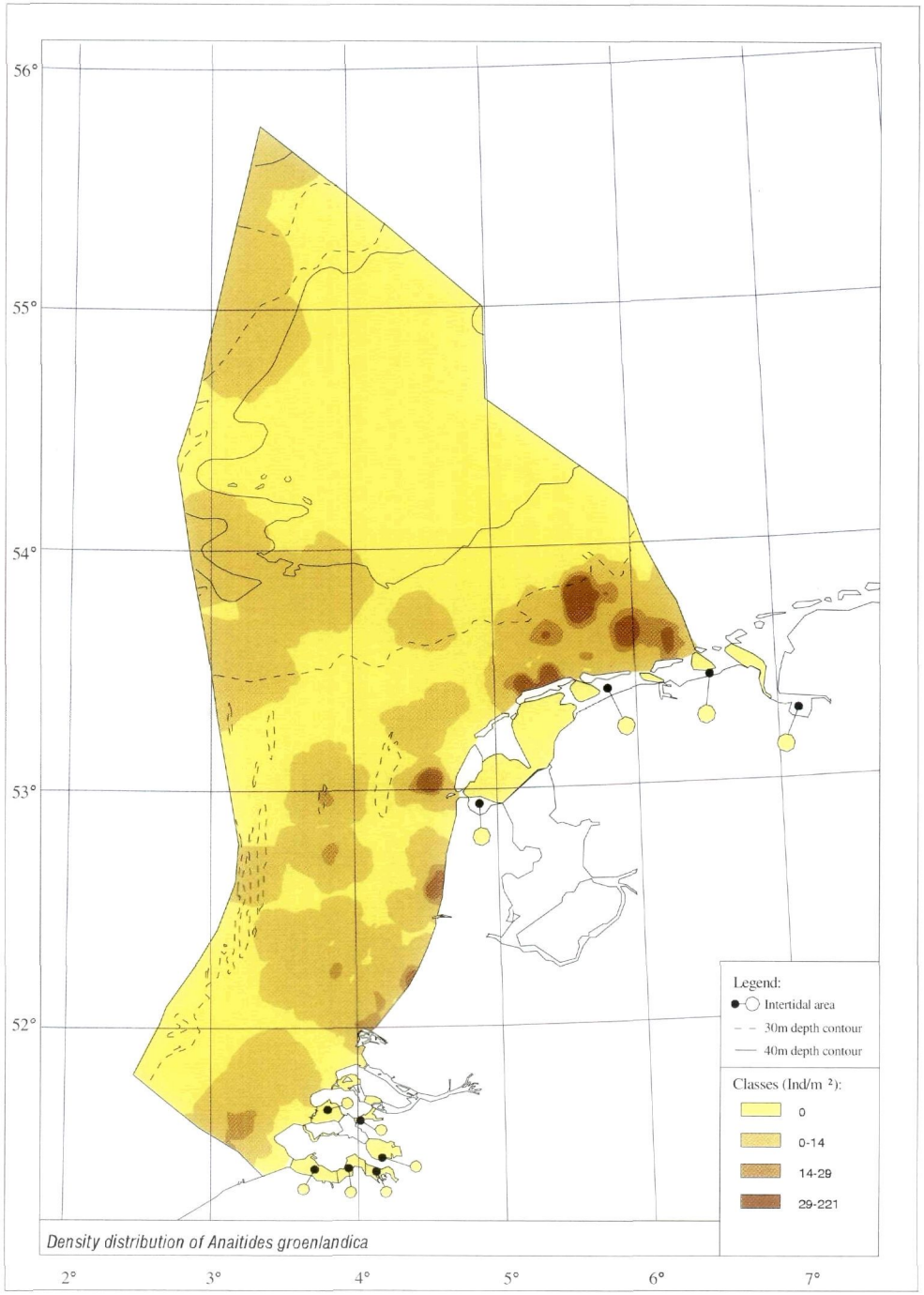
Polychaetes belong to the phylum Annelida or segmented worms. Polychaetes are almost entirely marine, occurring world-wide from the intertidal down to the bathyal zone of the oceans. In the deep sea they often form the most important group of macrofauna organisms. Like all annelids, polychaetes are basically cylindrical worms with numerous segments and a body composed of three layers, enclosing a real body cavity, or coelom. The polychaete body can be divided into three regions: the head (prostomium), the trunk and the tail (pygidium). Each segment of the trunk normally carries paired parapodia, which bear one to several types of chaetae (bristles) and sometimes gills. These parapodia are used for locomotion, feeding or breathing. The head bears two or more eyes, antennae, palps and cirri and contains a simple brain. The mouth characteristically opens at the second segment and the anus lies on the terminal segment. A number of species posses an eversible proboscis, with or without jaws, that is used for food handling.

The class is normally divided into two groups, *viz.* Errantia (errant species) and Sedentaria (sedentary species), but the taxonomic significance of these groups is still unclear and representatives of both groups share a lot of morphological features. Generally, all species that live in tubes belong to the Sedentaria, although this group also contains free-living species.

The trunk of sedentary species is, in contrast to errant ones, frequently composed of two regions, each with different types of parapodia. The parapodia of sedentary polychaetes are furthermore often reduced. While there are real tube-building species with skin glands that secrete a sticky substance to cement the sediment particles, there are also species living in semi-permanent burrows that are held together by mucus. A common feature in all these sedentary polychaetes is the possession of long appendages (palps, cirri, tentacles) on their head for capturing food particles. The presence of a tube and the shape and structure of the tube are important features for identification. Species without a tube are often identified on the basis of the shape of the head with its appendages as well as the structure of parapodia and bristles.

Generally, polychaetes are of separate sexes and hermaphroditism is rare. Gametes (eggs and sperm) are released directly into the water. The larvae are free-swimming trochophore larvae. These larvae are diamond-shaped and bear a ring of cilia (small hairs). They feed on diatoms and small organisms such as dinoflagellates. Gradually the larvae develop extra segments and other features present in adults. After settling they lose their trochophore characters and start to look like small adult specimens.

Epitoky, the phenomenon that fertile specimens are morphologically very different from non-fertile specimens, is widespread in the polychaete class. This phenomenon seems to be induced by a hormone. Females often release a pheromone into the water, which encourages the male to release its sperm. The sperm in turn induces spawning in the females. Many species are cosmopolitan and can be found in any kind of sediment. During the surveys of which data have been used in this atlas a total of 196 polychaete species have been identified.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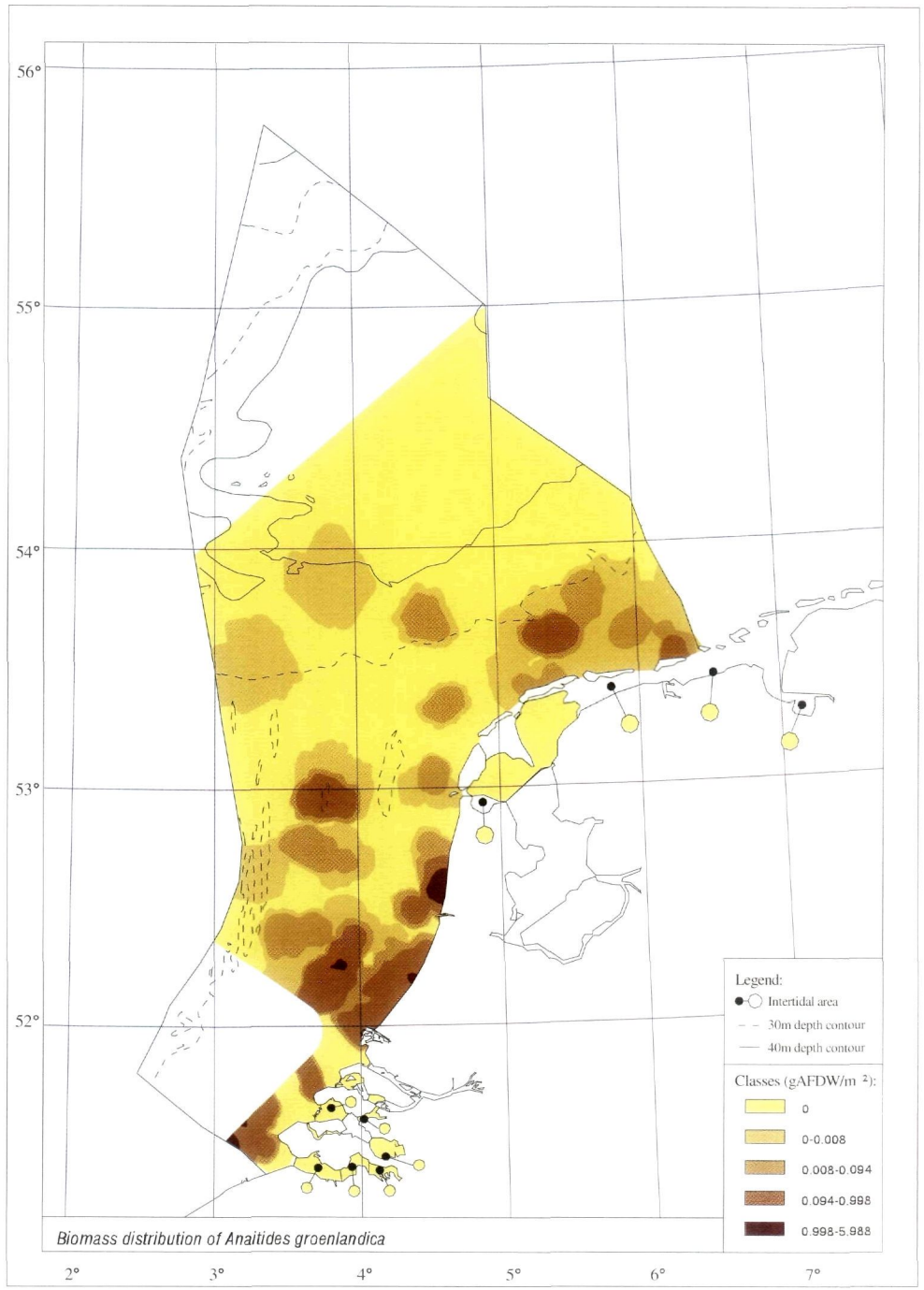
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-14
14-29
29-221
Density distribution of Anaitides groenlandica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Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-0.008
0.008-0.094
0.094-0.998
0.998-5.988
Biomass distribution of Anaitides groenlandica

J. VAN DER HOEK

Anaitides groenlandica

OERSTED / 1842

Synonym(s)

Phyllodoce groenlandica

Morphology

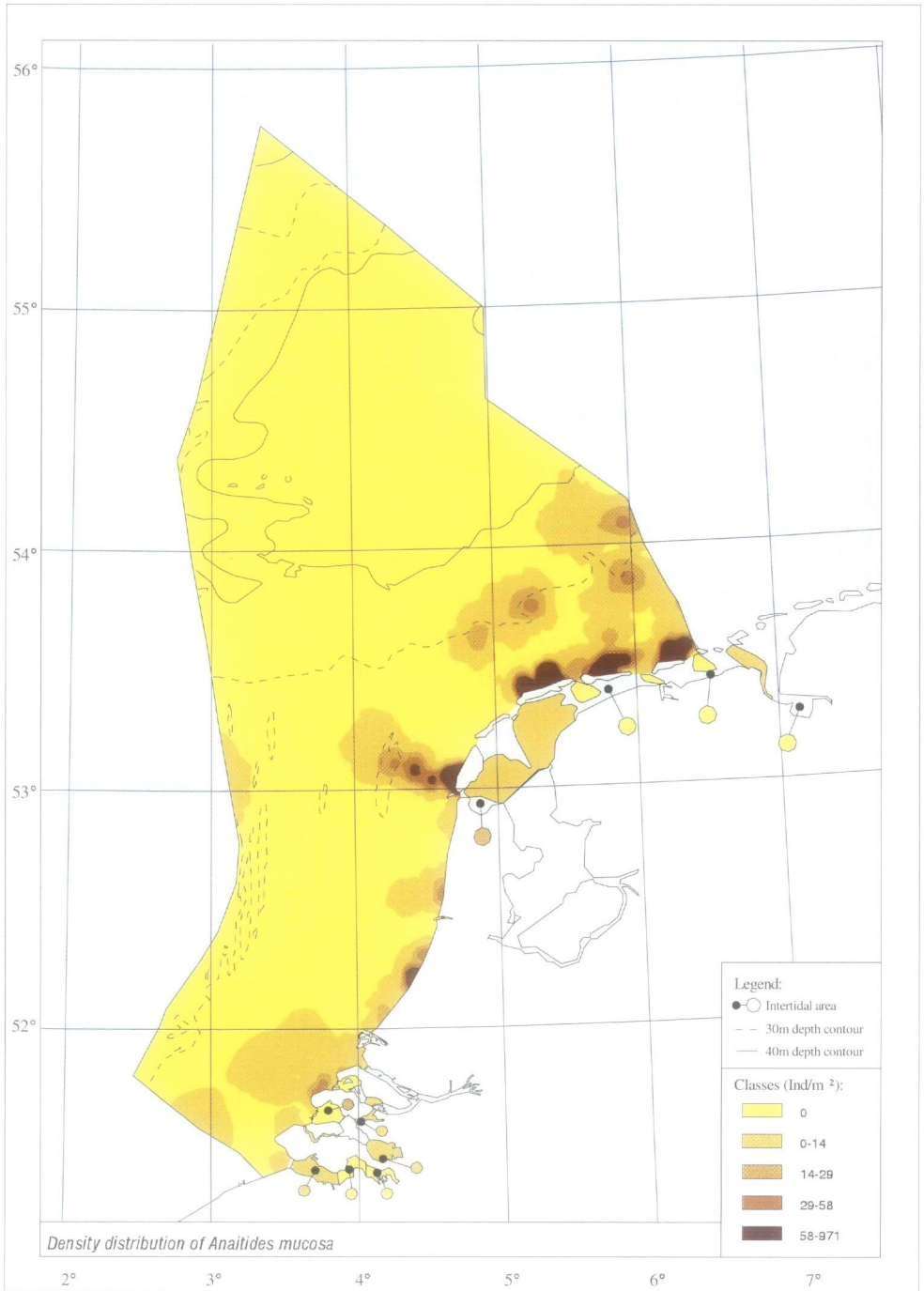
A relatively large worm with an elongated, flattened body, slightly tapering towards both ends. The head is well developed and bears four frontal antennae and two small eyes. The body segments are uniform with prominent parapodia bearing distinct rectangular lamellae on top. The body measures 50-100 mm with 700 segments. It is greenish yellow in colour with three transverse bands of brown and blue (Hartmann-Schröder, 1971; Hayward & Ryland, 1990).

Biology

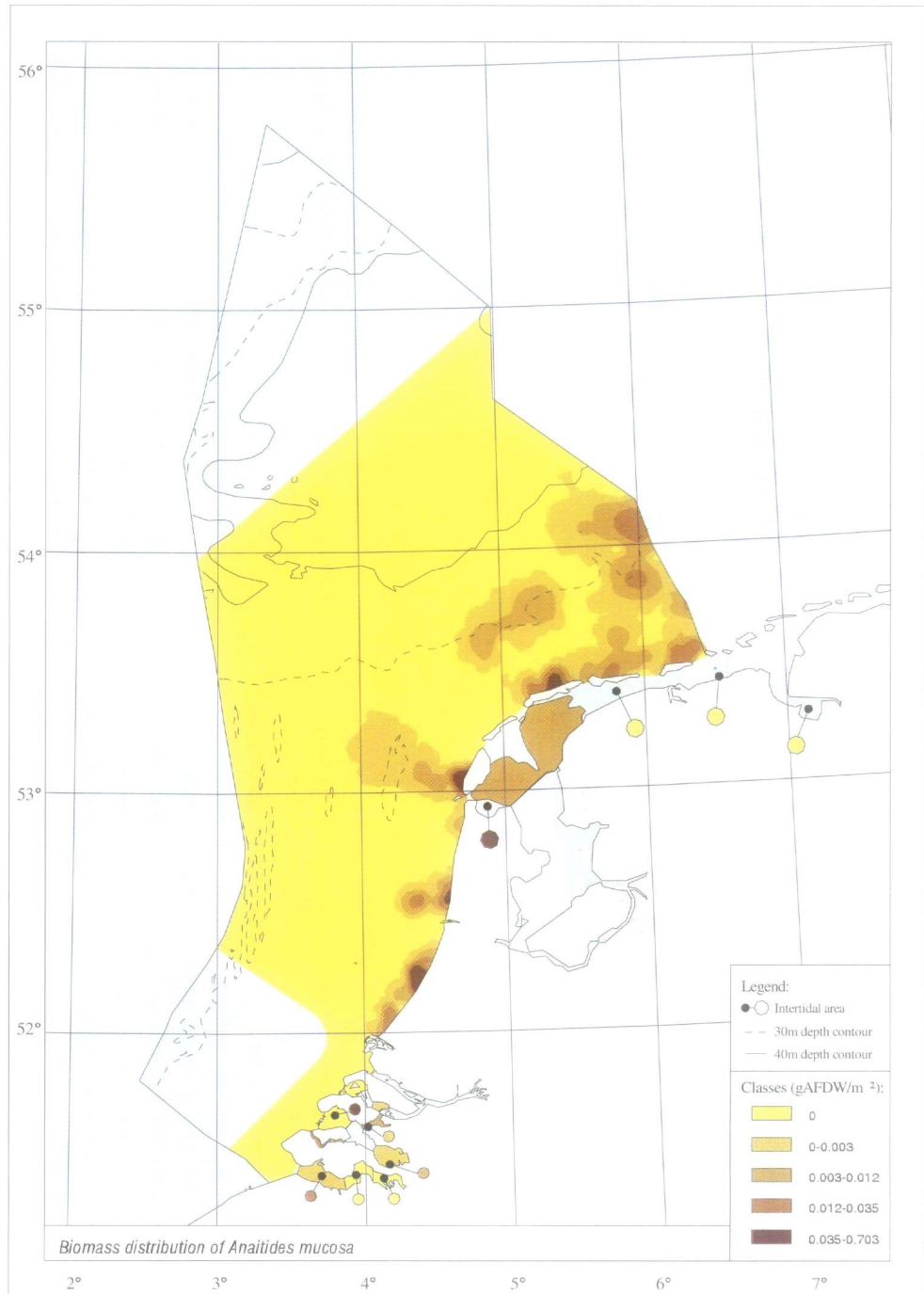
Reproduction and larval development take place in spring and early summer. The species has a long pelagic stage.
Most phyllodocids are considered predators, catching their prey with their muscular pharynx. They feed on a variety of small invertebrates, e.g. polychaetes, and fish. Cannibalism is widespread (Hartmann-Schröder, 1971; Wolff, 1973; Fauchald & Jumars, 1979).

Distribution

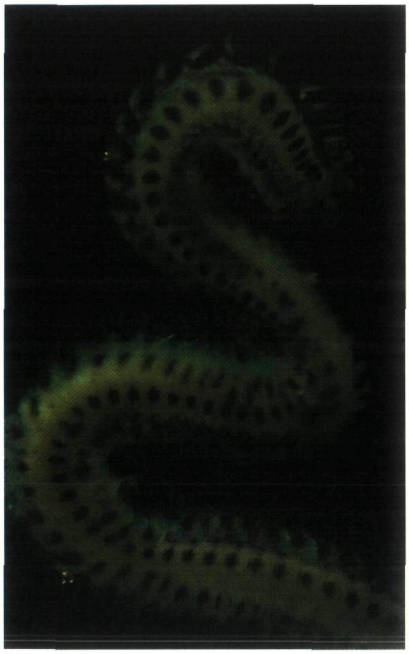
Highest densities are found north of the Wadden islands. It is found in lower numbers on the Brown Bank, at the Broad Fourteens, along the coast and at a few stations on the Cleaver Bank and Dogger Bank. *A. groenlandica* has not been observed in the Oyster Ground, the Wadden Sea and the Delta area. Earlier studies, however, mention this species from the Delta area.
A. groenlandica lives in fine to coarse sediment with a low content of mud. It is sometimes found in empty tubes of other polychaetes (Hartmann-Schröder, 1971; Wolff, 1973).



Density distribution of Anaitides mucosa



Biomass distribution of Anaitides mucosa



E. STIKVOORT

Anaitides mucosa

OERSTED / 1843

Synonym(s)

Phyllodoce mucosa

Morphology

This species resembles *A. groenlandica*, but differs by the shape of the lamellae on the parapodia and its smaller dimensions. It can reach 50 mm in length and 250 segments. *A. mucosa* is whitish or yellowish in colour, with transverse dark brown bands or patches. The species shows a strong production of mucus (Hartmann-Schröder, 1971; Hayward & Ryland, 1990).

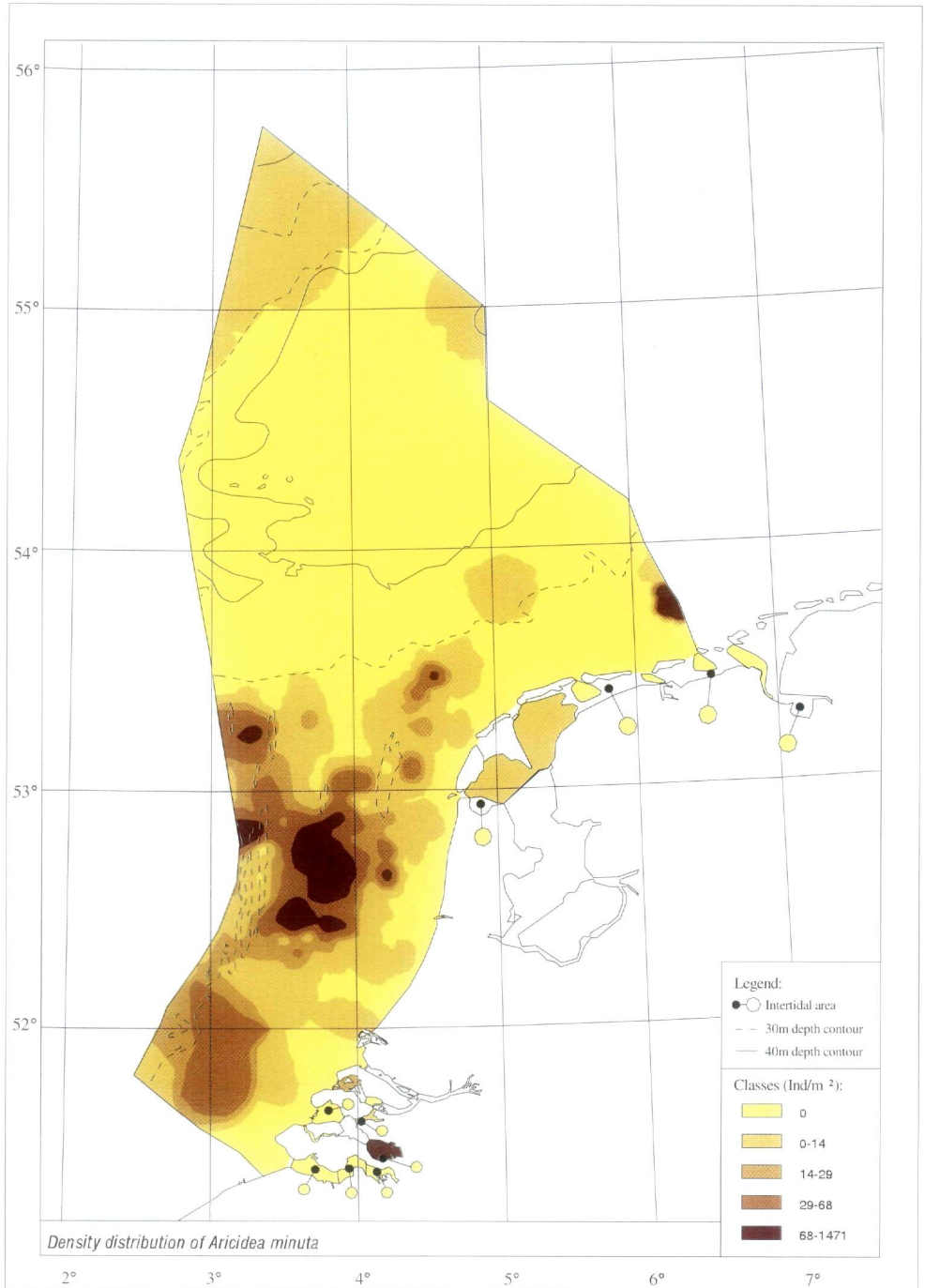
Biology

The species deposits its eggs in green gelatinous cocoons at the surface of mud flats and probably also on the bottom of tidal channels.
In the Delta area these egg capsules may be found from the first weeks of March until the first weeks of June. A second period of spawning occurs in October-November. The larvae become free-swimming after two days to three weeks and seem to have a planktonic life of several weeks.

A. mucosa, like most phyllodocids, is presumably a predatory carnivore, but this species is also reported as being a scavenger, feeding on animal remains (Hartmann-Schröder, 1971; Wolff, 1973; Fauchald & Jumars, 1979).

Distribution

A. mucosa occurs near the Dutch coast, from the Voordelta in the south to the Dutch Wadden islands in the north, where the species is most abundant. In contrast to *A. groenlandica* this species is present in the eastern and western part of the Wadden Sea as well as in the Delta area.
A. mucosa is abundant in the fine sand areas of the Dutch Continental Shelf. It is also reported from muddy sediment, mixed with sand, shell fragments and stones, and in mussel beds. Compared to *A. groenlandica*, this species inhabits the muddier types of sediment. It is suggested that one species forces the other into a different type of sediment by competition (Hartmann-Schröder, 1971; Wolff, 1973; Hayward & Ryland, 1990).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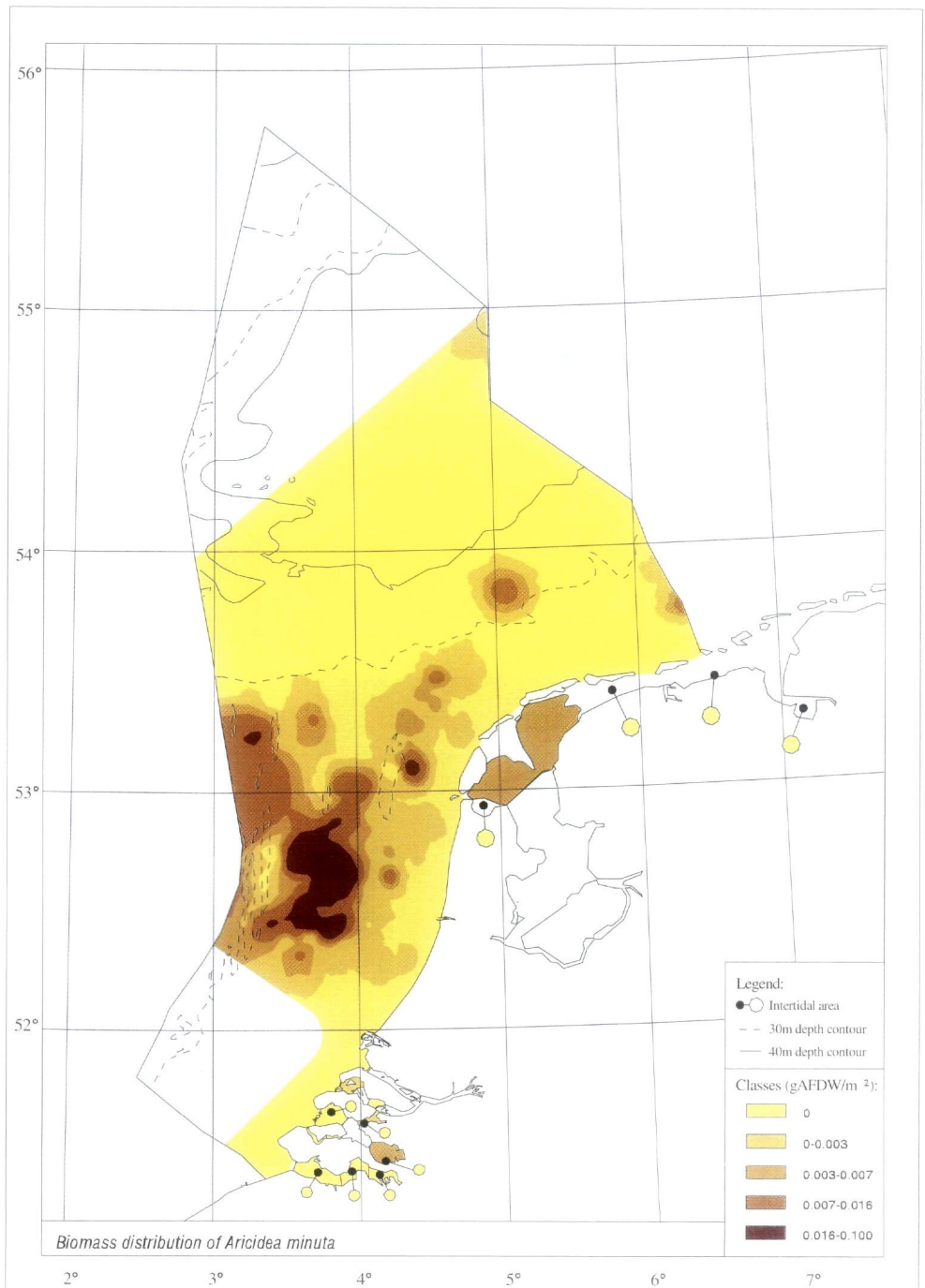
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-14
14-29
29-68
68-1471
Density distribution of Aricidea minuta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Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-0.003
0.003-0.007
0.007-0.016
0.016-0.100
Biomass distribution of Aricidea minuta

Aricidea minuta

SOUTHWARD / 1956

E. STIKVOORT

Morphology

Body minute, up to 15 mm long and made up of around 45 segments. The head is bluntly conical with one small median antenna and without eyes.

Ten to twelve pairs of simple gills are present from the fourth segment backwards. The parapodial lobes are small and finger-like. The species has no distinctive colour (Hartmann-Schröder, 1971).

Biology

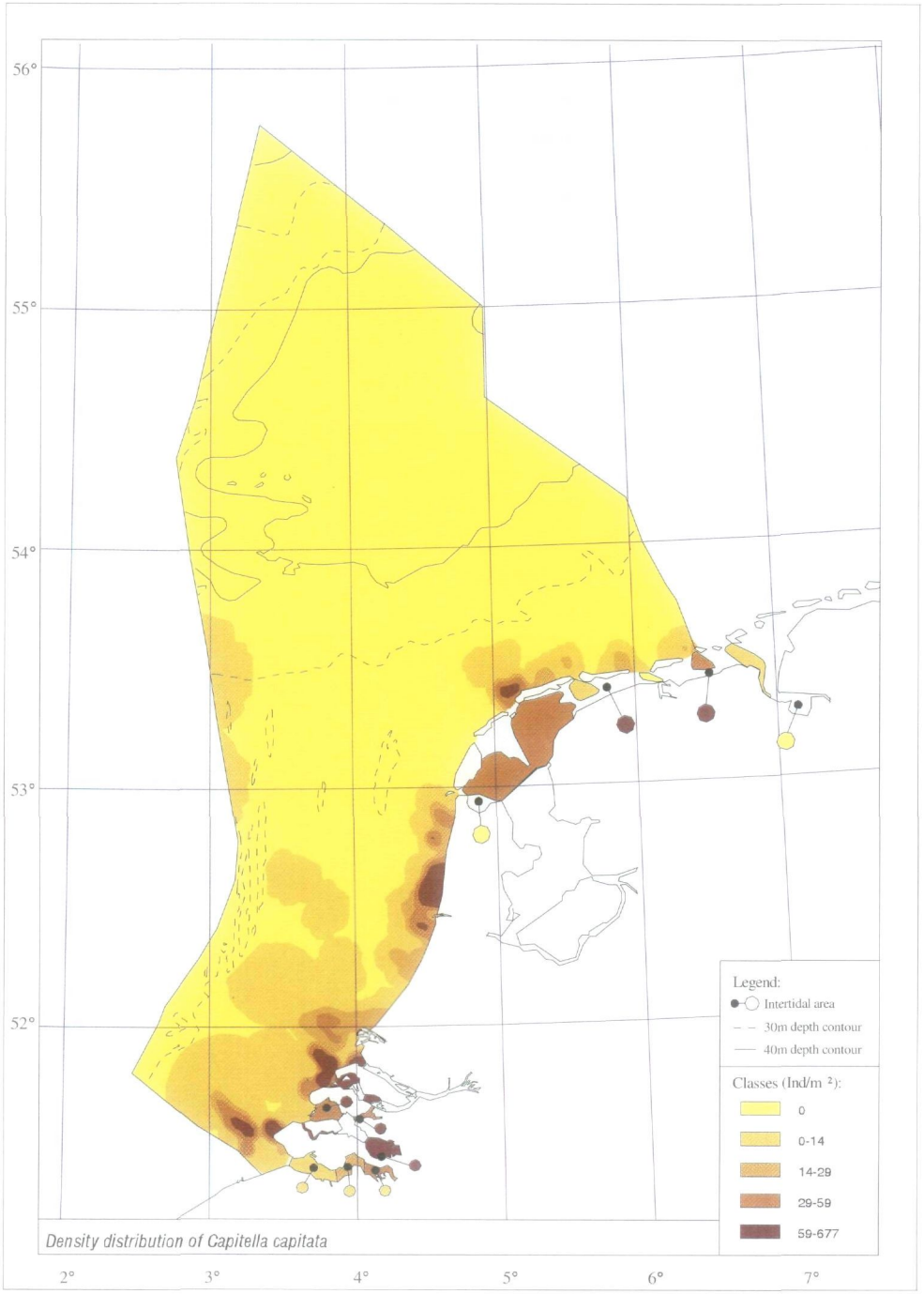
Spawning occurs between October and January. Mature females usually have less than 100 ova, which suggests a non-pelagic development.

A. minuta presumably is a surface deposit feeder (Wolff, 1973; Fauchald & Jumars, 1979).

Distribution

On the Dutch Continental Shelf, *A. minuta* is most frequent in the sandy sediments of the Southern Bight. It furthermore occurs north of the island of Rottum, on the Dogger Bank, in the western Wadden Sea and in the Oosterschelde, where it is very abundant.

The distribution of *A. minuta* in the open North Sea indicates that it prefers clean sandy sediments. In the estuaries *A. minuta* lives in fine and muddy sands mixed with shell fragments (Hartmann-Schröder, 1971; Wolff, 1973).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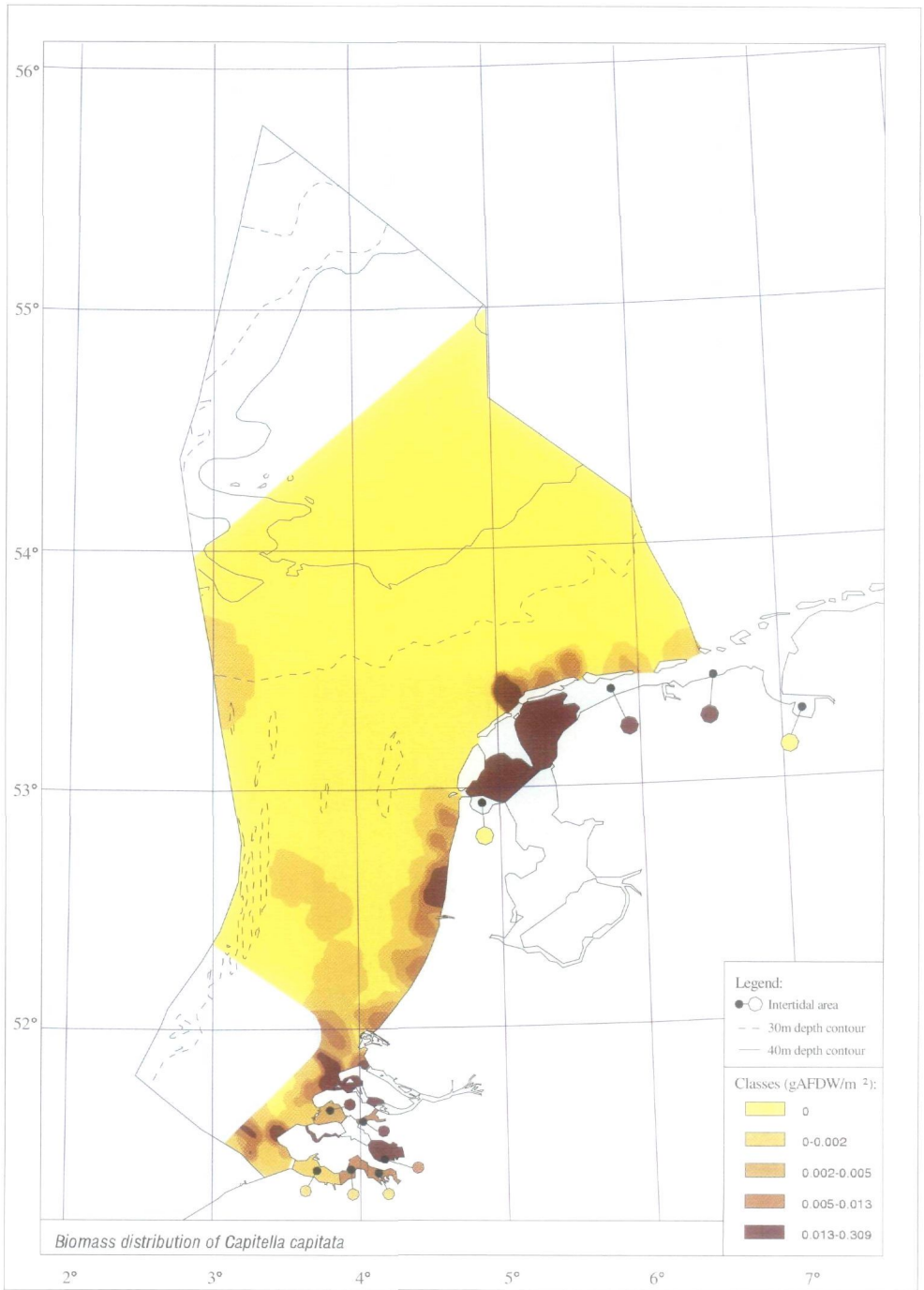
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-14
14-29
29-59
59-677
Density distribution of Capitella capitata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Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-0.002
0.002-0.005
0.005-0.013
0.013-0.309
Biomass distribution of Capitella capitata

E. STIKVOORT

Capitella capitata

FABRICIUS / 1780

Dutch

Slangpier

German

Kopfwurm

Morphology

Capitellids are simple, earthworm-like polychaetes, lacking prominent appendages such as parapodia, gills or antennae. The head is simple and pointed. The body of *C. capitata* is rather fragile, tapered at both ends and capable of considerable expansion and contraction. The species is 20-50 mm long with about 100 segments. The colour is blood-red (Hartmann-Schröder, 1971; Fish & Fish, 1989; Hayward & Ryland, 1990).

Biology

The female spawns the eggs (about 130) in the burrow, where they remain until the larvae hatch after two weeks. The larvae may remain in the plankton for at least a week, but a completely non-pelagic development is also possible. The reproduction takes place during the whole year, but larvae are mainly found in spring and summer. *C. capitata* is capable of rapid discovery and colonization of new habitats through planktonic larvae.

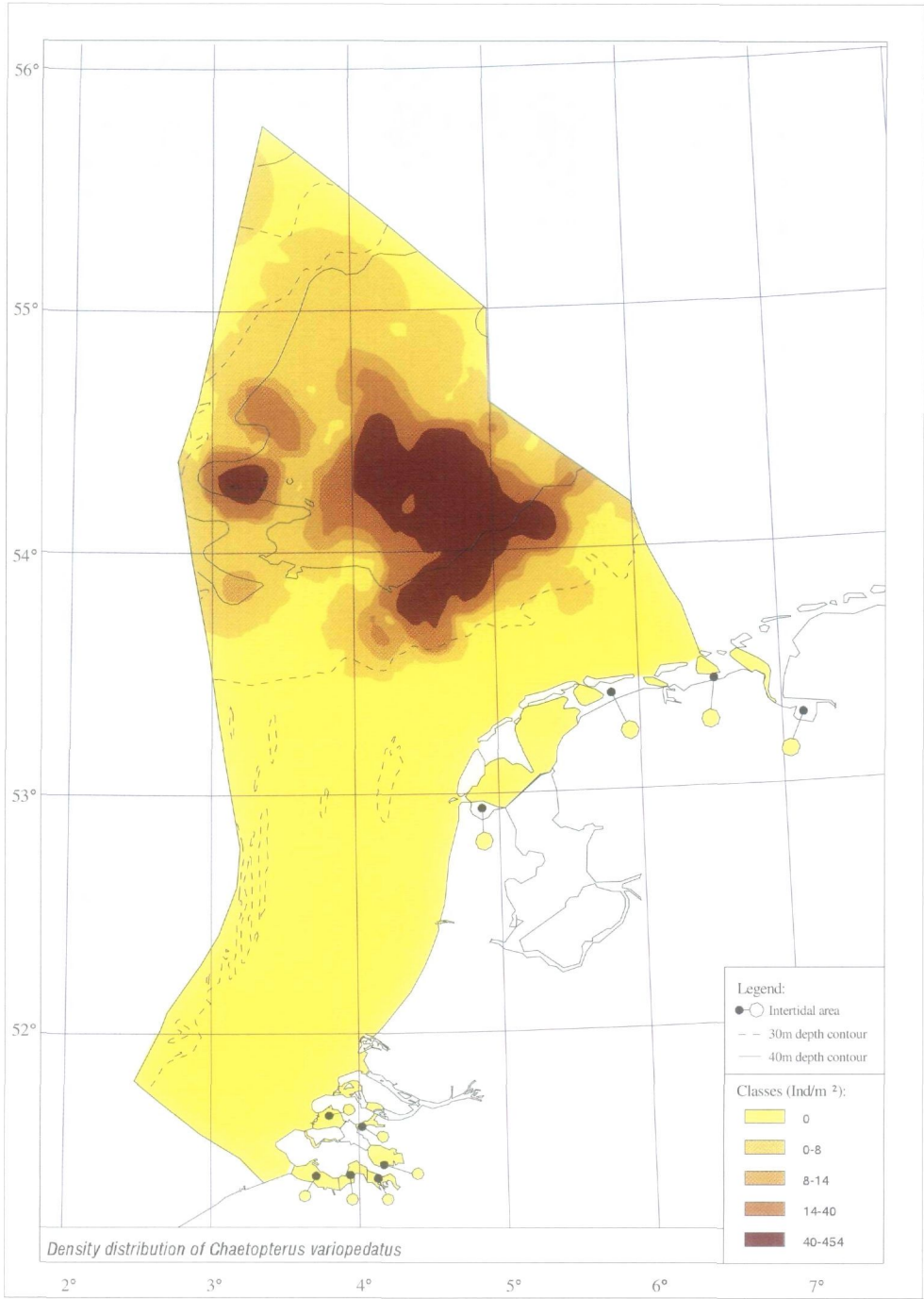
This species builds tubes at or near the surface of the sediment. These tubes maintain contact with the surface and allow the worm to feed in black, anoxic muds, obtaining the necessary oxygen from the overlying waters by irrigation of the burrow. It is able to survive several days without oxygen. Its resistance to low amounts of oxygen enables it to live in organically enriched environments such as found near sewage outlets.

C. capitata is a motile deposit feeder, ingesting micro-organisms and detritus by means of its eversible, papillose and sac-like pharynx. Gut contents analysis suggests that some selection is made in feeding, although opportunistic species like *C. capitata* are generally considered to be non-selective (Hartmann-Schröder, 1971; Wolff, 1973; Grassle & Grassle, 1974; Curtis, 1977; Fauchald & Jumars, 1979; Gosselck & Georgi, 1984; Fish & Fish, 1989).

Distribution

C. capitata is found only in the southern part of the Dutch Continental Shelf and is absent from the more offshore parts of the North Sea. Highest densities are recorded along the coast, in the Wadden Sea, and in the Delta area.

This species is known from a variety of habitats, but in the study area it is mainly found in fine sand mixed with mud. Other authors report *C. capitata* to be indifferent in its choice of sediment. It is found in coarse to fine sand, muddy sand, rich anoxic mud and under stones (Hartmann-Schröder, 1971; Wolff, 1973; Fish & Fish, 1989; Hayward & Ryland, 1990).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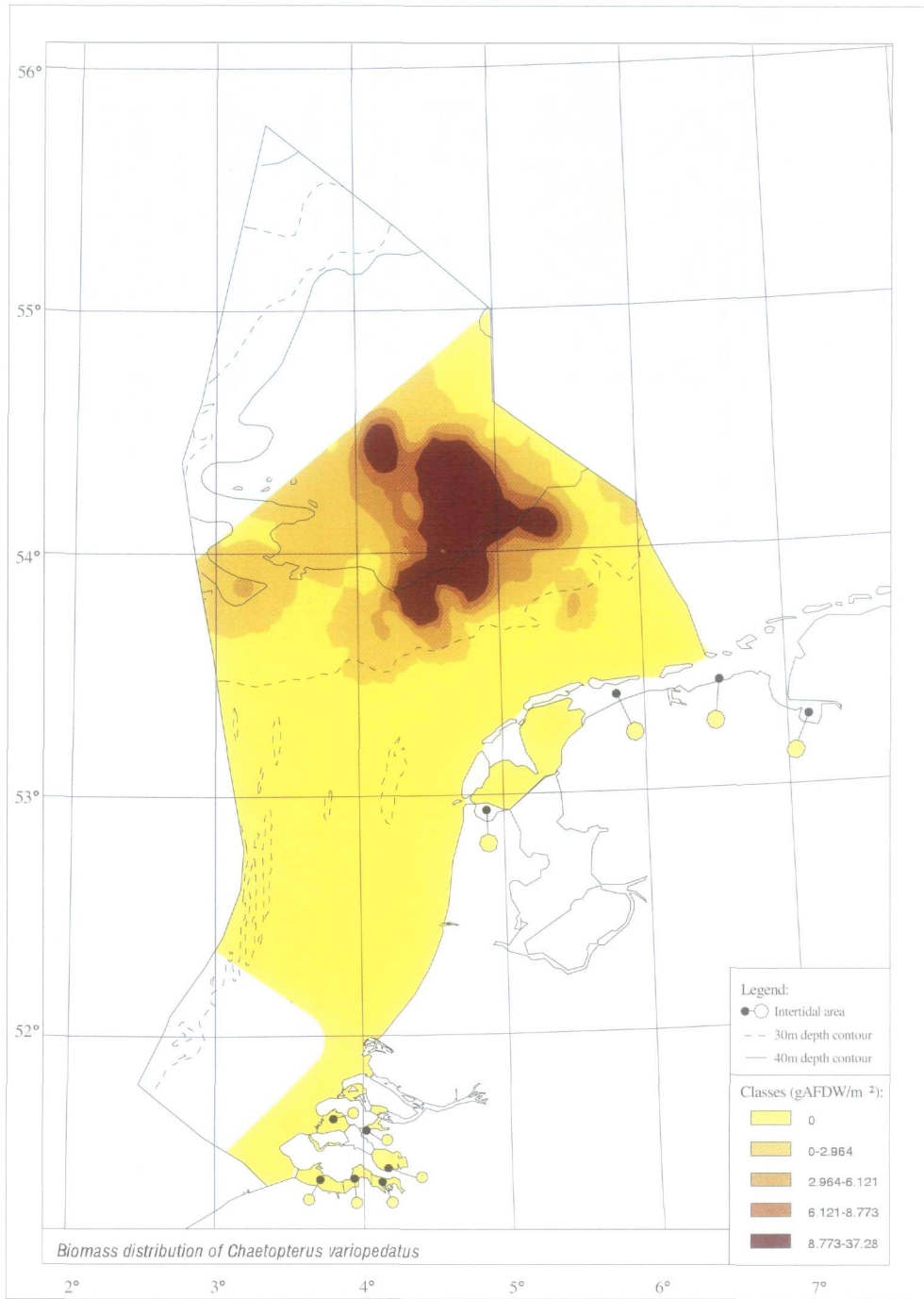
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-8
8-14
14-40
40-454
Density distribution of Chaetopterus variopedatus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Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-2.964
2.964-6.121
6.121-8.773
8.773-37.28
Biomass distribution of Chaetopterus variopedatus

Chaetopterus variopedatus

RENIER / 1804

E. STIKVOORT

Dutch

Perkamentworm

German

Pergamentwurm

Morphology

A large, stout, soft-bodied and fragile worm with a very distinctive appearance. The body is composed of about 85 segments, divided over 3 distinct regions. It reaches a length of up to 150 mm. The head is small and bears two short tapered palps. The first body segment forms a large glandular lower lip. The parapodia of the anterior 12 segments have triangular upper lobes with special thick chaetae. Among the 5 specialized segments of the middle region there is one with long, wing-like parapodia and some that are round and fan-like. The parapodia of the posterior 20 segments have finger-like upper lobes. It is yellowish or greenish white in colour. Mature females are pinkish. The thick, mud covered leathery tubes are U-shaped and tapered at both ends (Hartmann-Schröder, 1971; Fish & Fish, 1989; Hayward & Ryland, 1990).

Biology

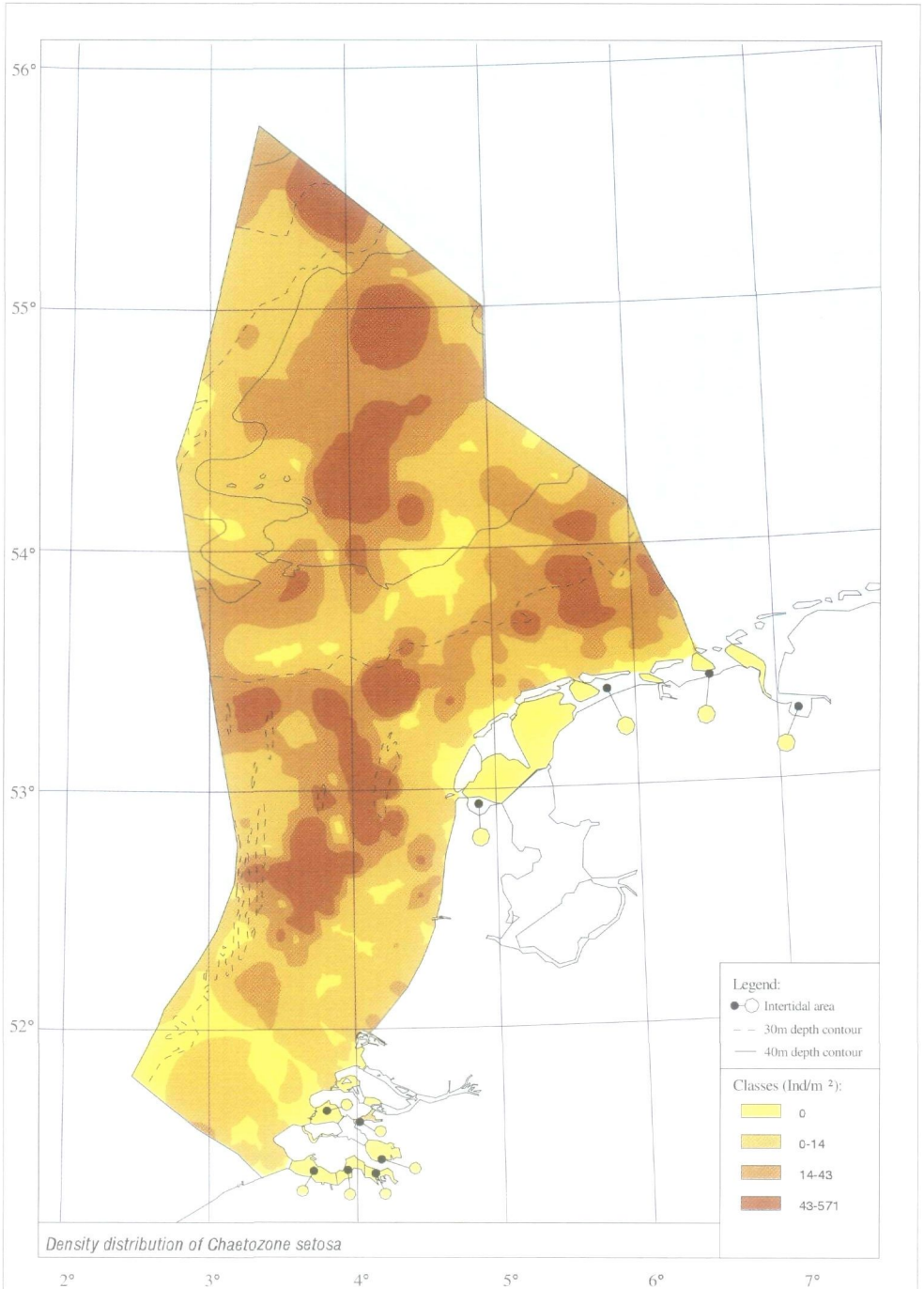
The sexes are separate and fertilization is external. Breeding takes place in summer.

The larvae are pelagic and can be found in the plankton until October.

C. variopedatus lives in the sediment in U-shaped tube. Both ends of the tube extend a few cm above the sediment surface. As the animal grows and the tube becomes too small, it cuts open the old tube and adds new material, lengthening and widening it at the same time. *C. variopedatus* feeds on the particles in the water current that is drawn in by the action of the large fan-like segments in the middle region of the body. The water is filtered through a mucus net suspended between the wing-like parapodia. Gut contents include unicellular algae and protozoans, small metazoans and detritus (Hartmann-Schröder, 1971; Fauchald & Jumars, 1979; Fish & Fish, 1989).

Distribution

On the Dutch Continental Shelf *C. variopedatus* is only found at the Oyster Ground, in very fine, muddy sands. Because of its size the species constitutes an important part of the total biomass.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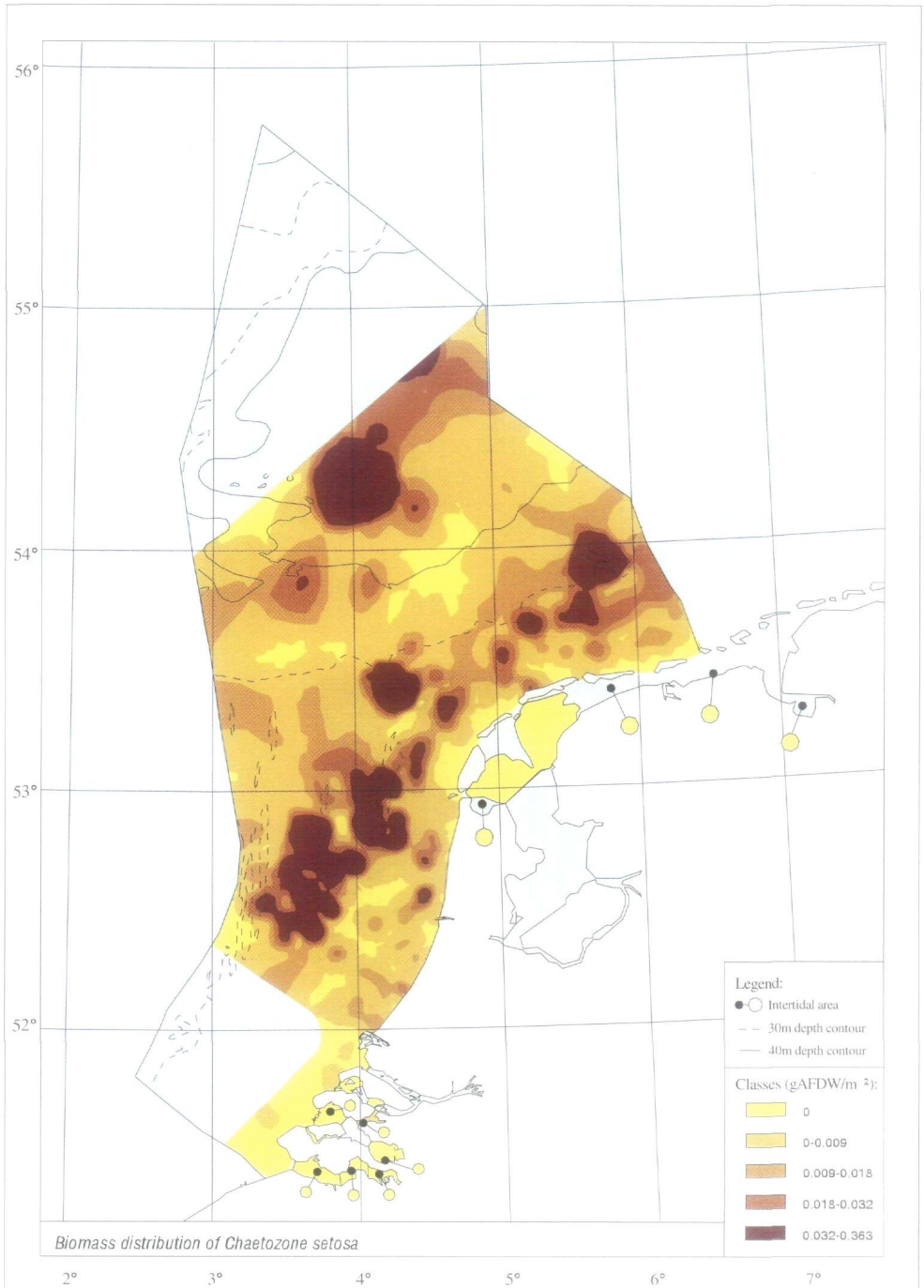
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-14
14-43
43-571
Density distribution of Chaetozone setosa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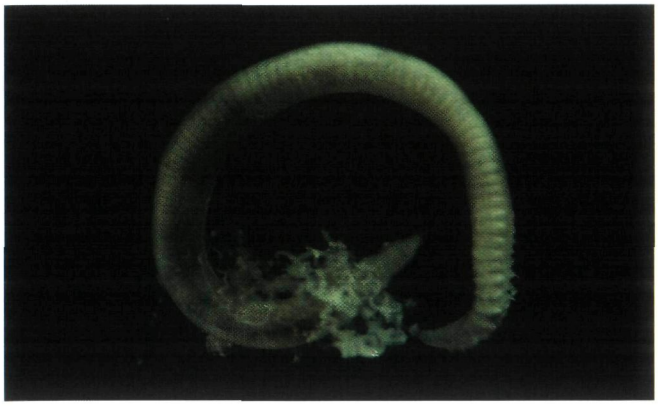
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-0.009
0.009-0.018
0.018-0.032
0.032-0.363
Biomass distribution of Chaetozone setosa



E. STIKVOORT

Chaetozone setosa

MALMGREN / 1867

Morphology

The body of *C. setosa* is strongly tapered at both ends and lacks parapodia. It is composed of 70-90 segments and few centimetres long. The pointed head bears no eyes. Filiform gills are present on a large number of segments throughout the first half of the body. The tail segments have a characteristic circle of chaetae. The species is grey, brownish or bluish black in colour (Hartmann-Schröder, 1971; Hayward & Ryland, 1990).

Biology

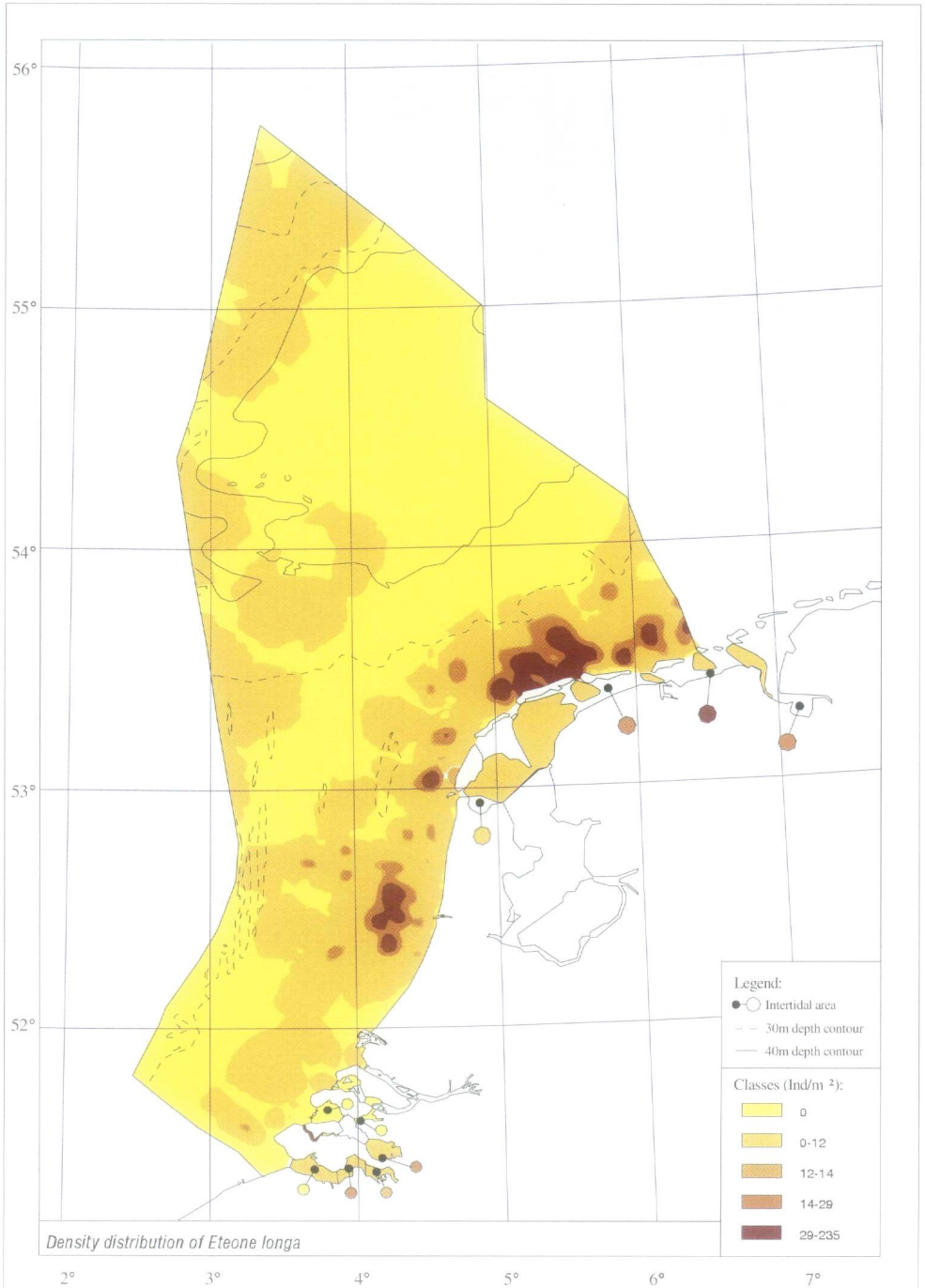
The time of spawning varies greatly in different areas. Females with ripe eggs have been observed from May until autumn. Like all cirratulids, this species has non-pelagic larvae. Its life span does not exceed 2 years.

C. setosa leads a sedentary life within the sediment and also lives in empty burrows of other polychaetes. The members of the family Cirratulidae primarily are deposit feeders that are mainly non-selective, but may be selective as in the case of *C. setosa* (Hartmann-Schröder, 1971; Wolff, 1973; Curtis, 1977; Fauchald & Jumars, 1979; Christie, 1985; Hily, 1987).

Distribution

Except for the Delta estuaries and the Wadden Sea, *C. setosa* occurs in the entire area.

The species has been recorded from many types of sediment, but shows a preference for the medium to fine grain sizes.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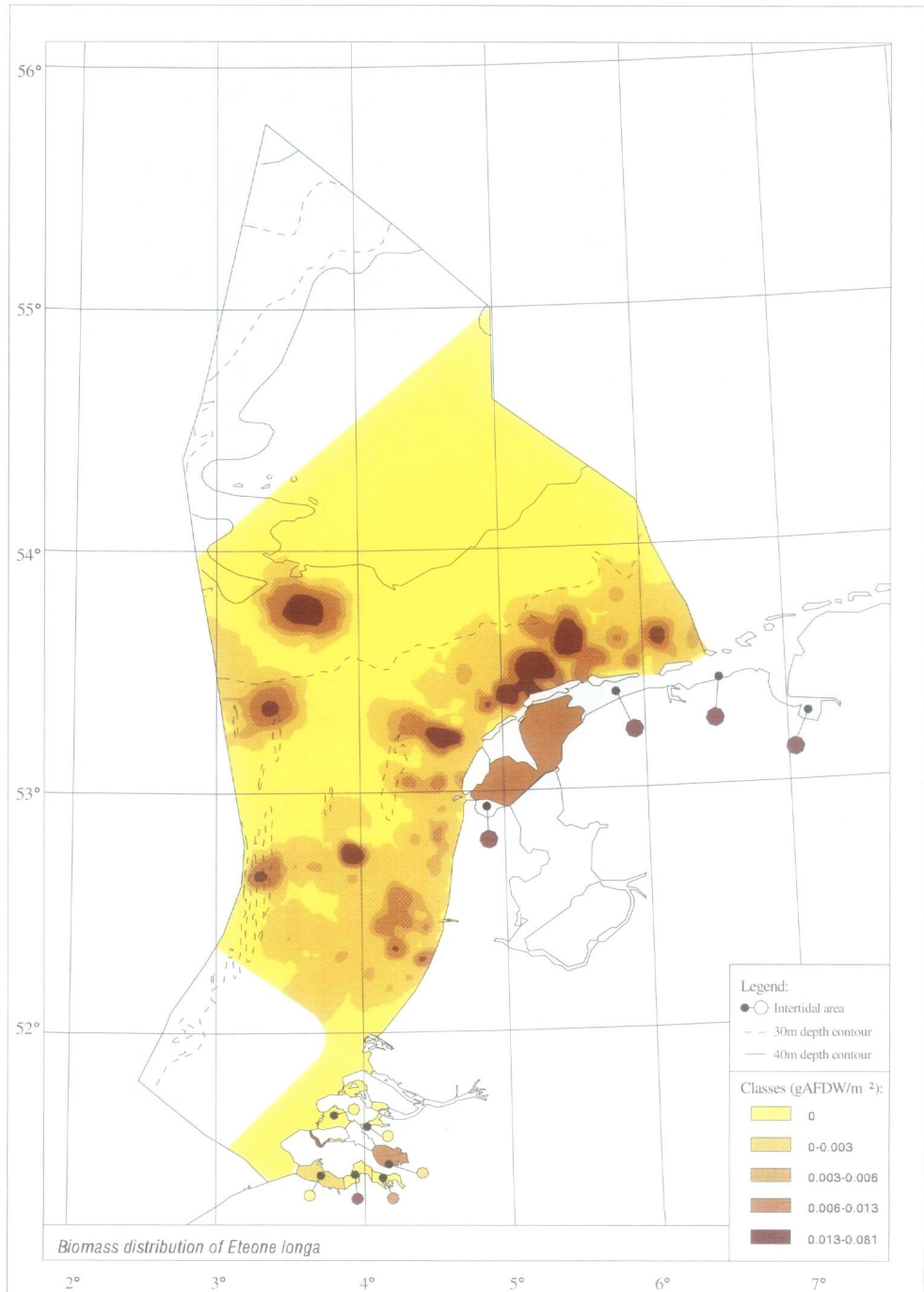
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-12
12-14
14-29
29-235
Density distribution of Eteone longa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Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-0.003
0.003-0.006
0.006-0.013
0.013-0.081
Biomass distribution of Eteone longa

E. STIKVOORT

Eteone longa

FABRICIUS / 1780

Dutch

Groengele wadworm

Morphology

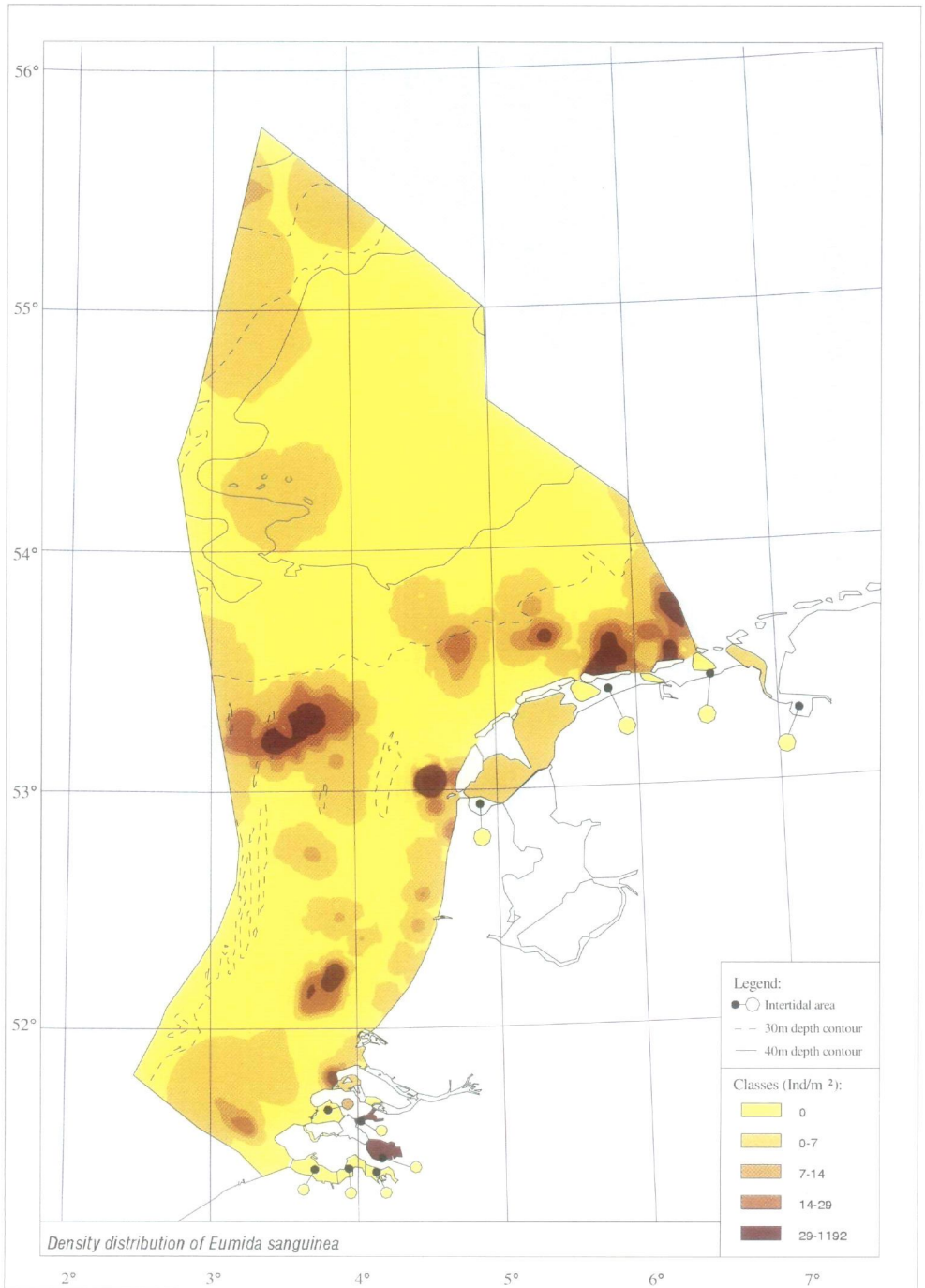
E. longa has a flattened, slender and elongated body with a length of a few centimetres and up to 200 segments. The numerous identical segments have prominent parapodia with a dorsal lamella. The head bears four short frontal antennae. It is whitish or pale grey in colour, with brown blotches or broad transverse bands of brownish green (Hartmann-Schröder, 1971; Hayward & Ryland, 1990).

Biology

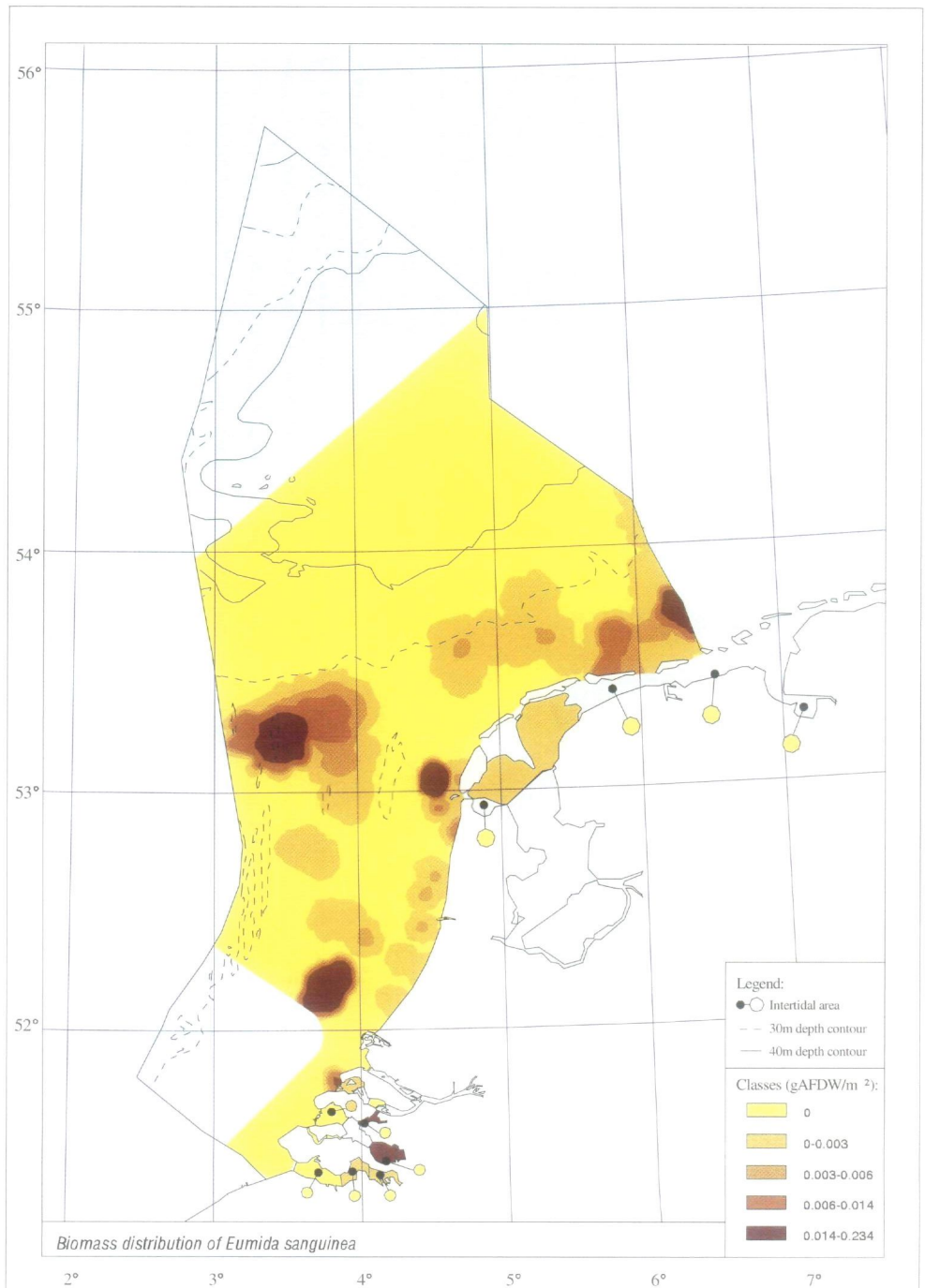
Breeding occurs from March to May. The eggs are deposited in a cocoon. In the Delta area the pelagic larvae are found in February-June and August-October. Before spawning it sometimes swims close to the water surface.
In the western Wadden Sea *E. longa* appears to be relatively tolerant to low winter temperatures. The species crawls on the surface or in the upper centimetres of the sediment. Many Phyllodocids are predatory carnivores, catching their prey with their muscular pharynx. *E. longa* feeds on spionids, e.g. *Spio filicornis* and *Scolelepis squamata*, and on a variety of small metazoans. Cannibalism is widespread (Hartmann-Schröder, 1971; Wolff, 1973; Beukema, 1979; Fauchald & Jumars, 1979).

Distribution

The distribution of *E. longa* ranges from the intertidal zone down to a depth of 30 m. The highest densities are found near the coast and north of the Wadden islands.
E. longa occurs in all types of sediments, but prefers fine and muddy sand. It is also found in empty tubes and on oyster banks. Well-sorted types of sediments are favoured (Hartmann-Schröder, 1971; Wolff, 1973).



Density distribution of Eumida sanguinea



Biomass distribution of Eumida sanguinea