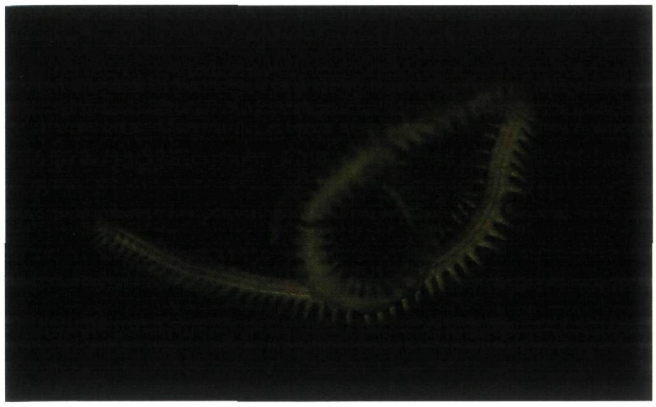


J. VAN DER HOEK

Sthenelais limicola

EHLERS / 1864

Morphology

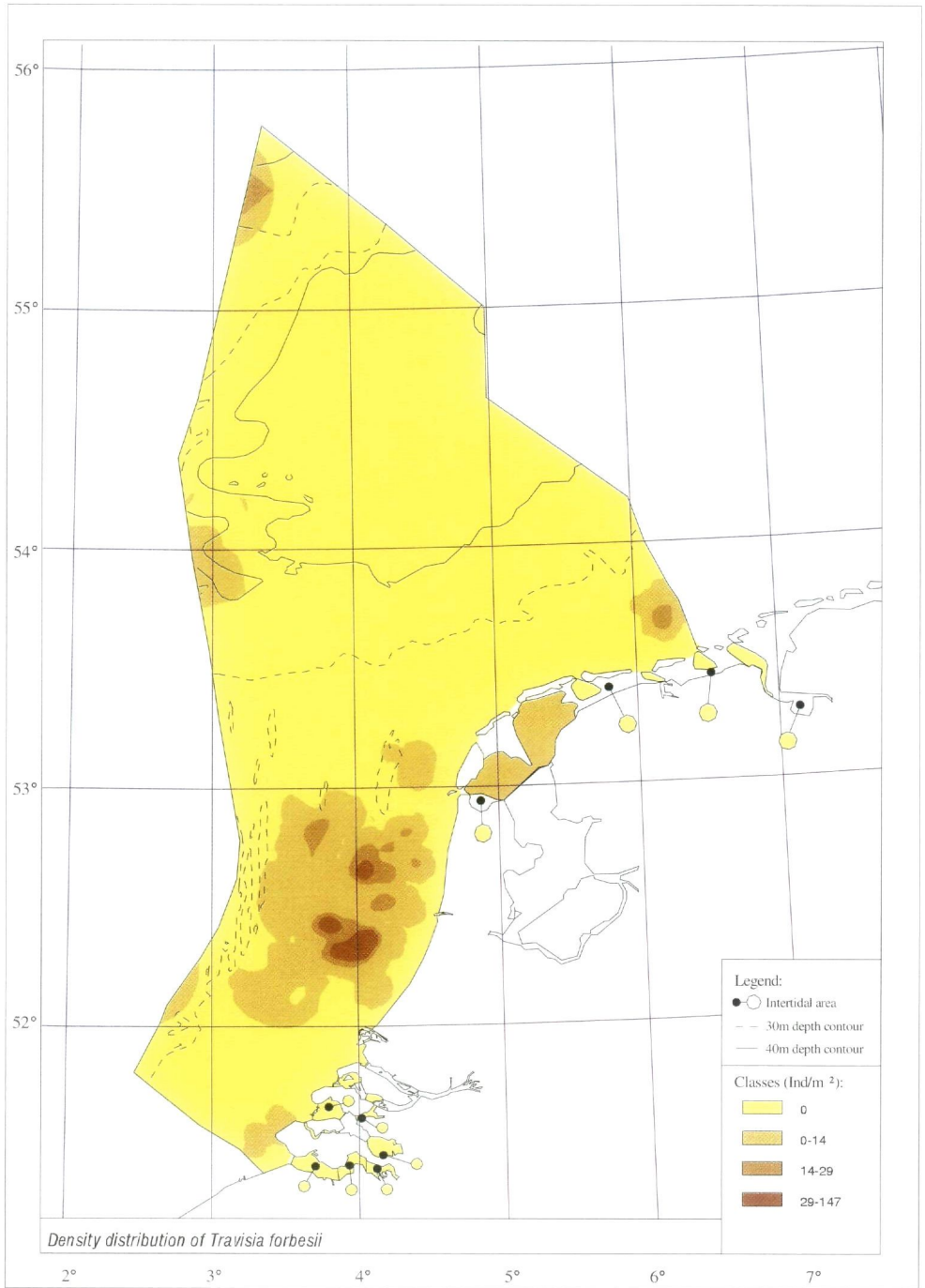
S. limicola has an elongate body composed of numerous segments and is dorsally covered with elytra. The elytra are smooth, without papillae, but with a notch-like incision on the outer edge. The maximum length measures 100 mm with up to 200 segments. The prostomium is round with four eyes and a prominent median antenna. The first segment projects alongside the head and bears two additional pairs of cirri. Two long palps extend forwards from under the first segment. The parapodia are bilobed, prominent and have complex chaetae. This worm is usually colourless, with brown patches on the elytra (Hartmann-Schröder, 1971).

Biology

No information on the reproduction of *S. limicola* is available. The species is an active, free-living carnivore, feeding on a variety of small invertebrates. The species is often eaten by juvenile fish (Hartmann-Schröder, 1971; Fauchald & Jumars, 1979).

Distribution

S. limicola is most abundant in the northern part of the Dutch sector at depths between 20 m and 50 m. The species is scarce in the Southern Bight, with only a few individuals found in the Brown Bank area. *S. limicola* has not been observed along the coast or in the brackish waters.
It is most frequent in very fine sediments mixed with mud, as found in the Oyster Ground.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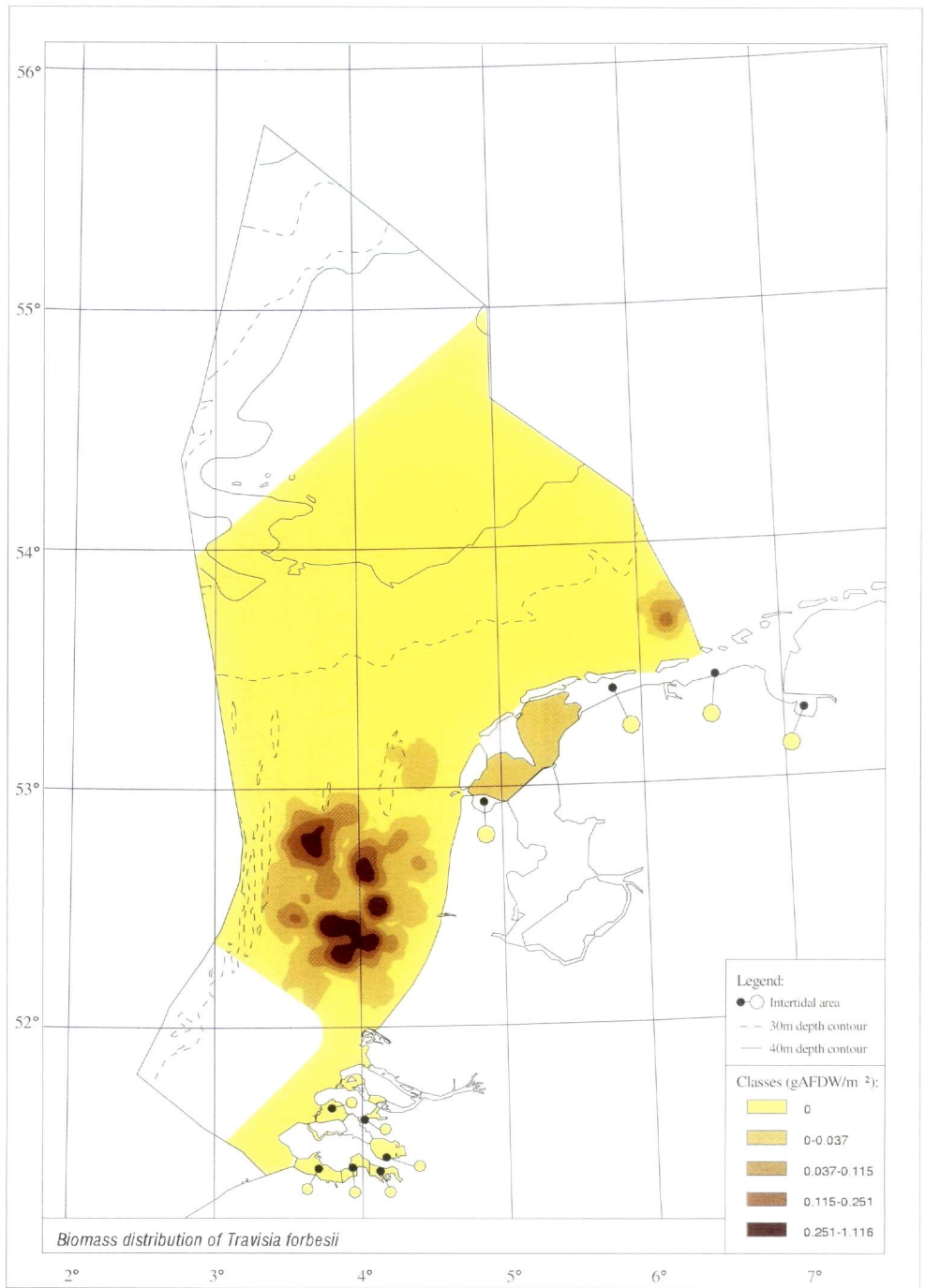
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-14
14-29
29-147
Density distribution of Travisia forbesii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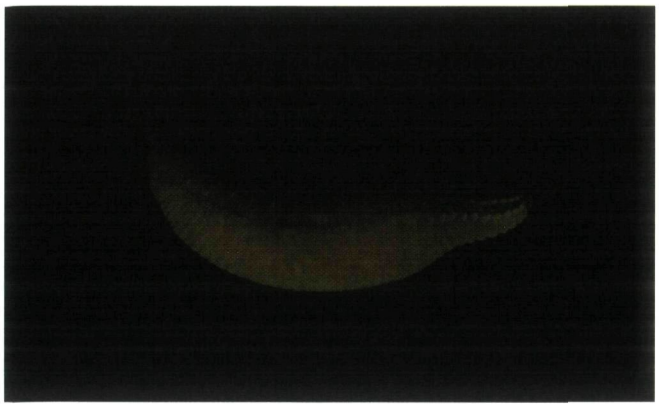
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-0.037
0.037-0.115
0.115-0.251
0.251-1.116
Biomass distribution of Travisia forbesii



J. VAN DER HOEK

Travisia forbesii

JOHNSTON / 1840

Morphology

Like *Ophelia borealis*, *T. forbesii* is a short, spindle-shaped worm with a conical head, circular in cross section anteriorly, but without a clear ventral groove in the hind part. The body is made up of 30 segments and measures about 30 mm in length and 7 mm in width. Parapodia are inconspicuous, but finger-like gills are present from the second segment onwards.
T. forbesii is whitish or flesh pink in colour and may be encrusted with sand. This species gives of a strong garlic-like smell when collected (Hartmann-Schröder, 1971; Hayward & Ryland, 1990).

Biology

T. forbesii spawns from November to February. Eggs and larvae are non-pelagic.

Like other Opheliids, it is generally considered to be a non-selective deposit feeder. *T. forbesii* is eaten by different kinds of fish (Wolff, 1973; Fauchald & Jumars, 1979; Hayward & Ryland, 1990).

Distribution

The distribution of *T. forbesii* comprises the subtidal zone in the western Wadden Sea, the Southern Bight and some locations in the Voordelta. Some individuals have been found at the Cleaver Bank, the Dogger Bank and in the north-eastern part of the area.
The species has been mainly found in medium to coarse sand with a very low silt content. *T. forbesii* is reported as a species inhabiting coarse to fine sand, and (rarely) mud (Hartmann-Schröder, 1971; Wolff, 1973; Hayward & Ryland, 1990).

Crustacea

Crustacea is an Arthropoda subphylum, characterized by the presence of two pairs of appendages at the front part of the body and paired appendages near the mouth that act as jaws. Although very variable in appearance, a typical crustacean is segmented and built up of a head, a thorax and an abdomen. The head consists of the unsegmented acron and the first 4 or more anterior segments. The thorax carries several paired appendages, which may carry out different functions. The appendages can be modified to walk, swim or gather food. The abdomen also carries limbs that may have different functions, such as, in males, the transfer of sperm. The last pair of appendages is often transformed into uropods and together with the last part of the abdomen, the telson, are used for swimming.

Another feature frequently found in crustaceans is the carapace. This is a fold arising from the back of the head, covering the thorax and/or the head and the abdomen. In case of a forward projection of the carapace, the anterior, often pointy, part is called the rostrum.

Crustaceans generally have separate sexes, but hermaphroditism is not uncommon. In some shrimp species a change of sex occurs during growth. Sexual dimorphism is common, the male being much smaller than the female or larger, and with distinct differences in the appendages. Fertilized eggs are mostly carried, either externally between the limbs or internally in a brood pouch.

The characteristic crustacean larva is a nauplius. This is a simple, unsegmented larva, with 3 pairs of appendages and 1 simple eye.

To grow crustaceans have to moult, as the rigid exoskeleton, or carapace can not expand. Before shedding the old carapace the calcium is extracted from it. Directly after leaving the old carapace behind the animal swells by the uptake of water. Finally, the new carapace hardens.

The wide variety of crustaceans utilizes all kinds of food. Some feed on microscopic phytoplankton, while others are predators. Some species are parasitic.

During the surveys of which data have been used for this atlas a total of 130 macrobenthic crustaceans have been identified on the species level, including 77 amphipods, 17 cumaceans and 23 decapods. Representatives of the following three groups are dealt with in this atlas.

Amphipoda

Amphipoda are laterally compressed, often brightly coloured crustaceans. They have long, hairy antennae. In size the amphipods range from 1 to 140 mm, but in the temperate zones their size mostly lies between 4 and 10 mm. Males have enlarged gnathopods (claws on the second segment of the thorax) that are used to hold the female during copulation.

The fertilized eggs are carried by the female and the larvae hatch after 2 to about 60 days. The larvae moult several times before reaching maturity.

Amphipods are active swimmers, although most marine species burrow in soft sediments. Most species are scavengers or herbivores, but predatory species occur as well.

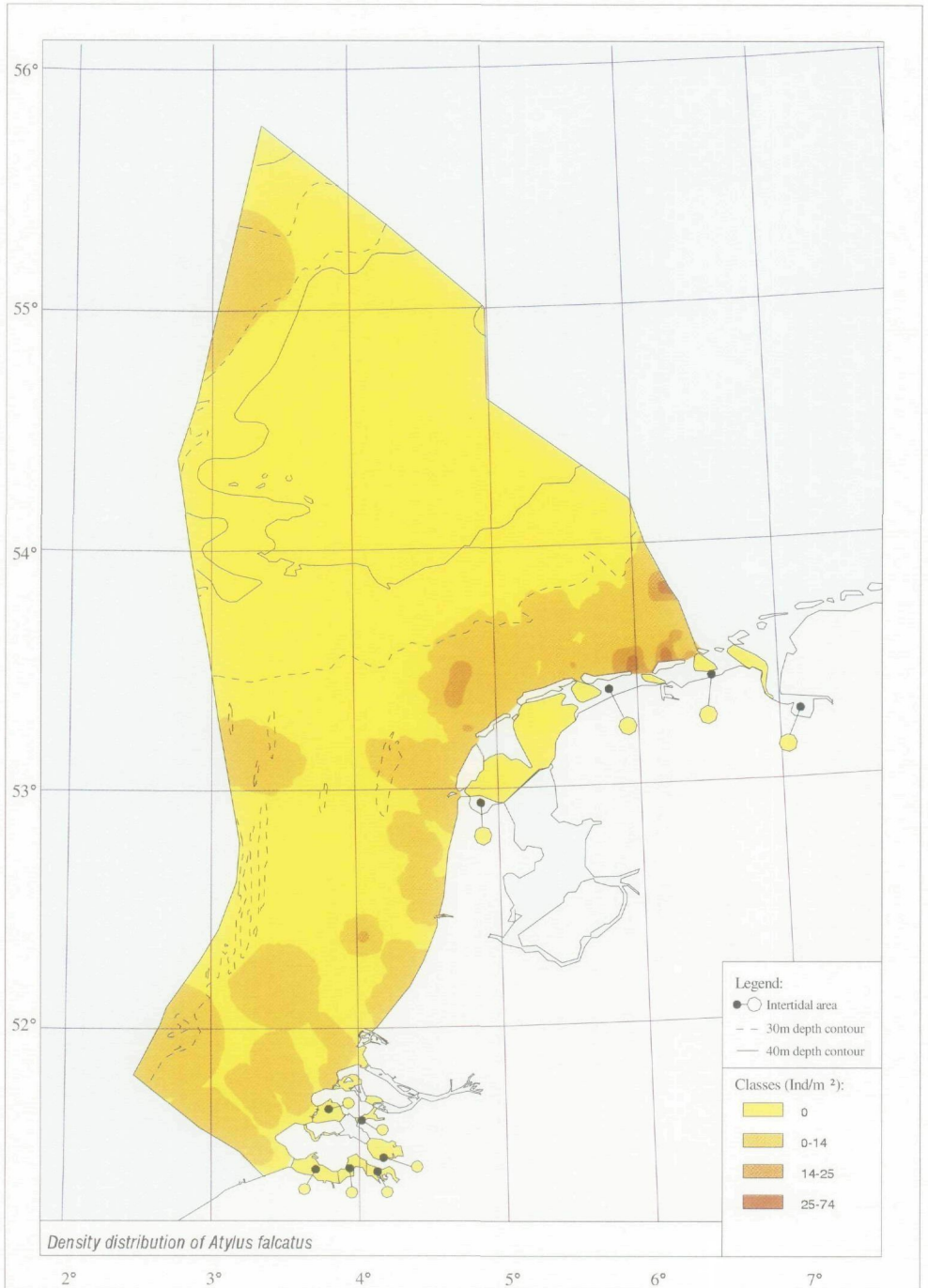
Cumacea

Cumaceans, or hooded shrimps, are small, mainly marine crustaceans. Their popular name refers to the widened and rounded head and thorax. The abdomen is slender and cylindrical and the tail is forked. Their size reaches from 2 to 10 mm.

Cumaceans mainly inhabit shallow offshore waters, where they burrow in the sediment. They feed on micro-organisms and detritus. The eggs and young are carried in a brood pouch.

Decapoda

Decapoda are characterized by the fusion of the head and the thorax, which are covered by the carapace. The carapace has an anterior projection, the rostrum, between the eyes. The thorax normally carries eight pairs of appendages of which the first and the third pair are used in feeding and the fourth to eight pairs are used for walking. The five pairs of appendages of the abdomen are used in swimming.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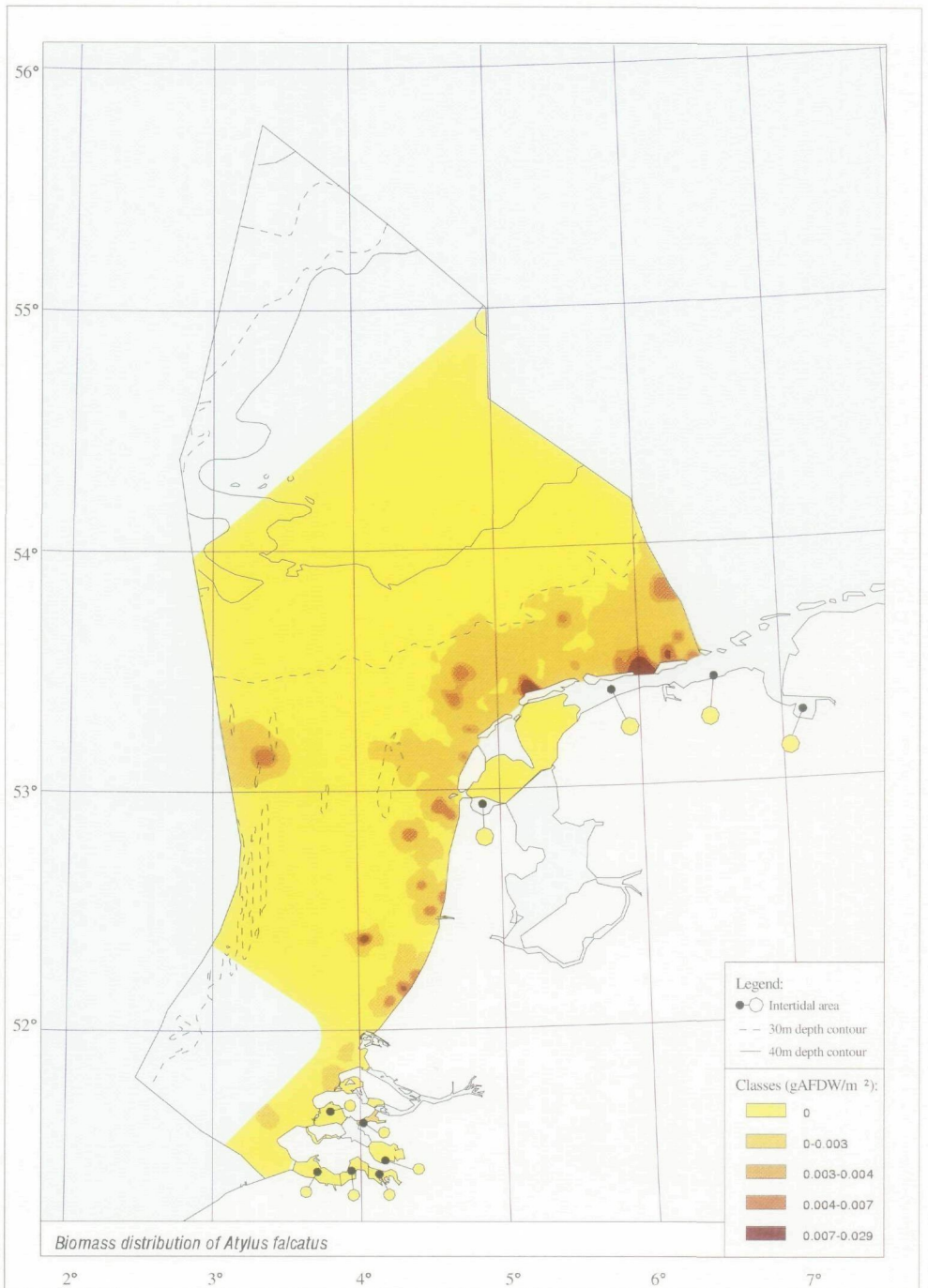
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-14
14-25
25-74
Density distribution of Atylus falcatus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Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-0.003
0.003-0.004
0.004-0.007
0.007-0.029
Biomass distribution of Atylus falcatus

J. VAN DER HOEK

Atylus falcatus

METZGER / 1871

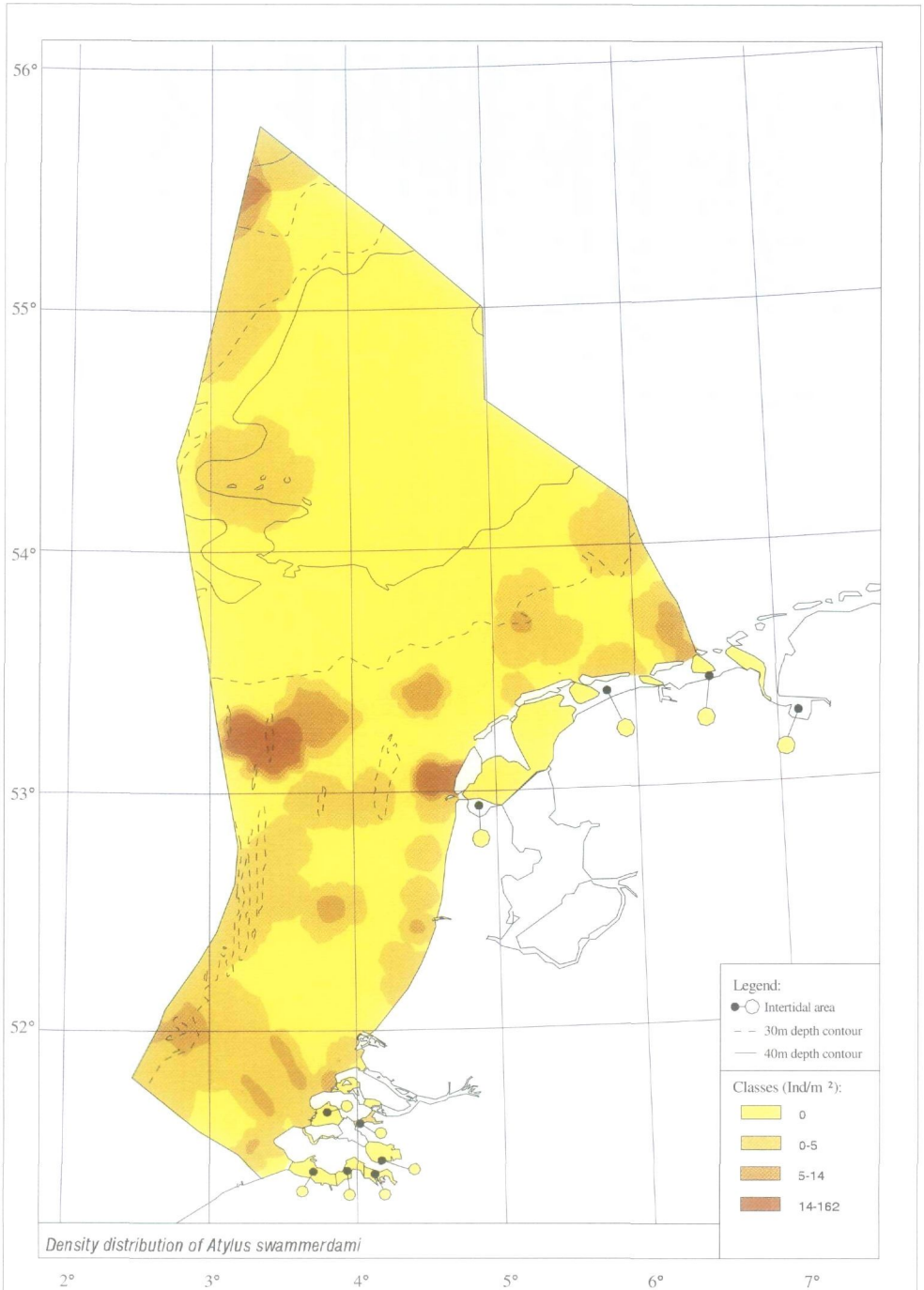
Morphology

This amphipod has a length of up to about 7 mm. Its colour is pale white with brown patches. The body is strongly compressed. The head has a well developed, slender rostrum. The eyes are moderately large in females and very large in males. *A. falcatus* differs from *A. swammerdami* (q.v.) because of the large claspers found on the robust third pereopod (Lincoln, 1979; Hayward & Ryland, 1990).

Distribution

A. falcatus is frequently found along the Dutch coast from the Voordelta to the Wadden islands and, in lower densities, at the shallow Dogger Bank. Both *A. swammerdami* and *A. falcatus* are absent from the Oyster Ground. In the Delta area, the Dutch Wadden Sea and at the Oyster Ground *A. falcatus* is absent.

In the study area, this species occurs in fine to medium sand with a low mud content. In literature *A. falcatus* is also described from shell or muddy sand (Lincoln, 1979).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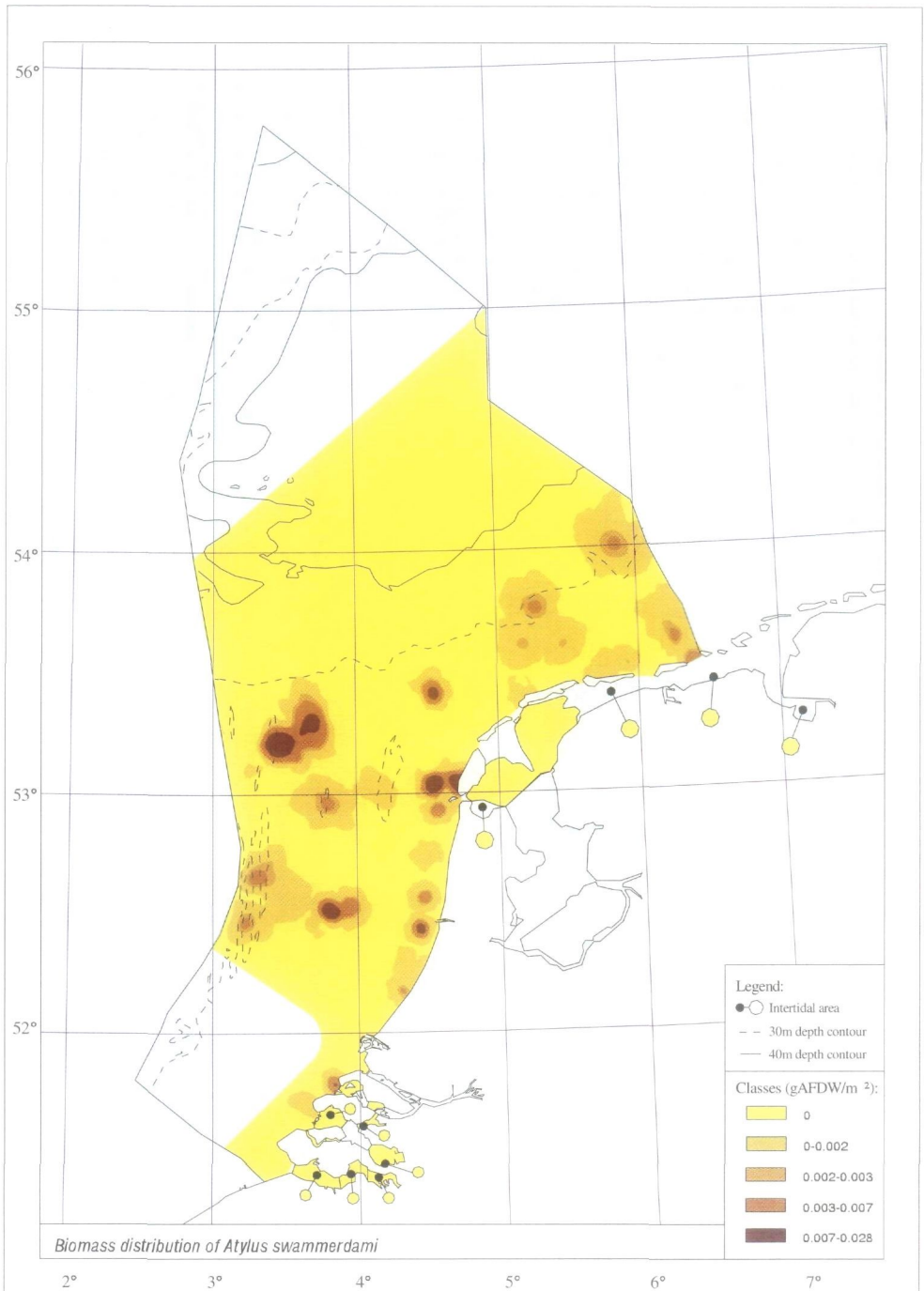
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-5
5-14
14-162
Density distribution of Atylus swammerdami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Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-0.002
0.002-0.003
0.003-0.007
0.007-0.028
Biomass distribution of Atylus swammerdami

E. STIKVOORT

Atylus swammerdami

MILNE-EDWARDS / 1830

Synonym(s)

Nototropis swammerdami

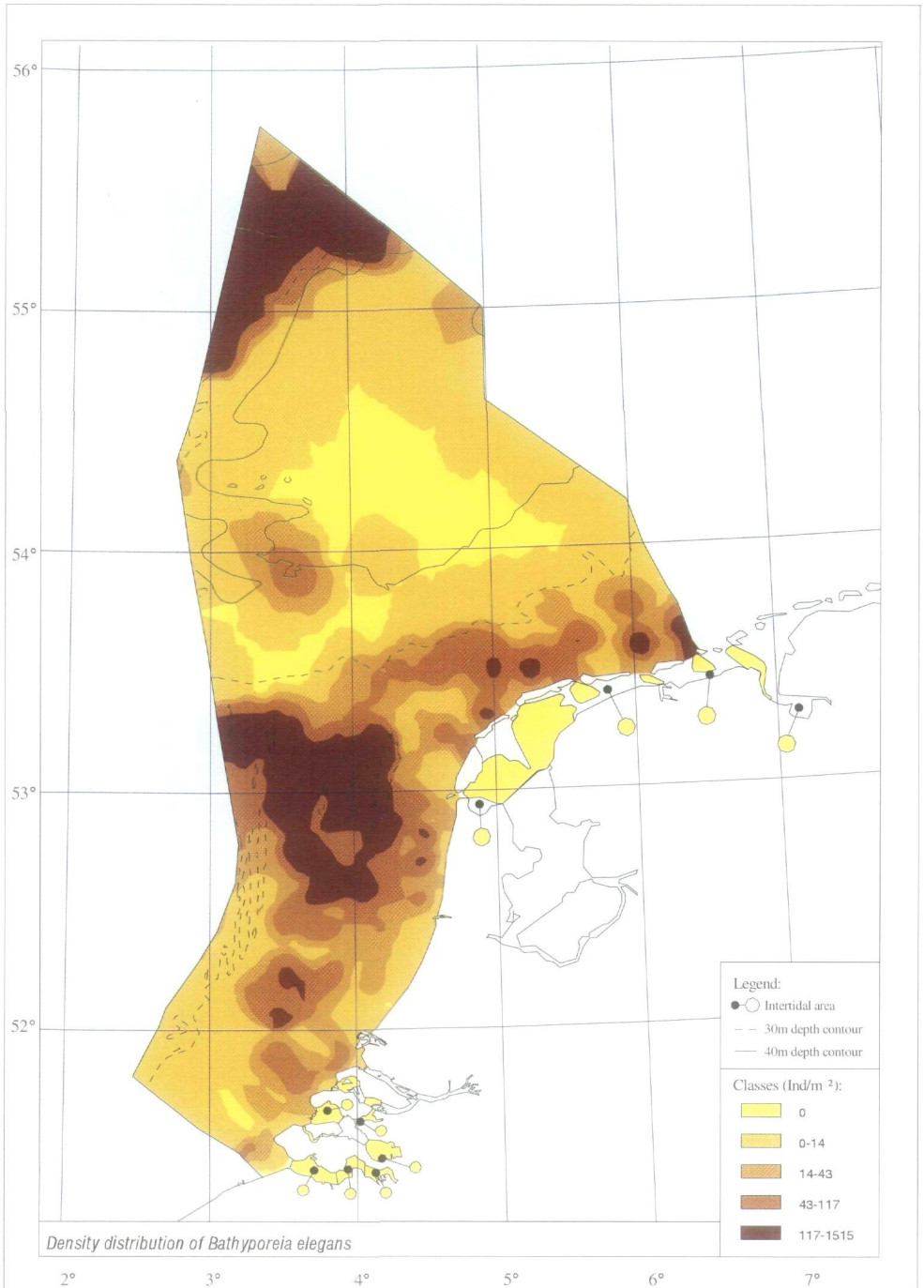
Morphology

A. swammerdami has a strongly compressed body of up to 10 mm in length. The head carries a small curved rostrum. The eyes are large and kidney-shaped. The first pair of antennae are shorter than the second pair. The abdomen consists of only 5 visible segments. The body is whitish in colour and is covered with brown patches (Lincoln, 1979; Fish & Fish, 1989). *A.swammerdami* differs from *A. falcatus* (q.v.) in lacking the large claspers on the robust third pereopod.

Distribution

A. swammerdami is found in the shallower part of the Dutch continental shelf. Both *A. swammerdami* and *A. falcatus* are absent from the Oyster Ground. In the Delta area, it is found in the Oosterschelde, but has previously also been recorded from the Westerschelde (Cattrijsse *et al.*, 1993). In literature the species is described from the lower intertidal to depths of about 50 m (Lincoln, 1979; Fish & Fish, 1989; Hayward & Ryland, 1990).

A. swammerdami mainly lives in fine sediments with a low mud content, but also occurs in sandy (coarse) deposits and among algae (Lincoln, 1979; Fish & Fish, 1989; Hayward & Ryland, 1990).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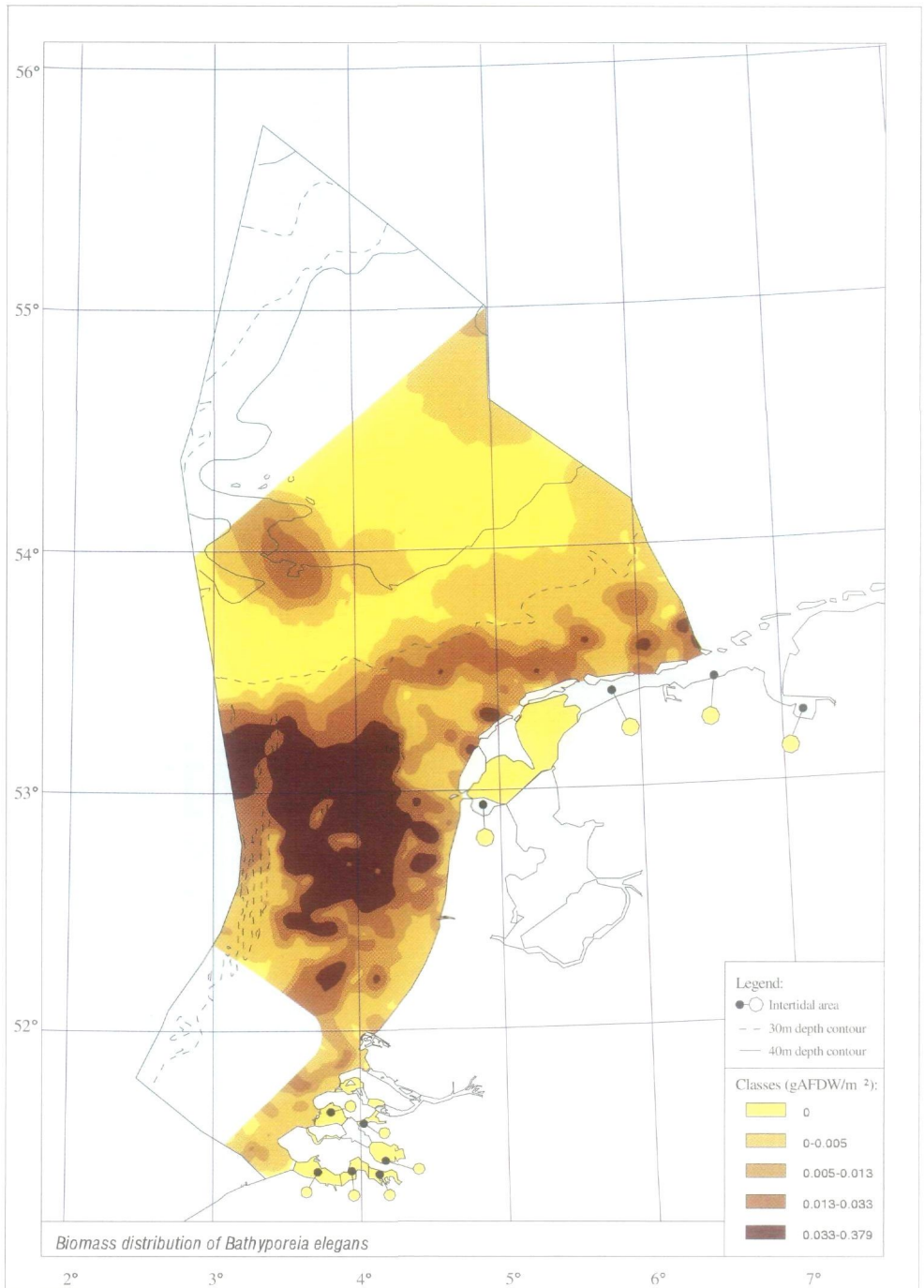
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-14
14-43
43-117
117-1515
Density distribution of Bathyporeia elegans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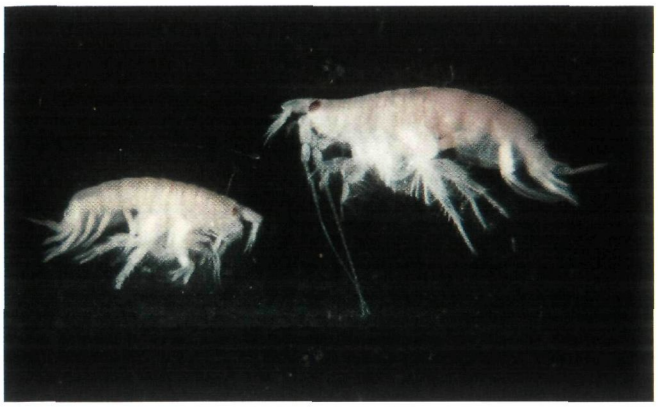
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-0.005
0.005-0.013
0.013-0.033
0.033-0.379
Biomass distribution of Bathyporeia elegans



J. VAN DER HOEK

Bathyporeia elegans

WATKIN / 1938

Morphology

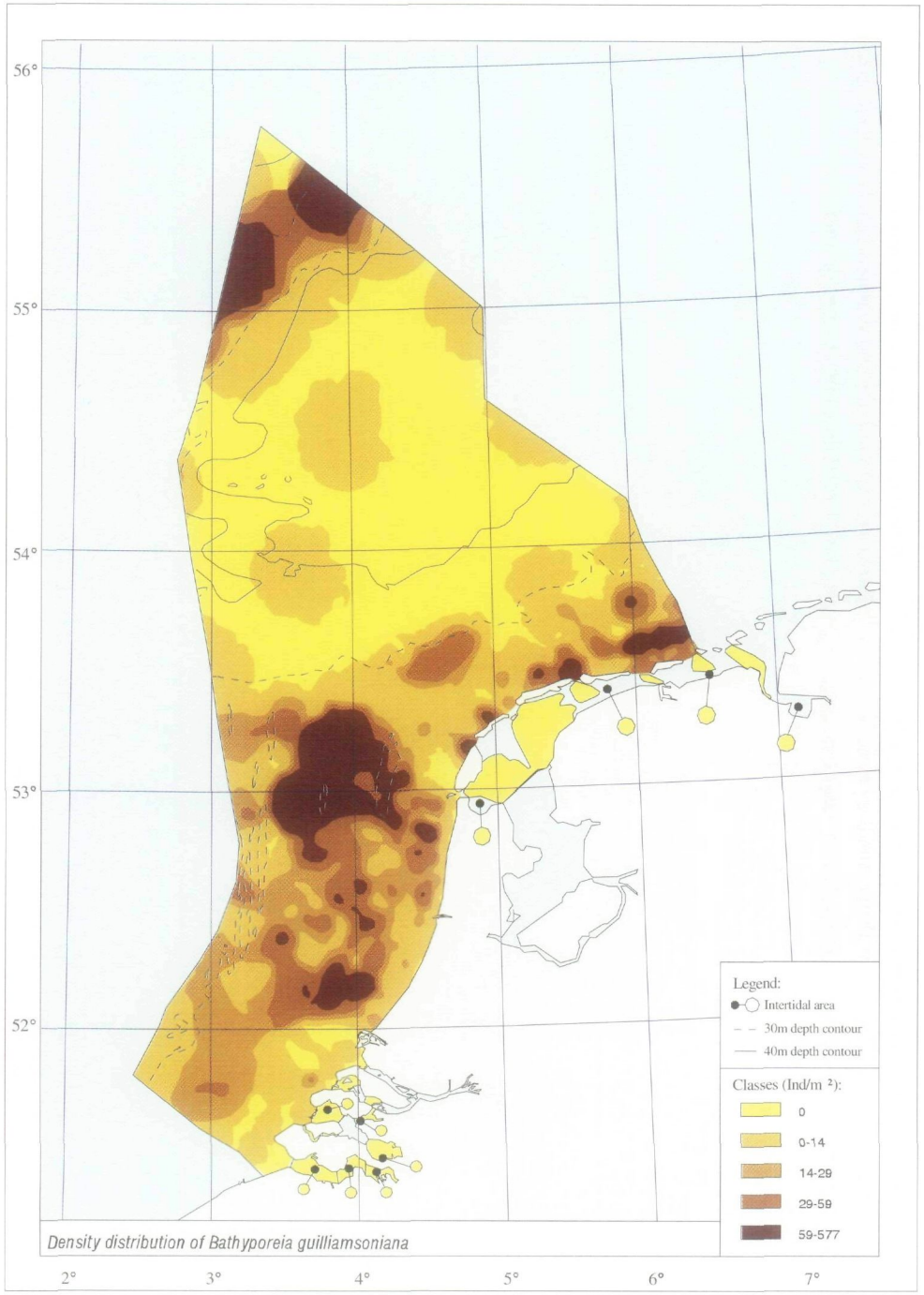
B. elegans has a length of up to 6 mm. Its body is laterally compressed, rather slender and elongate. The head has no rostrum and the eyes are distinct. The body is devoid of pigment. The telson is completely split (Lincoln, 1979; Hayward & Ryland, 1990). Species of the genus *Bathyporeia* are remarkably similar in general morphology. They mostly differ in the number or size of little spines that are present at the plates covering their bodies.

Biology

Bathyporeia spp. show two types of movement, swimming and burrowing, that may follow each other up in rapid succession. Often they seem to burrow with the dorsal side upwards. This may be associated with the breeding cycle. In deeper waters the spring rise in temperature initiates breeding, while in shallower waters it is induced by tidal phasing. Ovigerous females of *B. elegans* are found mainly from May to August (Watkin, 1939a, 1939b; Nicolaisen & Kanneworff, 1969; Finchham, 1971).
Bathyporeia shows a typical feeding position lying upside down in a small cavity in the sand, and may be considered a selective deposit feeder. It feeds by cleaning sand grains from adhering micro-organisms and detritus (Nicolaisen & Kanneworff, 1969).

Distribution

B. elegans is one of the most common macrobenthic species on the Dutch Continental Shelf and the most abundant species of the genus *Bathyporeia*. It is not present in the deeper central Oyster Ground and the Wadden Sea. *B. elegans* species prefers fine sand with a low content of mud.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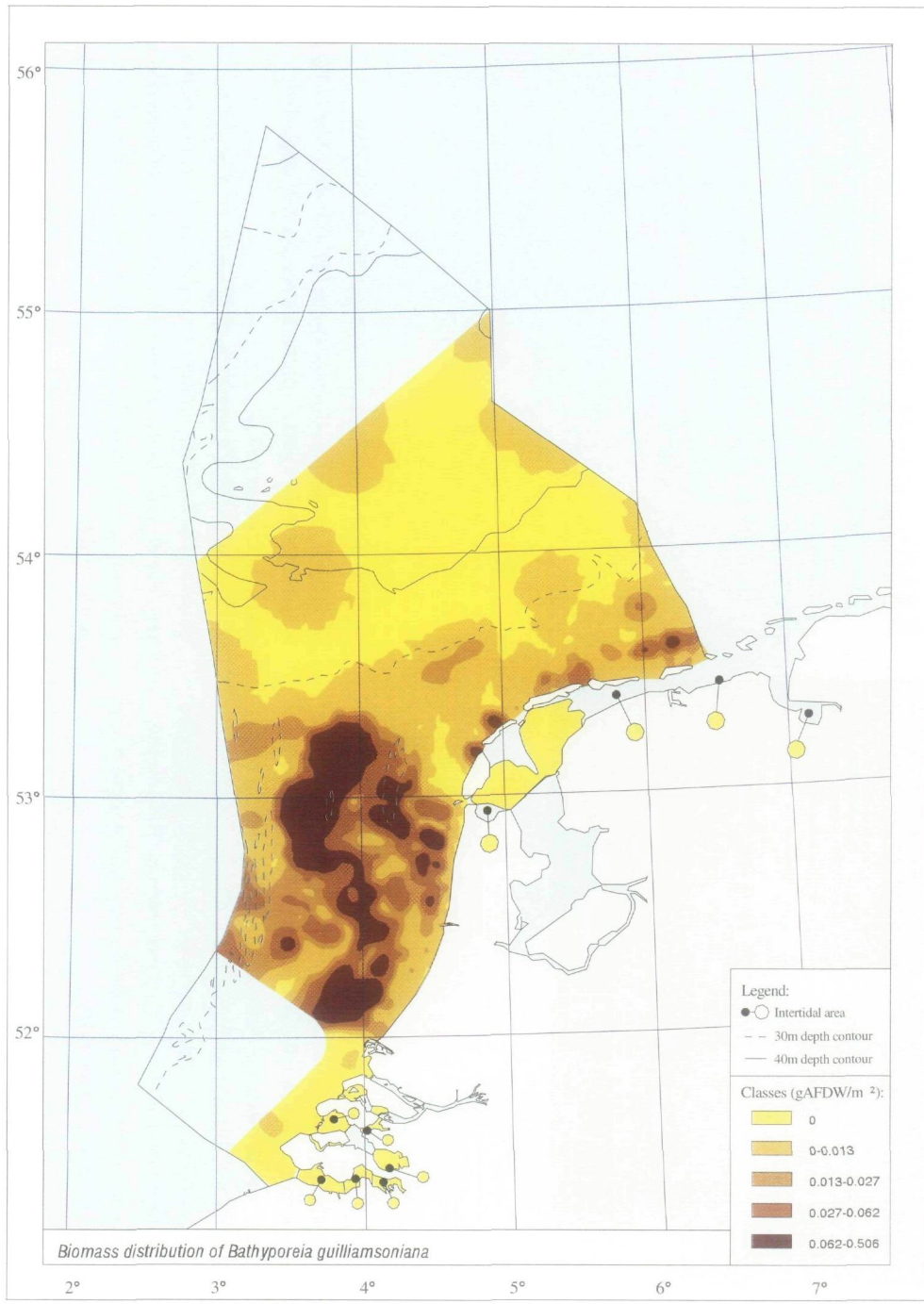
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-14
14-29
29-59
59-577
Density distribution of Bathyporeia guilliamsoniana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Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-0.013
0.013-0.027
0.027-0.062
0.062-0.506
Biomass distribution of Bathyporeia guilliamsoniana

E. STIKVOORT

Bathyporeia guilliamsoniana

BATE / 1856

Morphology

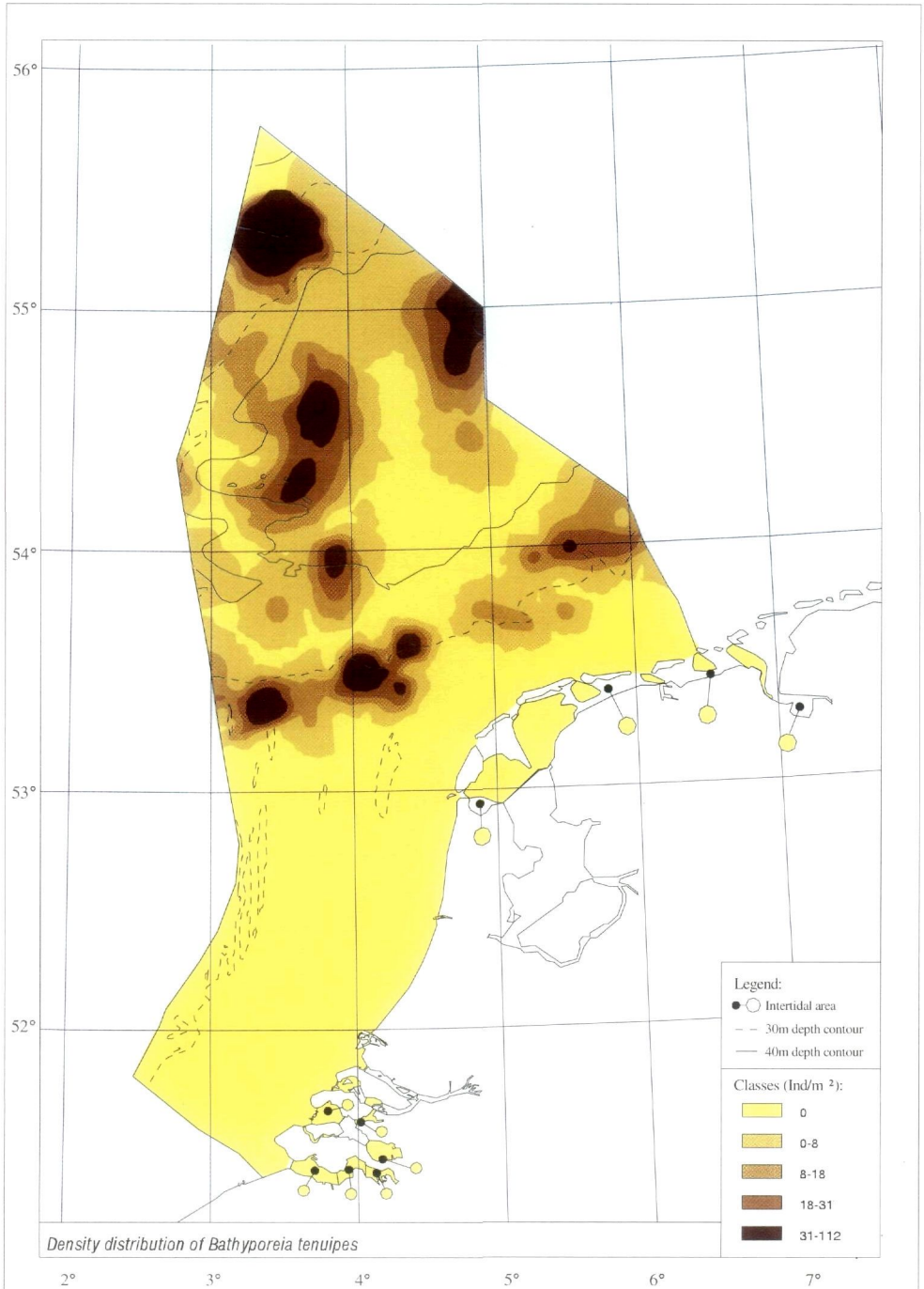
B. guilliamsoniana is the largest species of the genus, with a length up to about 8 mm. The body is robust and laterally compressed. The head lacks a rostrum and the eyes are distinct. The telson is completely split. The body is devoid of pigment. (Lincoln, 1979; Hayward & Ryland, 1990). Species of the genus *Bathyporeia* are remarkably similar in general morphology. They mostly differ in the number or size of little spines that are present at the plates covering their bodies.

Biology

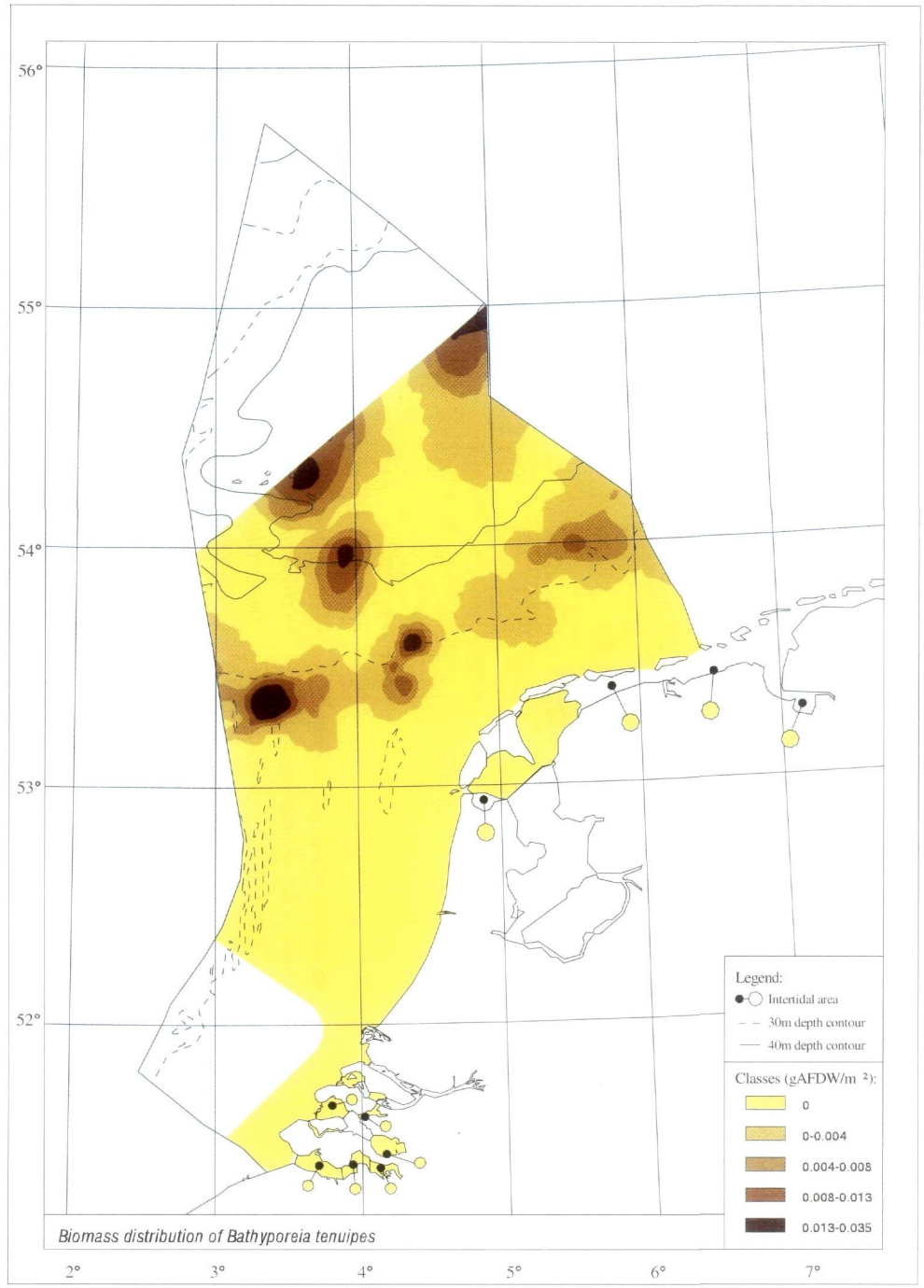
Bathyporeia spp. show two types of movement, swimming and burrowing, that may follow each other up in rapid succession. Often they seem to burrow with the dorsal side upwards. This may be associated with the breeding cycle. In deeper waters the spring rise in temperature initiates breeding, while in shallower waters it is induced by tidal phasing. Breeding of *B. guilliamsoniana* starts in January and becomes intense in May. In the deeper waters the breeding season is short and occurs only in spring. The breeding season in the shallower areas may extend into August (Watkin, 1939a, 1939b; Nicolaisen & Kanneworff, 1969; Finchham, 1971). *Bathyporeia* shows a typical feeding position lying upside down in a small cavity in the sand, and may be considered a selective deposit feeder. It feeds by cleaning sand grains from adhering micro-organisms and detritus (Nicolaisen & Kanneworff, 1969).

Distribution

In the studied area *B. guilliamsoniana* is very abundant in the area of the Southern Bight, north of the Wadden islands, and at the Dogger Bank. The distribution pattern is almost the same as found for *B. elegans,* but *B. guilliamsoniana* is nearly missing at the Oyster Ground.
B. guilliamsoniana mainly lives in medium to fine sand with a very low mud content.



Density distribution of Bathyporeia tenuipes



Biomass distribution of Bathyporeia tenuipes

M. LAVALEYE

Bathyporeia tenuipes

MEINERT / 1877

Morphology

B. tenuipes has a length of up to about 6 mm. The body is slender and laterally compressed. The head lacks a rostrum and the eyes are distinct. The telson is completely split (Lincoln, 1979; Hayward & Ryland, 1990). Species of the genus *Bathyporeia* are remarkably similar in general morphology. They mostly differ in the number or size of little spines that are present at the plates covering their bodies. *B. tenuipes* furthermore differs from *B. elegans* and *B. guilliamsoniana* (q.v.) in the triangular shape of the bases of the first antennae.

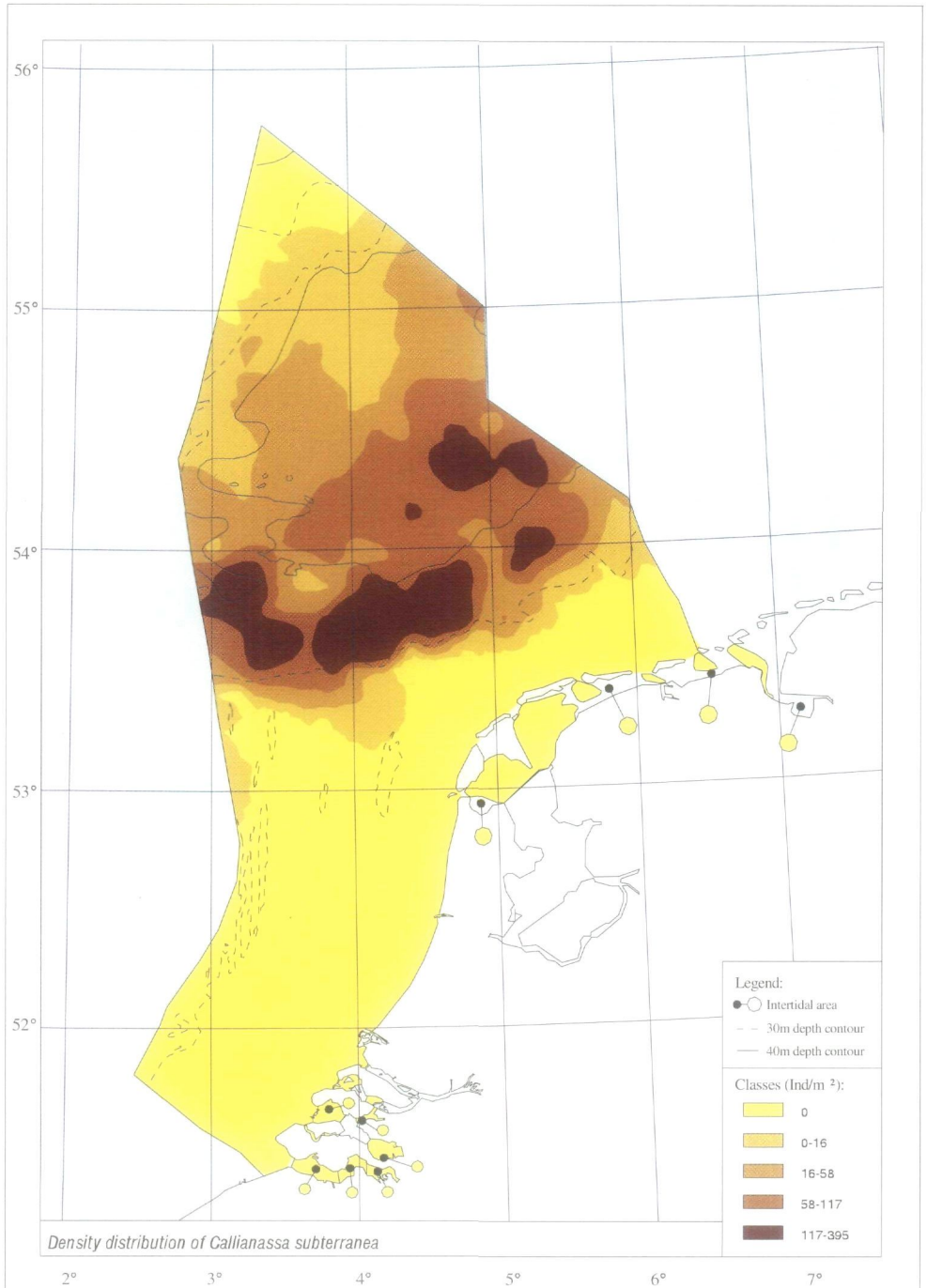
Biology

Bathyporeia spp. show two types of movement, swimming and burrowing, that may follow each other up in rapid succession. Often they seem to burrow with the dorsal side upwards. This may be associated with the breeding cycle. In deeper waters the spring rise in temperature initiates breeding, while in shallower waters it is induced by tidal phasing (Watkin, 1939a, 1939b; Nicolaisen & Kanneworff, 1969; Finchham, 1971).

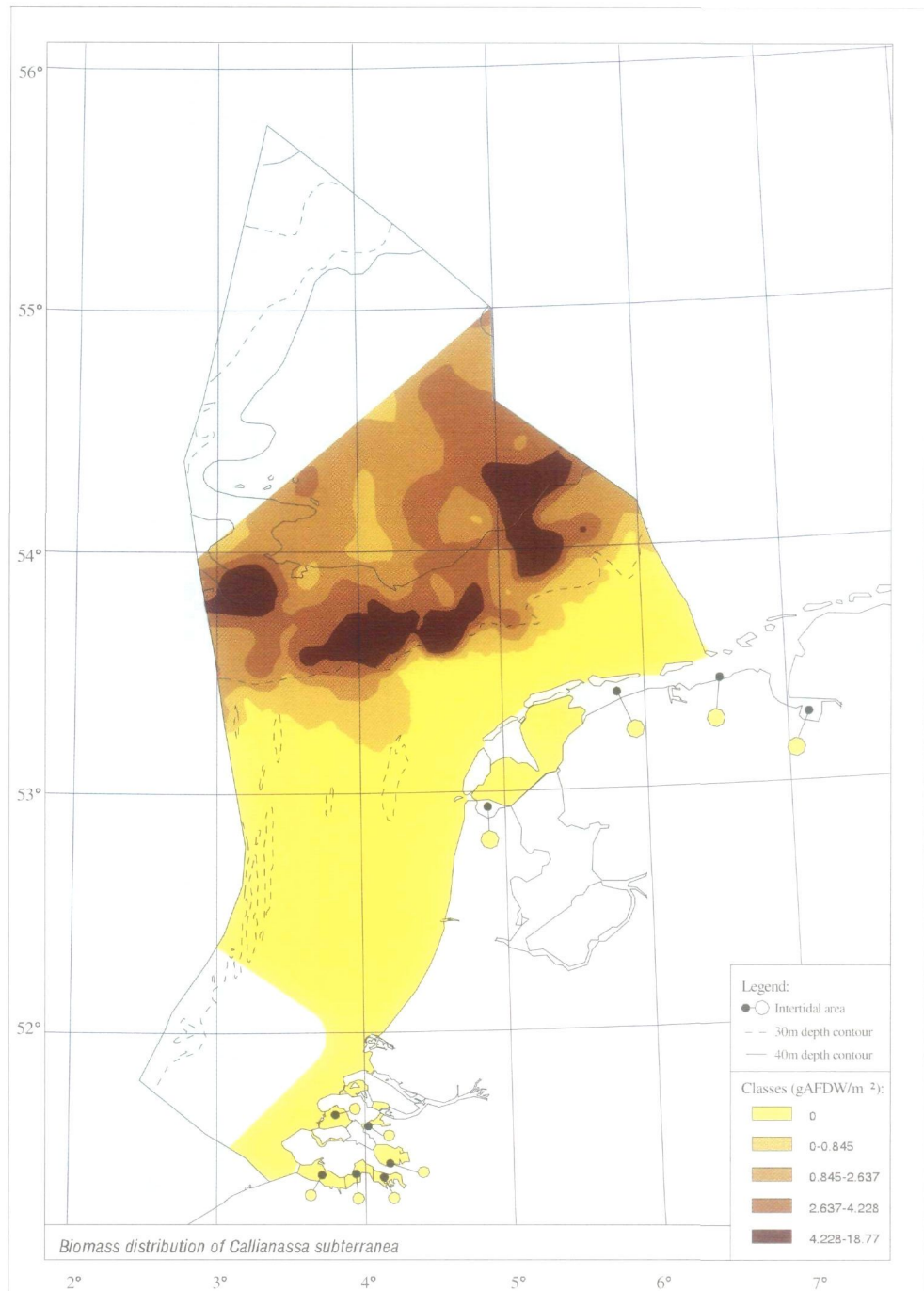
Bathyporeia shows a typical feeding position lying upside down in a small cavity in the sand, and may be considered a selective deposit feeder. It feeds by cleaning sand grains from adhering micro-organisms and detritus (Nicolaisen & Kanneworff, 1969).

Distribution

The third species of the genus *Bathyporeia* found in the area, shows a distribution pattern different from the other two species. *B. tenuipes* is not recorded from the area of the Southern Bight. Only a few individuals are found south of the Oyster Ground. The highest densities are found at the Dogger Bank. *B. tenuipes* usually lives in fine to very find sand or muddy sand.



Density distribution of Callianassa subterranea



Biomass distribution of Callianassa subterranea

J. VAN DER HOEK

Callianassa subterranea

MONTAGU / 1808

Synonym(s)

Callianassa stebbingi

Morphology

Callianassidae are decapod shrimps with a large pincher on just one of the front legs. They are superficially similar to lobsters. *C. subterranea* is one of the smaller species of the family. It can reach up to 46 mm overall length. Its rostrum is minute. Its colour is pale puce, but sometimes quite dark (Lutze, 1938; Hayward & Ryland, 1990).

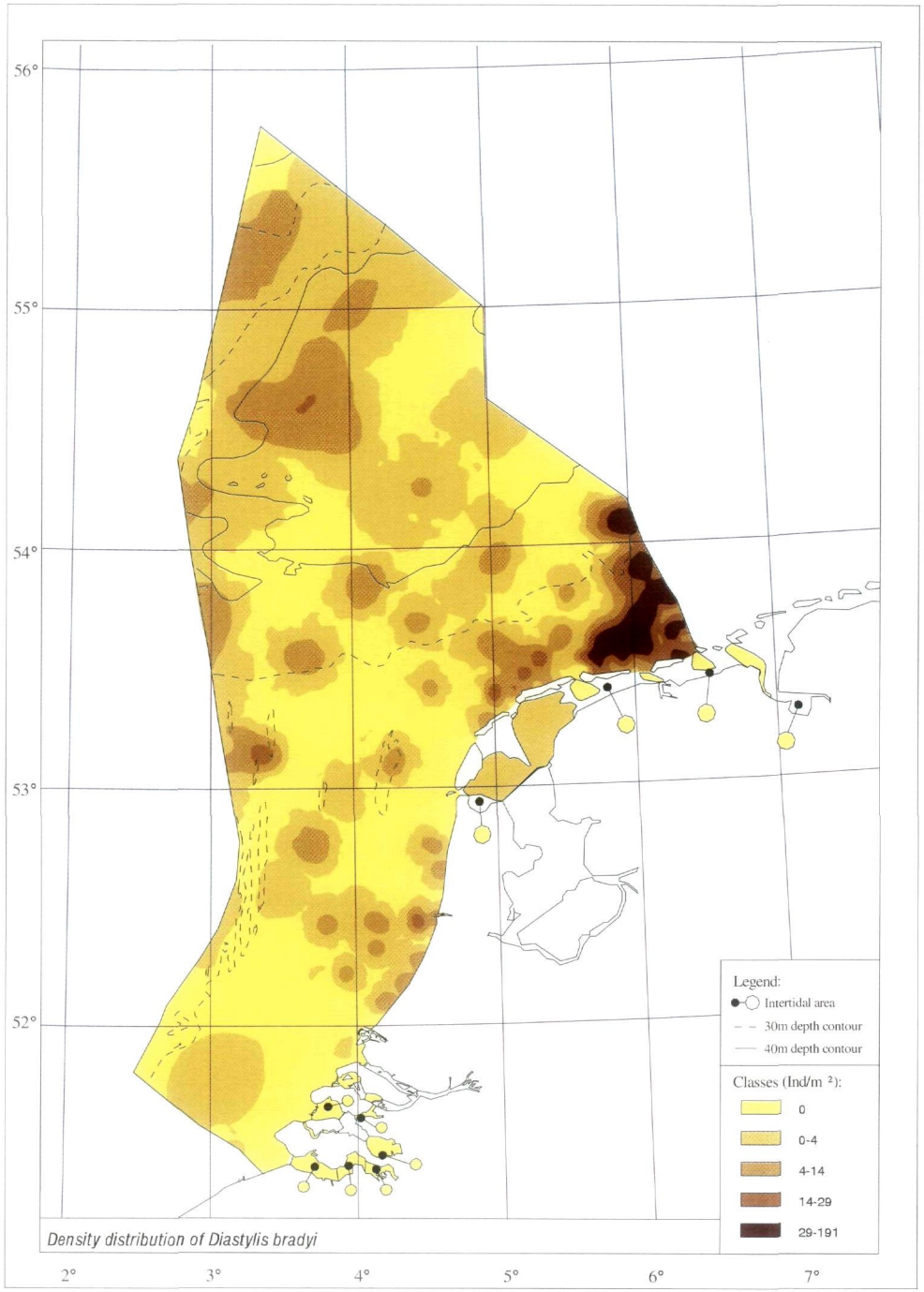
Biology

Callianassa shrimps are burrowing, deposit-feeding crustaceans that live in complex burrow systems. These burrows have numerous galleries and chambers and are connected to the surface by a tube. The burrows are found down to a depth of about 50 cm in marine soft sediments (Witbaard & Duineveld, 1989).

The parasitic isopod *Ione thoracica* can sometimes be found in the branchial chamber beneath the carapace of *C. subterranea* (Rowden & Jones, 1994).

Distribution

In the Dutch part of the North Sea this decapod is mainly found at the Oyster Ground, an area with very fine sediments containing a high amount of silt. Pure sand seems to be avoided (Adema *et al.*, 1982; Witbaard & Duineveld, 1989). It is a dominant species at the Oyster Ground and shows the highest density and biomass in the area of the Frisian Front.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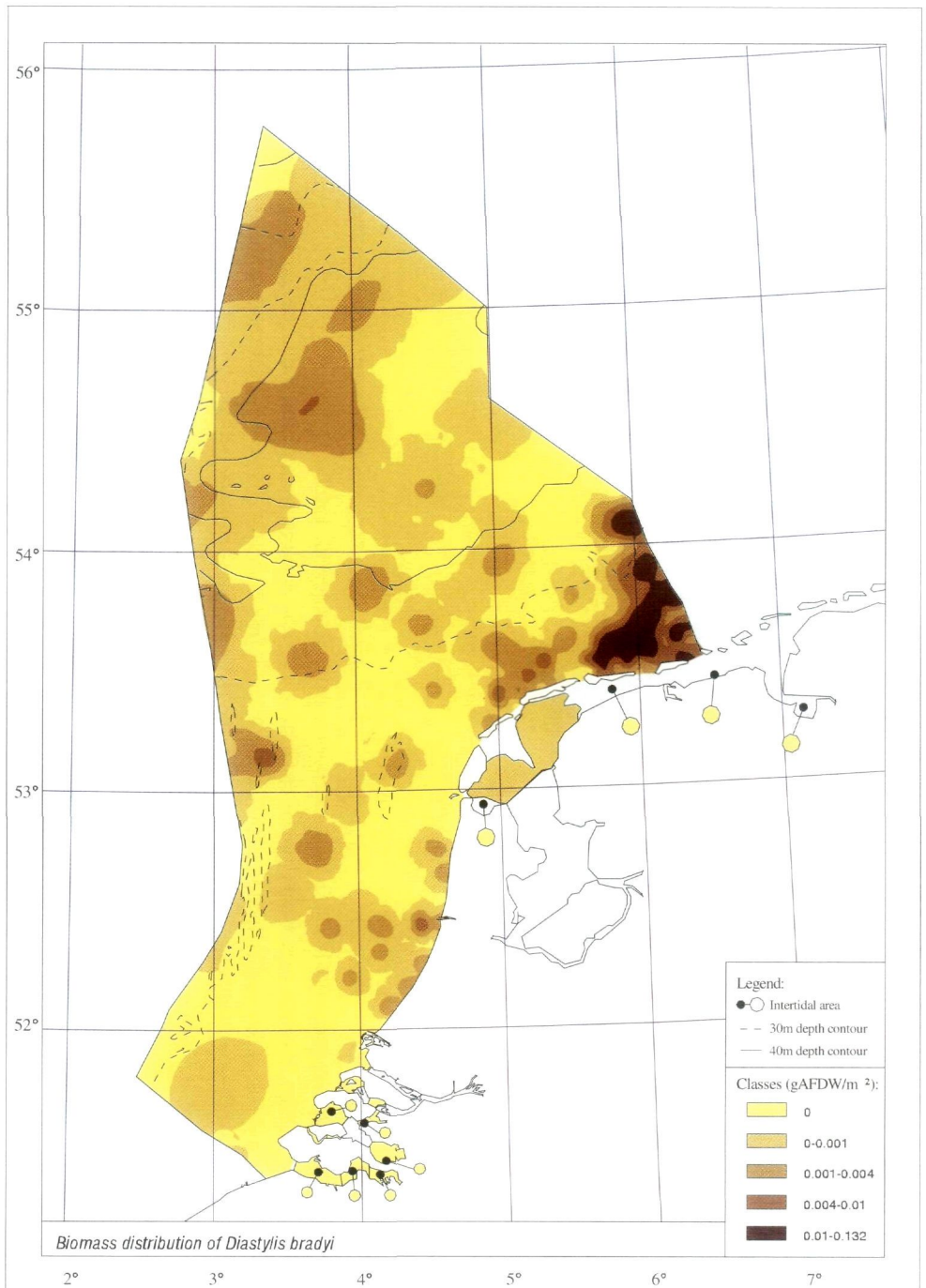
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-4
4-14
14-29
29-191
Density distribution of Diastylis bradyi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Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-0.001
0.001-0.004
0.004-0.01
0.01-0.132
Biomass distribution of Diastylis bradyi

E. STIKVOORT

Diastylis bradyi

NORMAN / 1879

Morphology

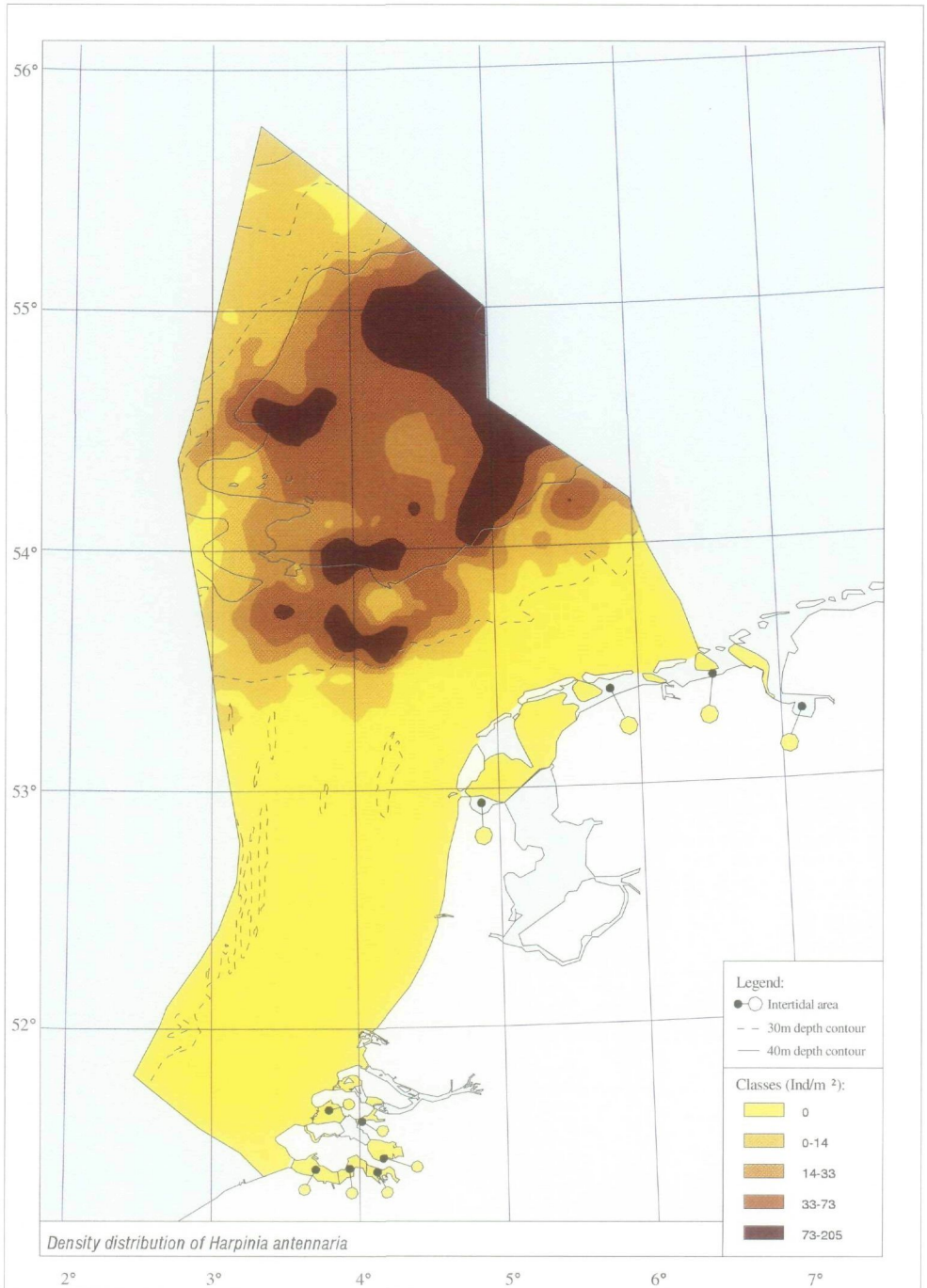
D. bradyi can grow up to 12 mm long. It has a carapace with an acute pseudorostrum (Jones, 1976; Hayward & Ryland, 1990).

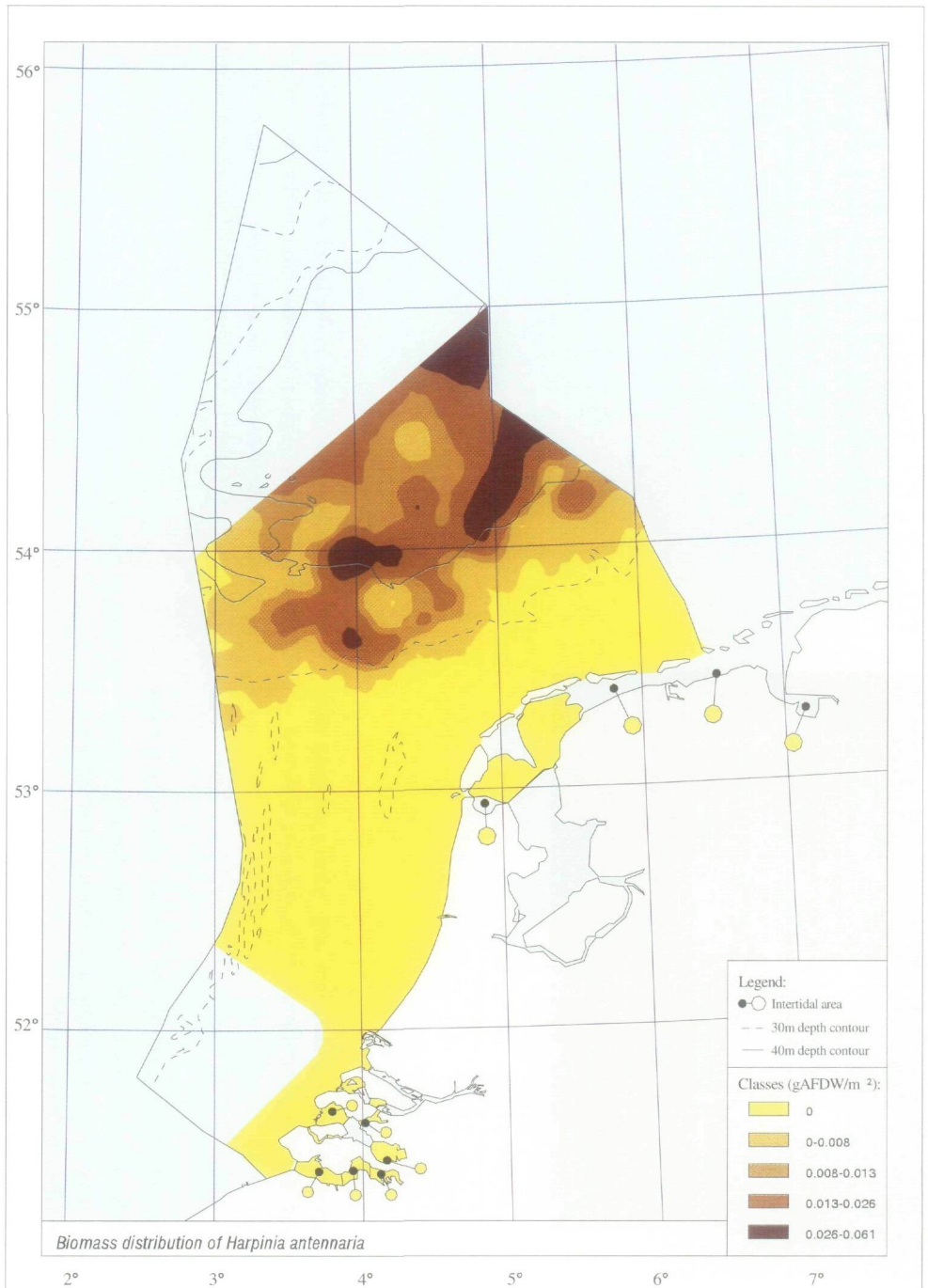
Biology

The majority of cumacean species in temperate shallow waters probably lives for a year or less and breeds twice each year. They feed on micro-organisms and organic matter from the bottom deposit (Jones, 1976).

Distribution

The distribution of *D. bradyi* in the Dutch part of the North Sea is very patchy. Highest densities are found in the eastern part, near the German Bight. *D. bradyi* lives in all kinds of sediment, from coarse to very fine sand, often associated with mud.


56°
55°
54°
53°
52°
2°
3°
4°
5°
6°
7°
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-14
14-33
33-73
73-205
Density distribution of Harpinia antennaria


56°
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52°
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3°
4°
5°
6°
7°
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-0.008
0.008-0.013
0.013-0.026
0.026-0.061
Biomass distribution of Harpinia antennaria

J. VAN DER HOEK

Harpinia antennaria

MEINERT / 1890

Morphology

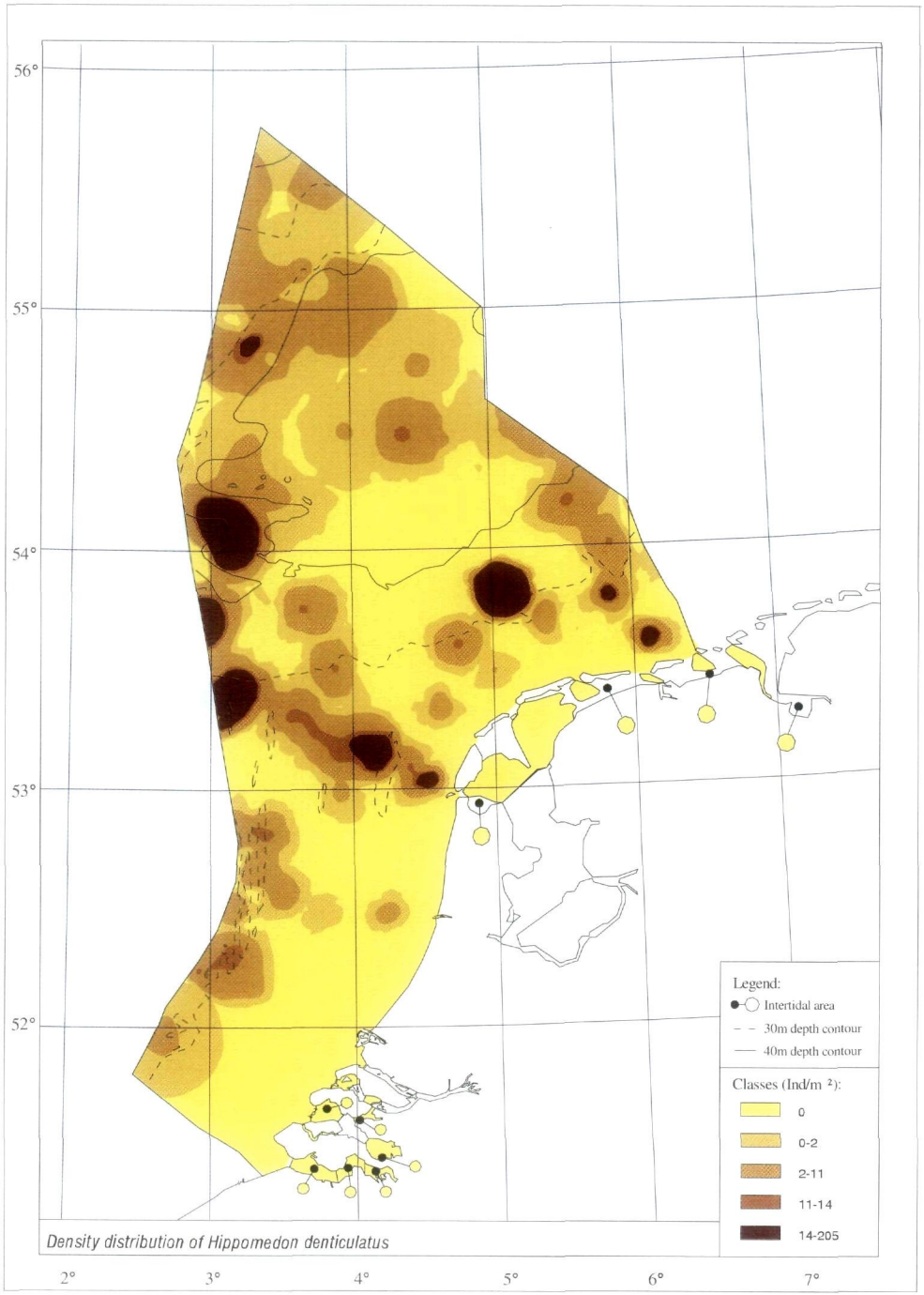
H. antennaria is up to 5 mm long. It is greyish white in colour. Eyes are absent (Lincoln, 1979; Hayward & Ryland, 1990).

Biology

Harpinia spp. lie buried in the bottom, 2-20 mm below the surface. Only adults can swim up from the bottom. The well-developed hands of the gnathopods help to transfer the sediment to the mouth parts. The species has a restricted ability to separate detritus from the clay (Enequist, 1949).

Distribution

On the Dutch Continental Shelf *H. antennaria* occurs from the 30 m depth contour north up to the Dogger Bank. The species seems to prefer very fine sand with a high mud content.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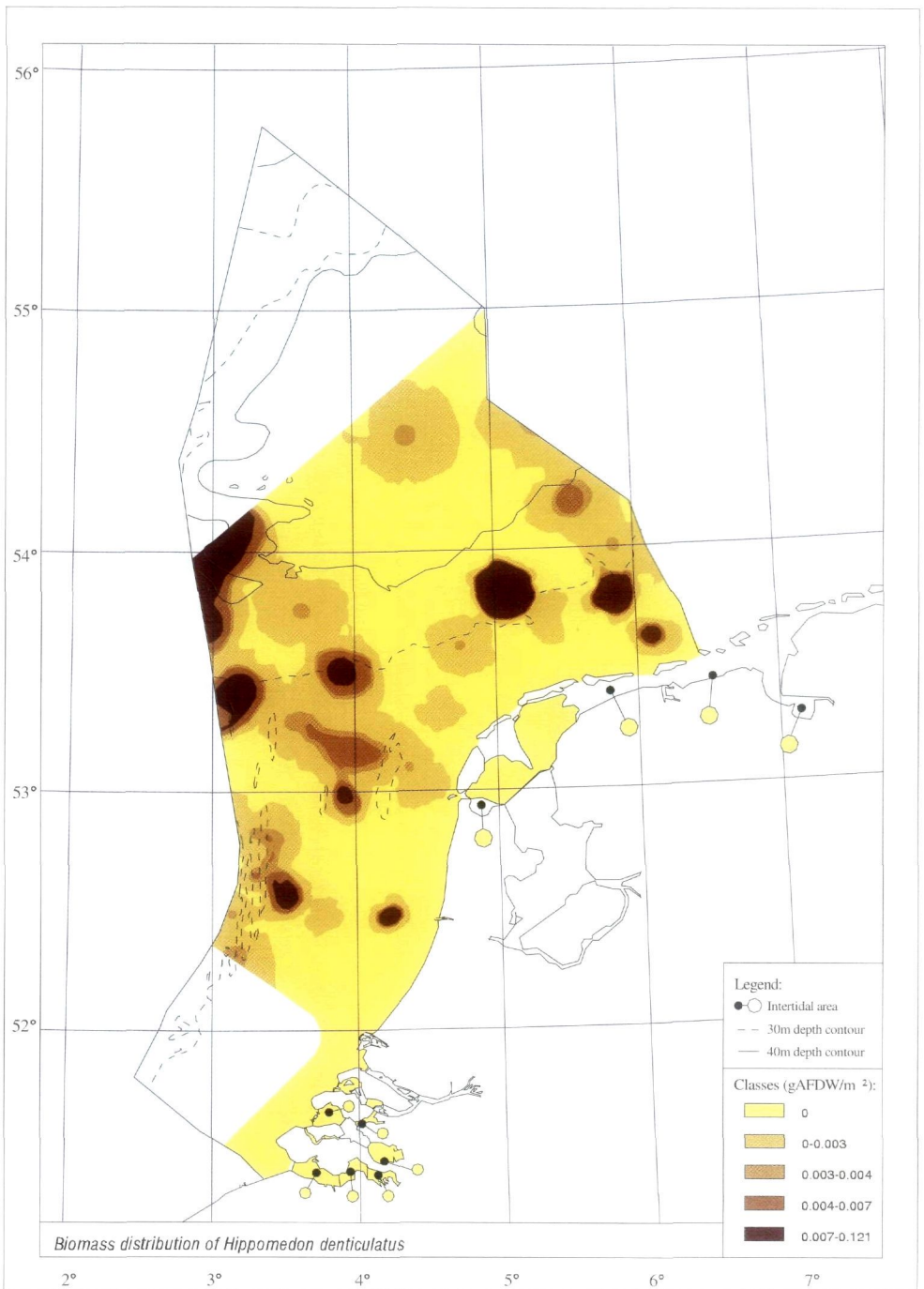
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-2
2-11
11-14
14-205
Density distribution of Hippomedon denticulatus


56°
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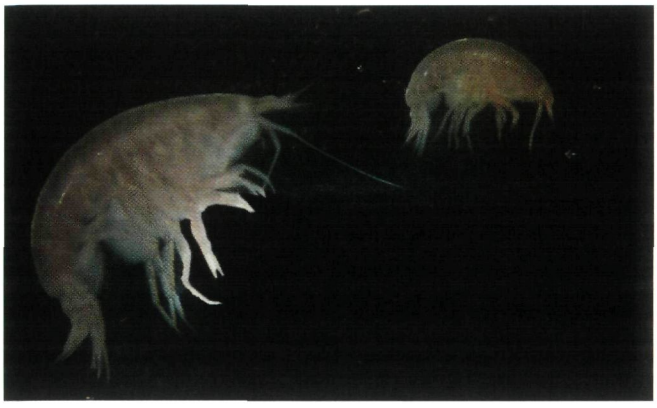
52°
2°
3°
4°
5°
6°
7°
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-0.003
0.003-0.004
0.004-0.007
0.007-0.121
Biomass distribution of Hippomedon denticulatus



J. VAN DER HOEK

Hippomedon denticulatus

BATE / 1857

Morphology

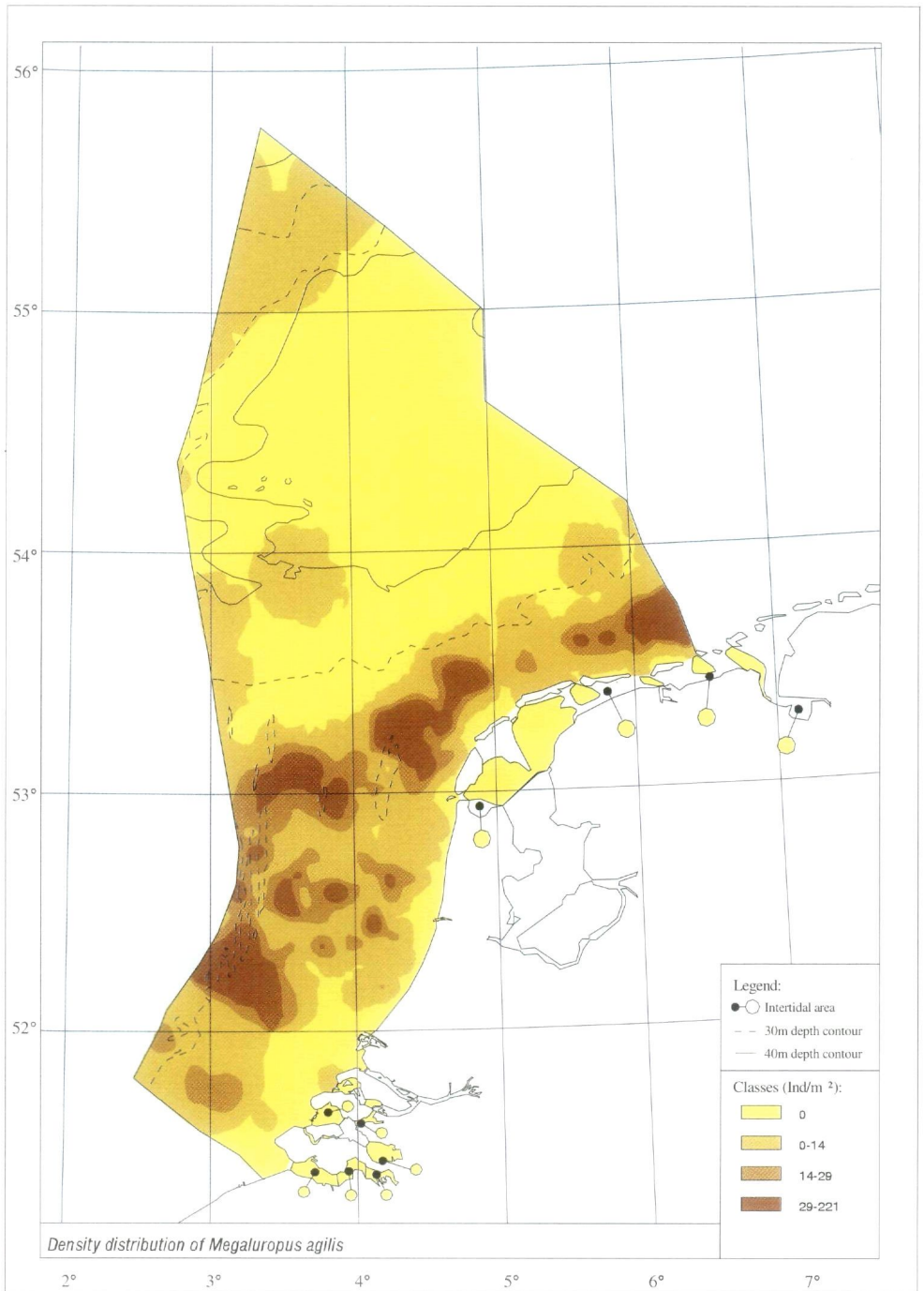
This amphipod has a compressed body, up to about 14 mm. The head is small and the telson is deeply cleft. It is whitish in colour with transverse orange banding (Lincoln, 1979; Hayward & Ryland, 1990).

Biology

H. denticulatus buries itself in soft sediments with great dexterity (Lincoln, 1979; Hayward & Ryland, 1990).

Distribution

H. denticulatus is found throughout the area at depths of over 20 m. This amphipod is most abundant at the Cleaver Bank and in the southern part of the Oyster Ground. It lives in bottoms of fine sand, sometimes mixed with mud.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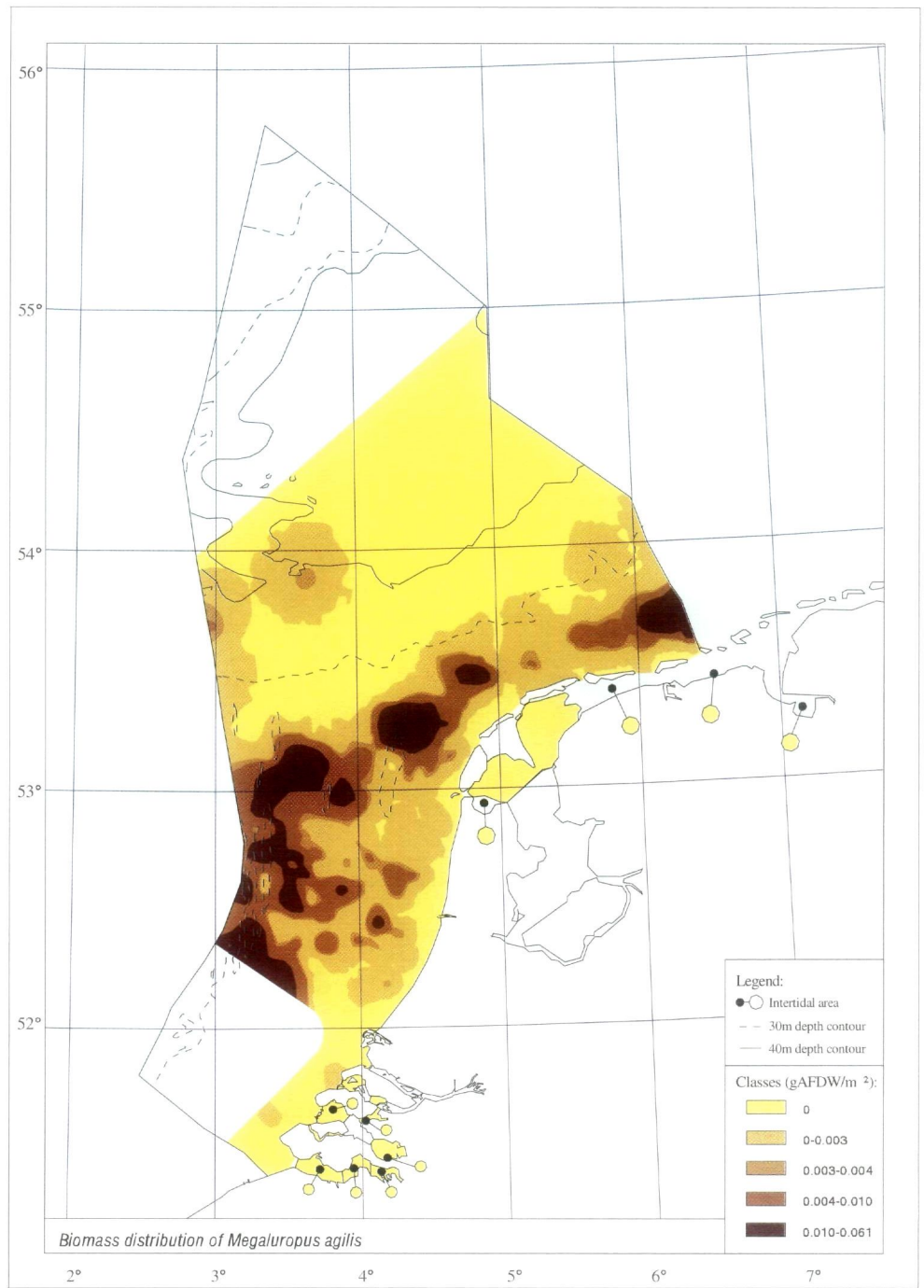
6°
7°
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-14
14-29
29-221
Density distribution of Megaluropus agilis


56°
55°
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52°
2°
3°
4°
5°
6°
7°
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-0.003
0.003-0.004
0.004-0.010
0.010-0.061
Biomass distribution of Megaluropus agilis

J.A. VAN DALFSEN

Megaluropus agilis

HOEK / 1889

Morphology

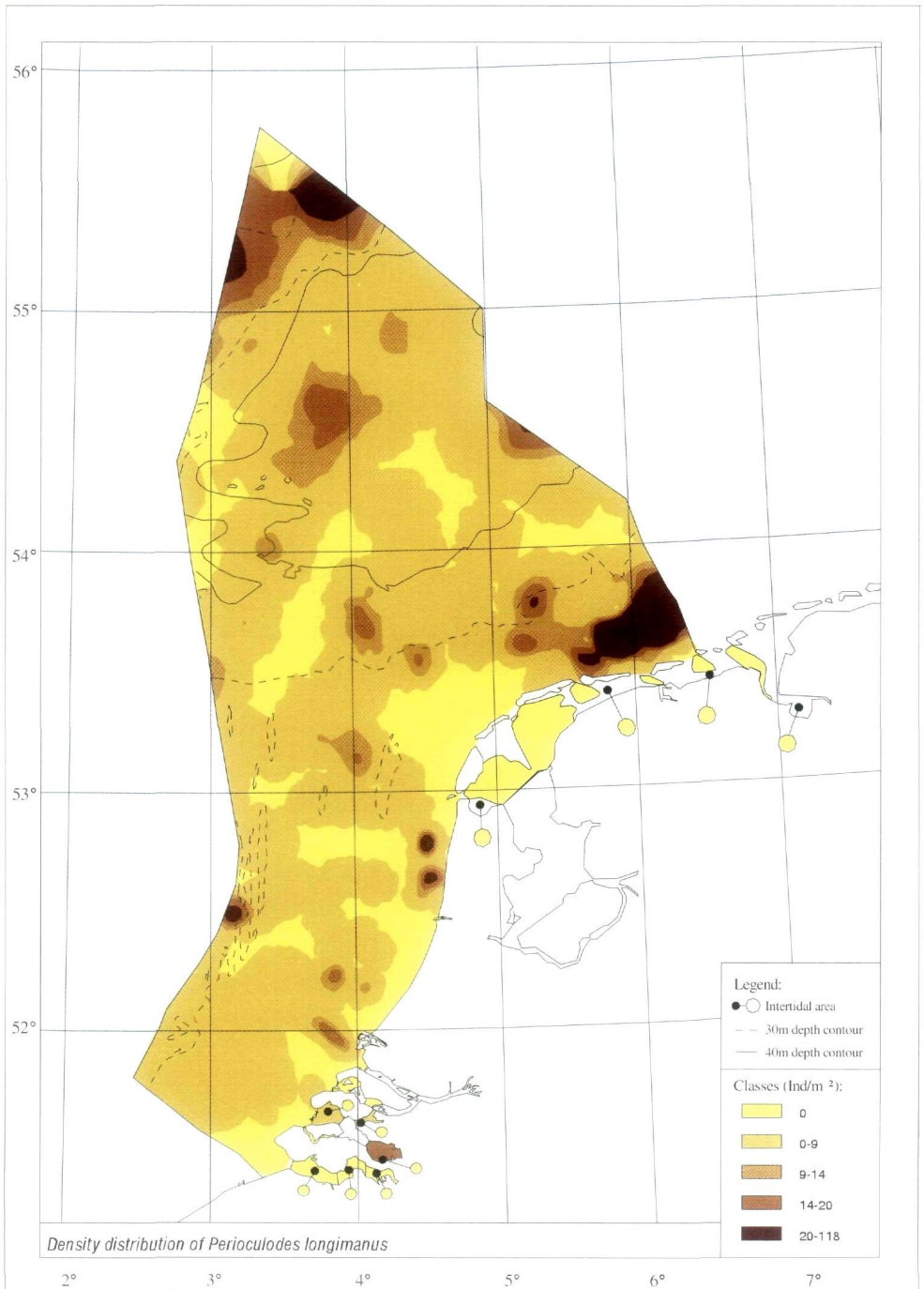
An amphipod with a slender, dorsally smooth body. The head has a small acute rostrum.
The eyes are especially large in males. The telson is deeply cleft. Its length reaches up to 5 mm. This species is mottled red, orange and white (Lincoln, 1979; Hayward & Ryland, 1990).

Biology

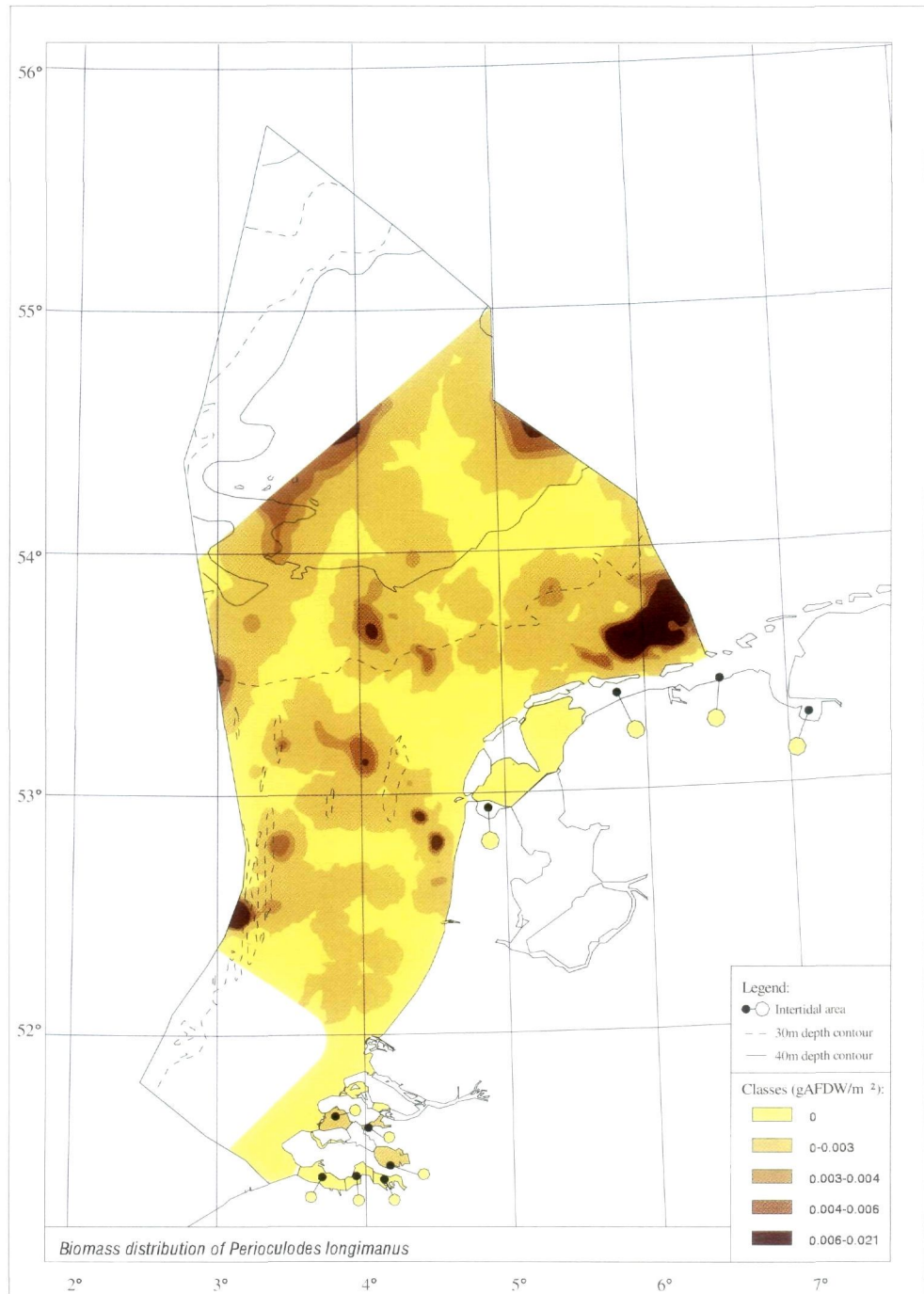
Generally, breeding behaviour of infaunal amphipods like *M. agilis* is influenced by location. In deeper waters the spring rise in temperature initiates breeding, while in shallower waters it is induced by tidal phasing (Fincham, 1971).

Distribution

This amphipod is very abundant in the Southern Bight, at the Brown Bank and Broad Fourteens and occurs on several locations in the Dogger Bank area and south of the Cleaver Bank. *M. agilis* does not inhabit the coastal area and the brackish waters of the Delta area and the Dutch Wadden Sea. In the investigated area the species prefers fine to medium sand with low contents of mud.



Density distribution of Perioculodes longimanus



Biomass distribution of Perioculodes longimanus

J. VAN DER HOEK

Perioculodes longimanus

BATE & WESTWOOD / 1868

Morphology

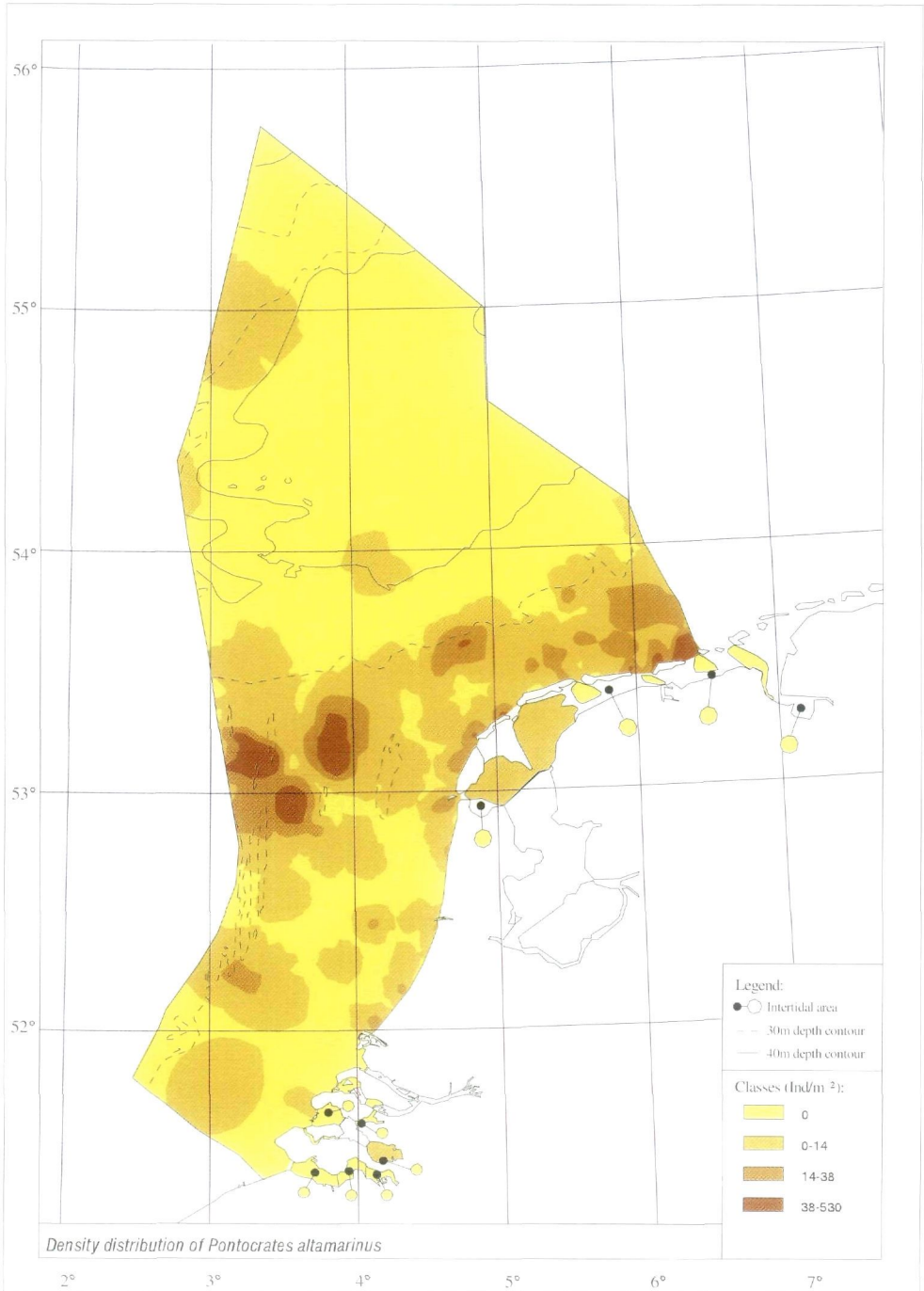
P. longimanus is up to about 5 mm in length. The head has a wide down turned rostrum. The eyes are very large, bright red, completely coalesced and have relatively few large visual elements. The telson is not subdivided. The body is pale orange and translucent (Lincoln, 1979; Hayward & Ryland, 1990).

Biology

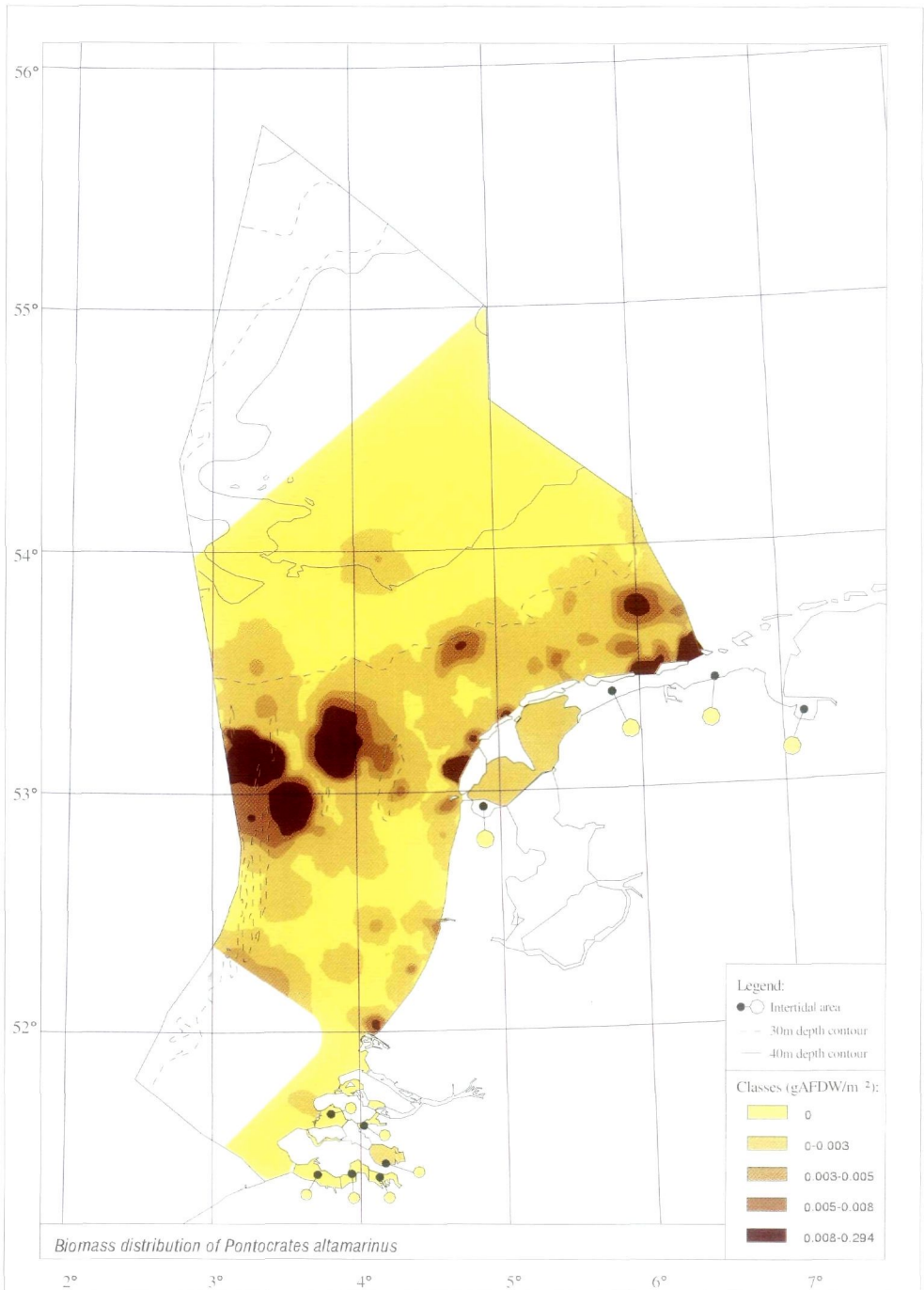
This amphipod burrows in the superficial layer of the sediment. Generally, breeding behaviour of infaunal amphipods is influenced by location. In deeper waters the spring rise in temperature initiates breeding, while in shallower waters it is induced by tidal phasing (Fincham, 1971; Lincoln, 1979). Oedicerotids, the amphipod family to which *P. longimanus* belongs, burrow through the surface layer of the sediment while feeding. Aquarium investigations showed that they are detritivore and only use the mouth parts and the gnathopods for collecting food. They ingest loose detritus sifted from the mud-and-water interface or gathered by the maxillipeds from the material passed to them by the gnathopods (Enequist, 1949).

Distribution

P. longimanus is widespread and is frequently recorded from the subtidal in the Delta area down to depths of about 50 metres at the Oyster Ground. The highest densities are recorded at the Dogger Bank and in the eastern part of the Dutch Continental Shelf. There seems to be no preference for any type of sediment.



Density distribution of Pontocrates altamarinus



Biomass distribution of Pontocrates altamarinus

M. LAVALEYE

Pontocrates altamarinus

BATE & WESTWOOD / 1862

Morphology

This amphipod has a robust body, up to 7 mm in length. The eyes are very large and rounded. The body is whitish or yellowish in colour, with distinctive dark brown patches. The head has a short down turned, pointed rostrum (Lincoln, 1979; Fish & Fish, 1989; Hayward & Ryland, 1990).

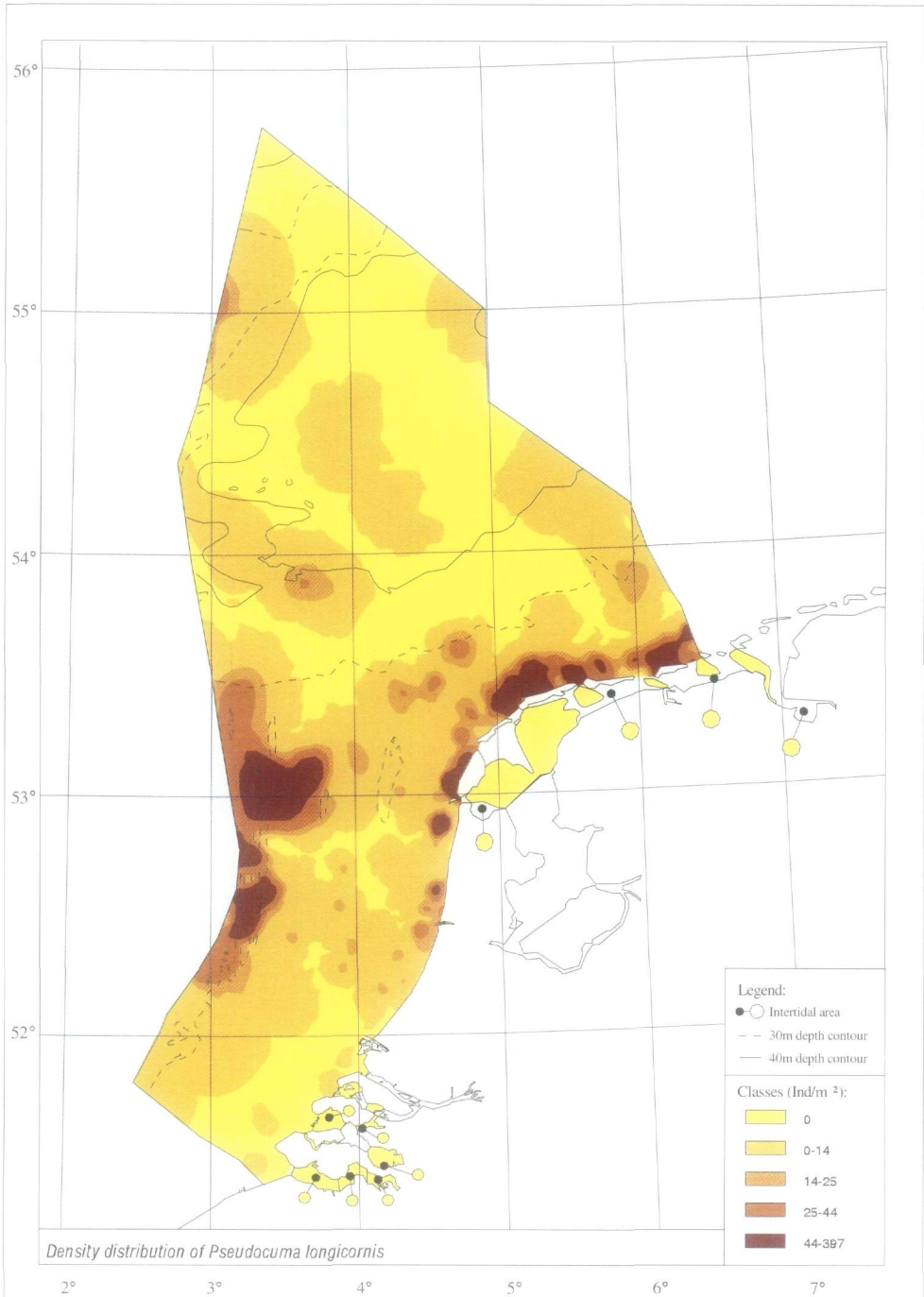
Biology

Generally, breeding behaviour of infaunal amphipods like *P. altamarinus* is influenced by location. In deeper waters the spring rise in temperature initiates breeding, while in shallower waters it is induced by tidal phasing (Fincham, 1971). Oedicerotids, the amphipod family to which *P. altamarinus* belongs, burrow through the surface layer of the sediment while feeding. They only use the mouth parts and the gnathopods for collecting food. Aquarium investigations have shown that they ingest loose detritus sifted from the mud-and-water interface or gathered by the maxillipeds from the material passed to them by the gnathopods (Enequist, 1949). Apparently, *P. altamarinus* can switch foods at different times of the year: harpacticoids in summer and diatoms and other algae scraped from sand grains in winter (Beare & Moore, 1994).

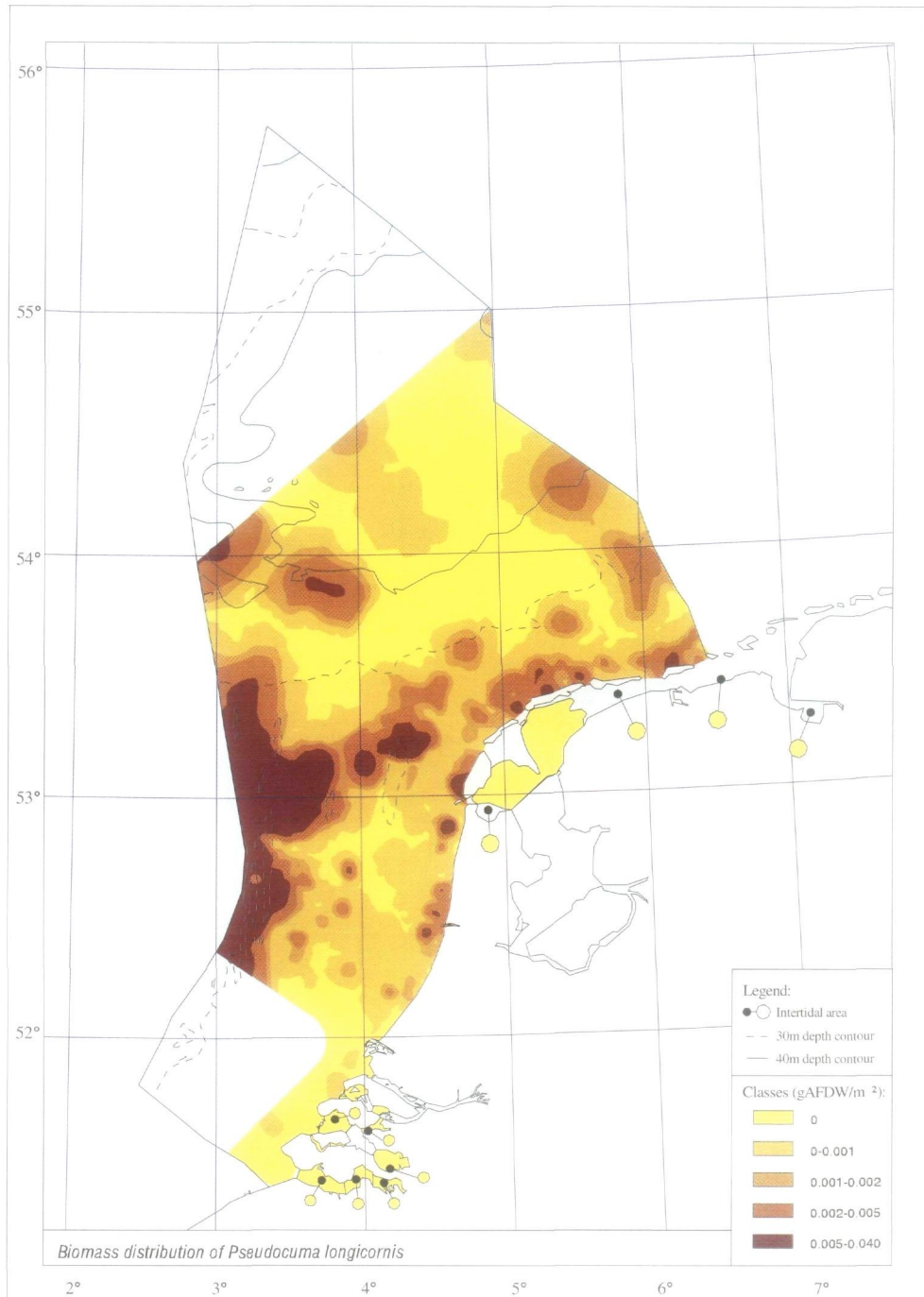
Distribution

P. altamarinus can be observed most frequently in the area south of the 30 m isobath and is locally very common between 53°30'N and 52°30'N. The species is also found in the sublittoral of the western part of the Dutch Wadden Sea and in the eastern part of the Oosterschelde. It has also been recorded in the marine part of the Westerschelde (Cattrijse *et al.*, 1993).

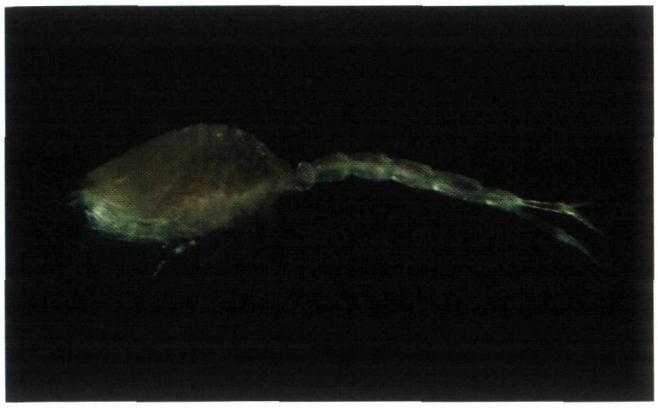
This amphipod prefers bottoms of fine and medium sand with a low percentage of silt.



Density distribution of Pseudocuma longicornis



Biomass distribution of Pseudocuma longicornis



E. STIKVOORT

Pseudocuma longicornis

BATE / 1858

Morphology

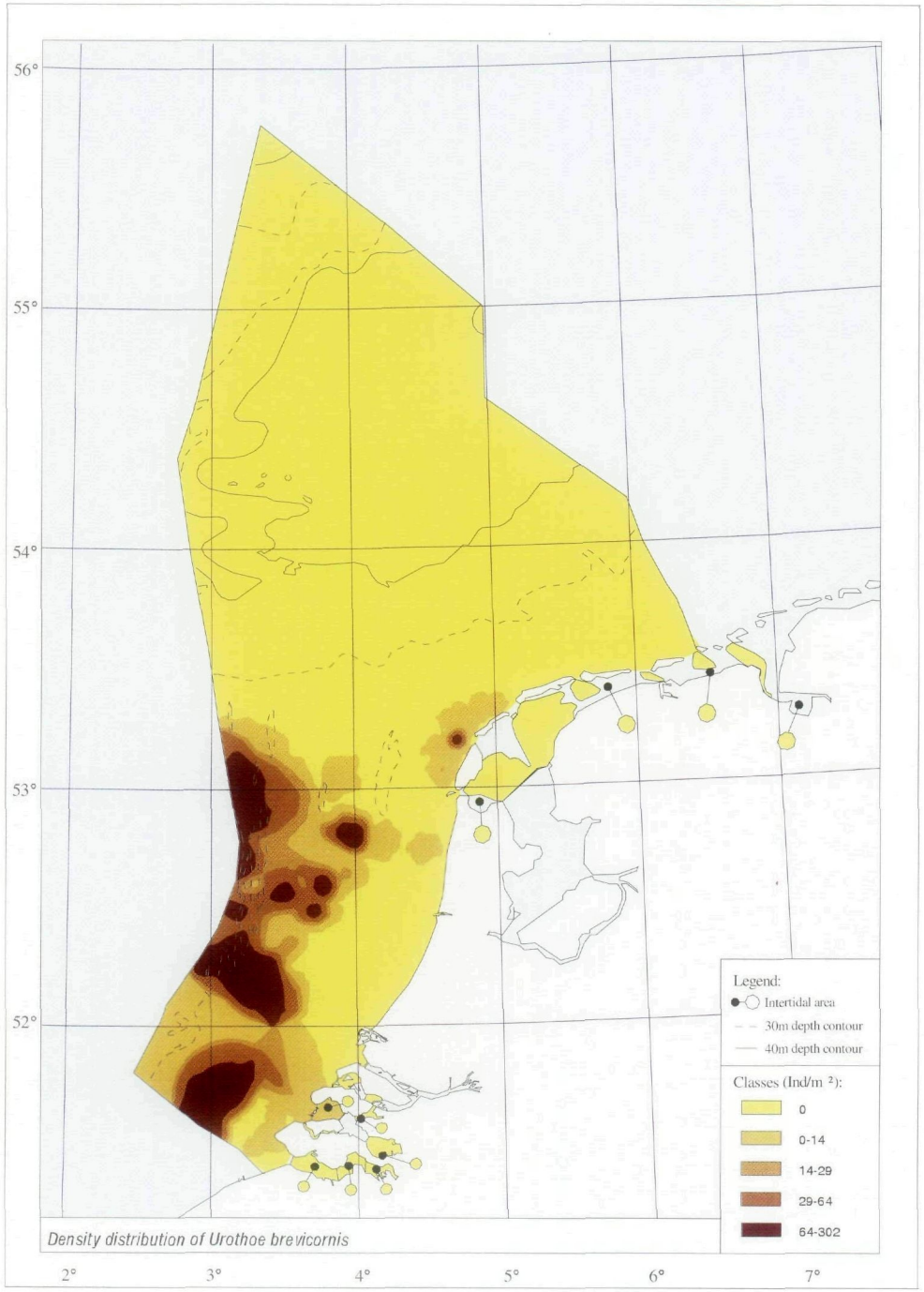
This cumacean species is up to 4 mm long. The body is marked with dark brown patches. The eyes are well developed (Jones, 1976; Hayward & Ryland, 1990).

Biology

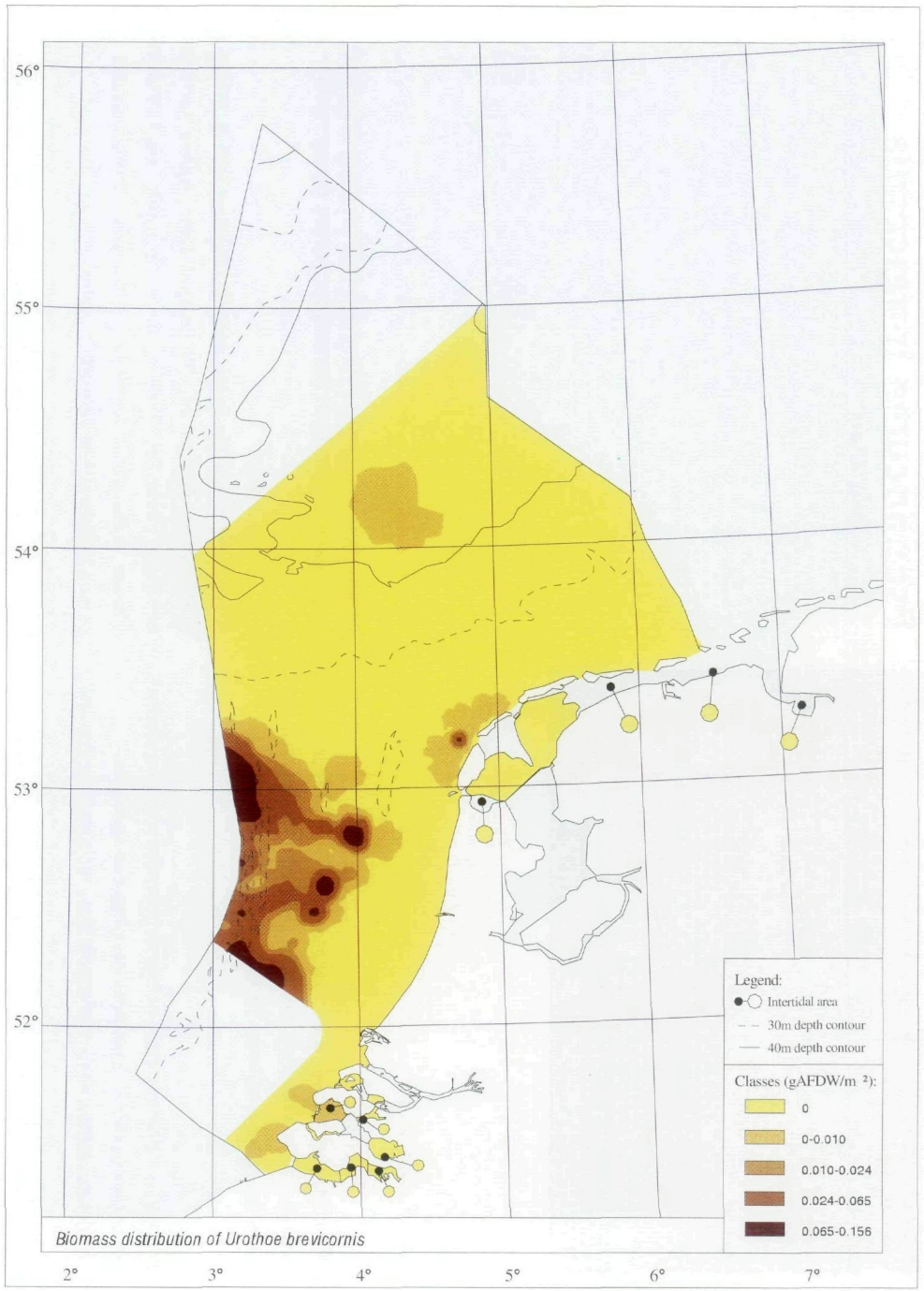
P. longicornis breeds more or less continuously and no distinct generations exist. The majority of cumacean species in temperate shallow waters probably lives for a year or less and breeds twice each year. Cumaceans feed on micro-organisms and organic matter from the bottom deposit (Jones, 1976).

Distribution

A widespread species, living near the shore as well as offshore at the Oyster Ground and the Dogger Bank. Highest densities are found at the Brown Bank and north of the Dutch Wadden islands. In the Dutch sector of the North Sea this cumacean occurs mainly in fine to medium sand.



Density distribution of Urothoe brevicornis



Biomass distribution of Urothoe brevicornis

M. LAVALEYE

Urothoe brevicornis

BATE / 1862

Morphology

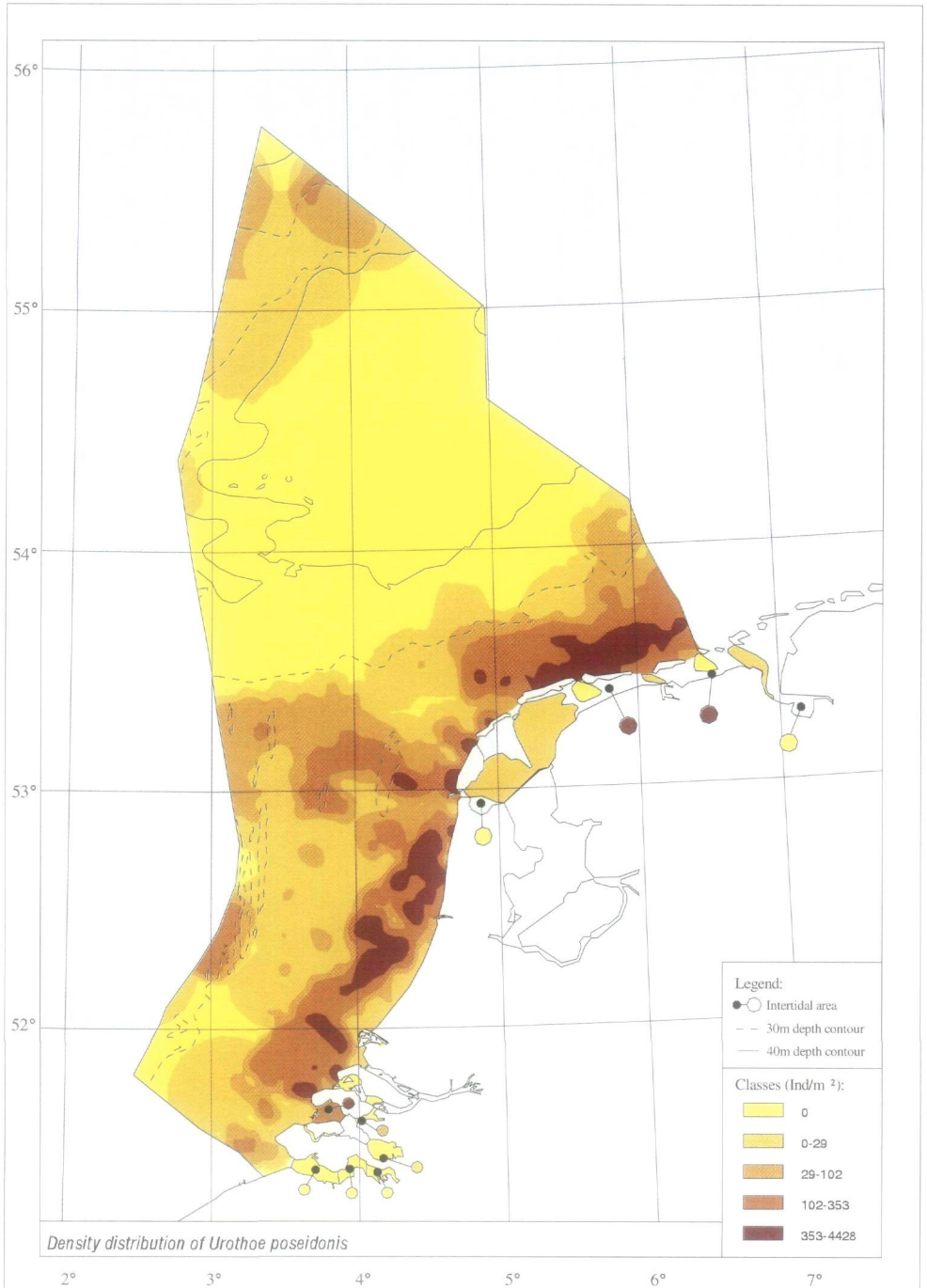
U. brevicornis has a rounded, broad and robust body. It can reach up to about 7 mm in length. The eyes are very large in males and almost adjoining on top of the head. In females the eyes are moderately large and reniform. The head has a small rostrum. The body is yellowish white and the eyes are black (Lincoln, 1979; Fish & Fish, 1989; Hayward & Ryland, 1990). *U. brevicornis* differs *U. poseidonis* (q.v.) in having a much smaller carpus of the fifth pereopod.

Biology

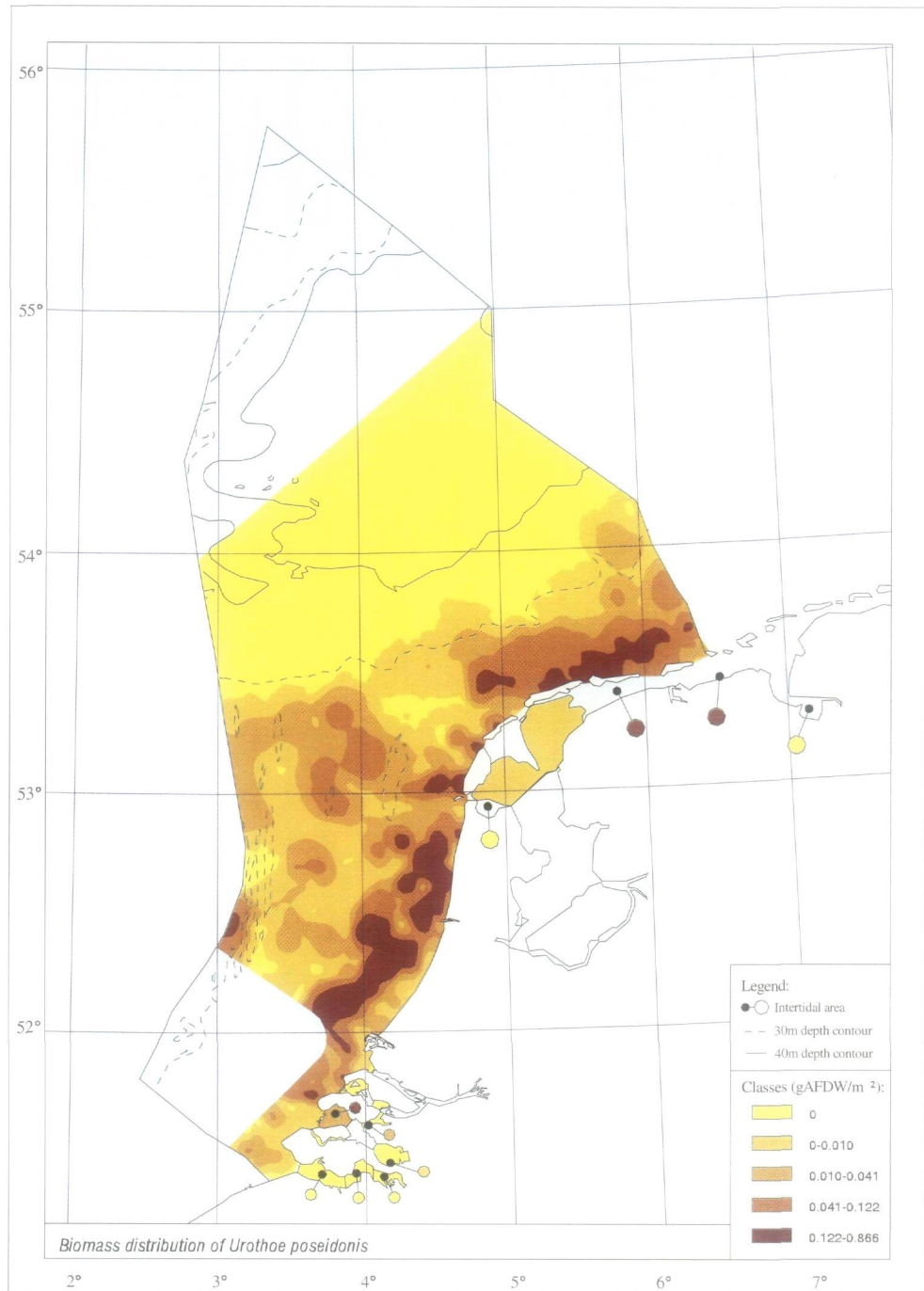
U. brevicornis shows two types of movement, swimming and burrowing into the sediment (Watkin, 1939a). *U. brevicornis* reproduces from summer to autumn. Little is known of its life cycle. It probably lives for one to two years. Generally, breeding behaviour of infaunal amphipods is influenced by location. In deeper waters the spring rise in temperature initiates breeding, while in shallower waters it is induced by tidal phasing (Wolff, 1973; Fish & Fish, 1989).
The species of the genus *Urothoe* may be considered selective deposit feeders. They feed by cleaning sand grains from adhering micro-organisms and detritus (Nicolaisen & Kanneworff, 1969).

Distribution

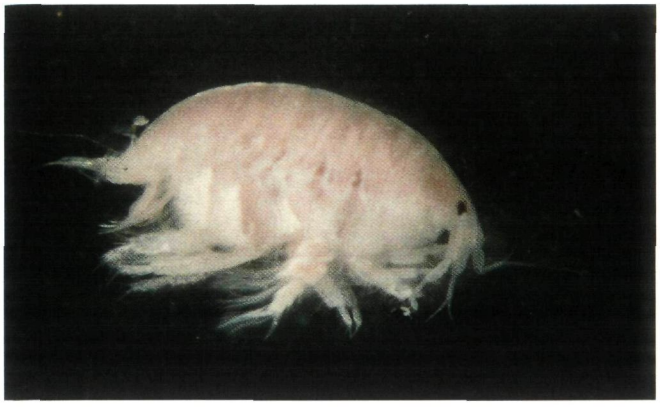
U. brevicornis is a common inhabitant of the offshore part of the Southern Bight and is found in high densities at the Brown Bank and west of the Voordelta. In contrast to *U. poseidonis*, *U. brevicornis* occurs more offshore in the Southern Bight and is absent from the Dogger Bank. In the Delta area the species is found only in the marine part of the Oosterschelde. North of the 30 m isobath this amphipod is absent.
U. brevicornis is widely distributed in clean, medium to fine sand as found in the Southern Bight.



Density distribution of Urothoe poseidonis



Biomass distribution of Urothoe poseidonis



J. VAN DER HOEK

Urothoe poseidonis

REIBISCH / 1905

Dutch

Buldozerkreeftje

Morphology

The body of this amphipod is rounded, broad and robust. Its length reaches up to about 6 mm. The eyes are very large in males and contiguous on top of head. The eyes of females are small and oval. The head has a small rostrum. This species is reddish in colour (Lincoln, 1979; Hayward & Ryland, 1990). *U. poseidonis* differs from the other species of this family described in this atlas, *U. brevicornis* (q.v.), in having a much bigger carpus of the fifth pereopod.

Biology

U. poseidonis shows two types of movement, swimming and burrowing into the sediment (Watkin, 1939a). Little is known of its life cycle. Generally, breeding behaviour of infaunal amphipods is influenced by location. In deeper waters the spring rise in temperature initiates breeding, while in shallower waters it is induced by tidal phasing (Wolff, 1973; Fish & Fish, 1989).

The species of the genus *Urothoe* may be considered selective deposit feeders. They feed by cleaning sand grains from adhering micro-organisms and detritus (Nicolaisen & Kanneworff, 1969).

Distribution

In the studied area *U. poseidonis* is much more common than *U. brevicornis*. The species is very abundant in the Southern Bight, with highest densities near the coast. *U. poseidonis* also lives offshore at the shallow Dogger Bank, but is absent from the Oyster Ground. The species is present in the Oosterschelde and several parts of the Wadden Sea. Previously, it has also been found in the Westerschelde (Heip *et al.*, 1986).
U. poseidonis is widely distributed in clean, sandy sediments as commonly found in the Southern Bight and at the Dogger Bank.

Echinodermata

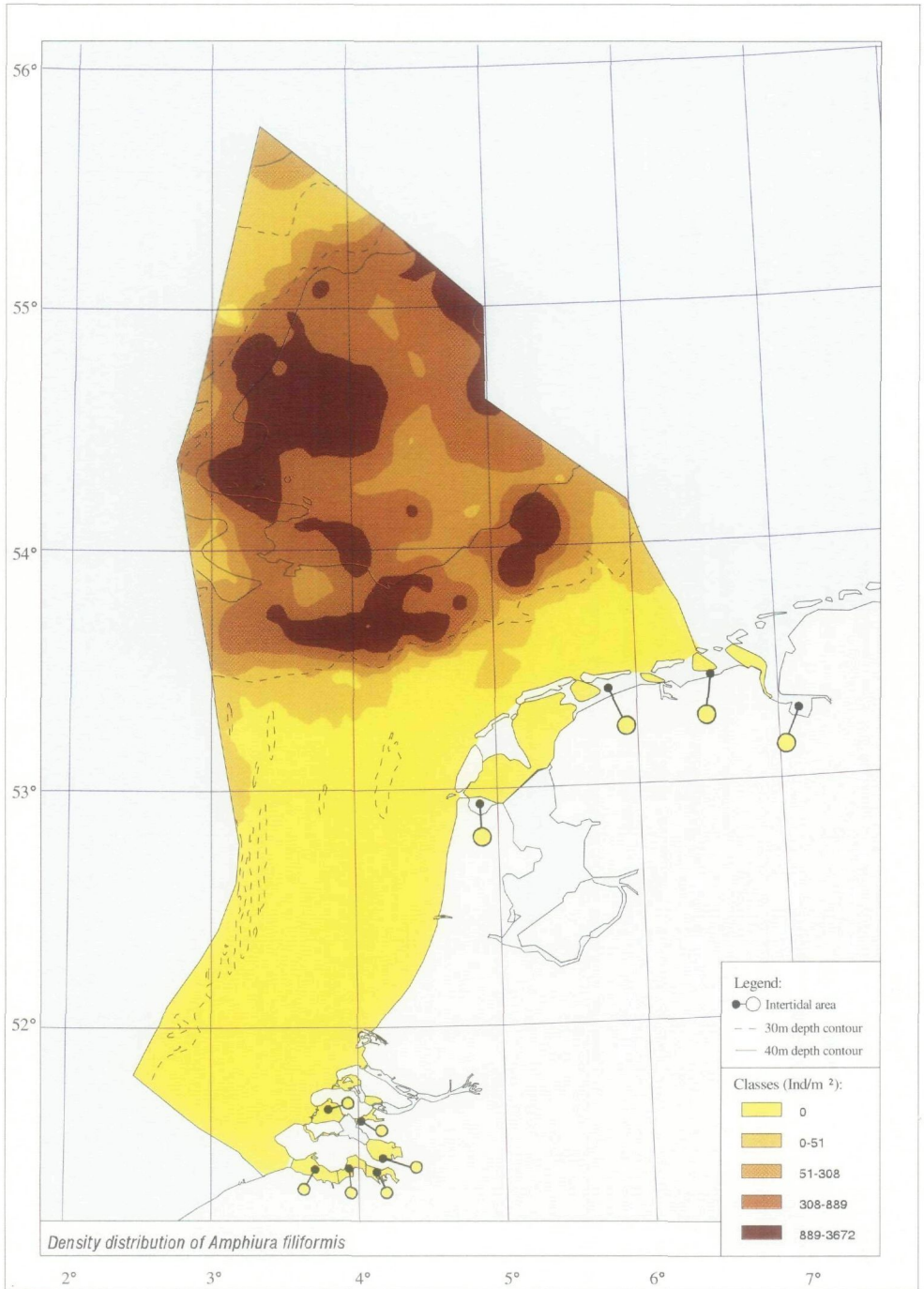
With about 6,000 recent species world-wide, the Echinodermata is a small animal group compared to the Mollusca, Polychaeta and Crustacea. The recent species of this phylum are divided into six classes: Crinoidea (sea lilies and feather stars), Concentricycloidea (sea daisies), Asteroidea (starfishes), Ophiuroidea (brittle stars), Echinoidea (sea urchins) and Holothurioidea (sea cucumbers).

Echinoderms are characterized by a five-rayed, radially symmetric body. They have a skeleton built up of numerous calcareous plates that may be held together by muscles or ligaments, resulting in a flexible body, as in asteroids and ophiuroids or form a rigid test as in echinoids. Another typical echinoderm trait is the hydraulic, or water-vascular system. Via this system, muscles control the extension and retraction of the numerous tube feet. These feet are arranged in five rows radiating from the mouth and can be used for locomotion, respiration, sensory perception, feeding or grasping.

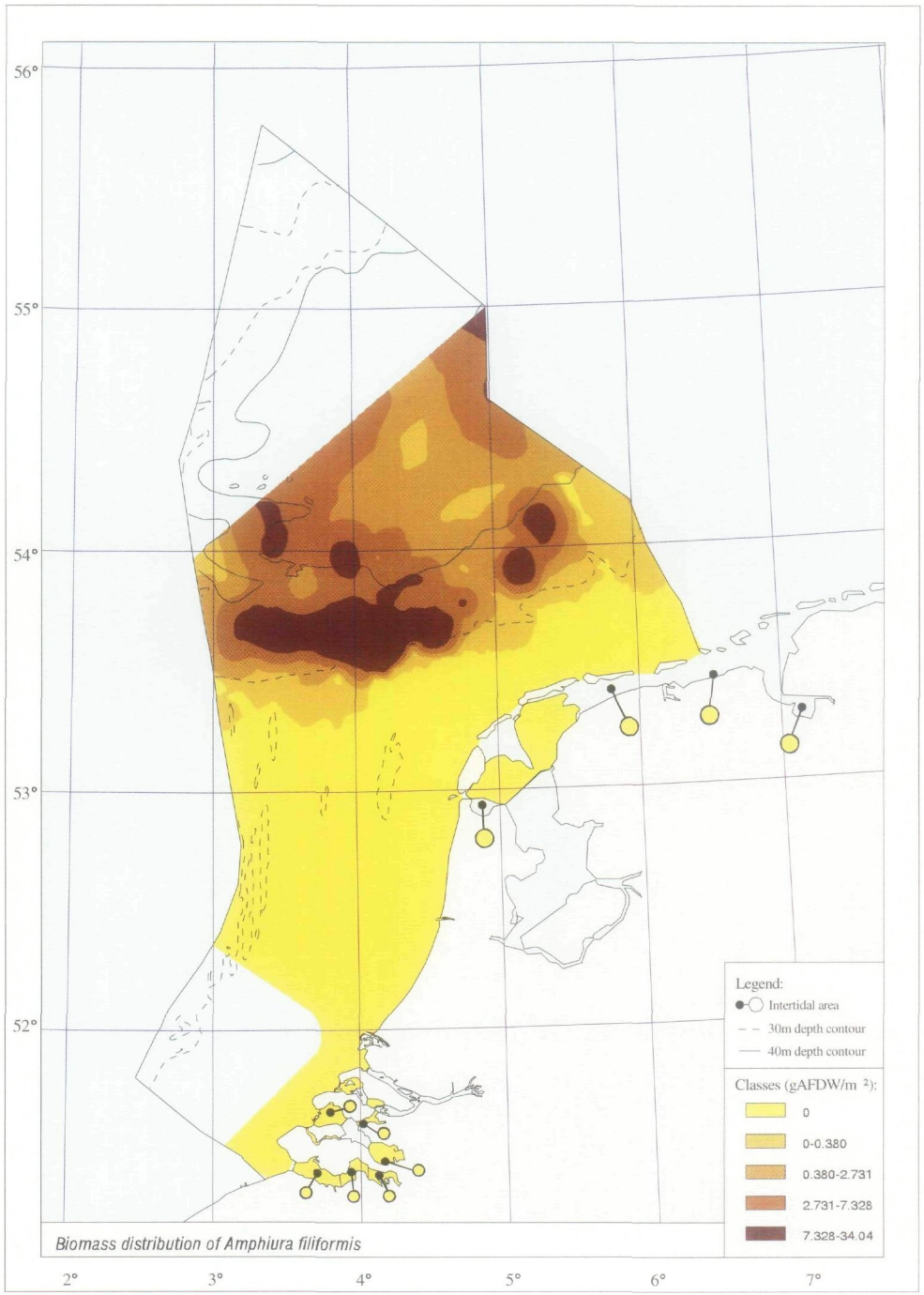
Reproduction can be sexual as well as asexual. The sexes are mostly separate. Asexual reproduction in asteroids and ophiuroids occurs by fission and subsequent regeneration. Any part of the body actively or accidentally lost can grow into a complete organism as long as a small part of the central disc stays attached. In sexual reproduction the gametes (eggs and sperm) are released into the water, where fertilization takes place. Spawning is often restricted to one or two months a year, but continuously reproducing species occur. Fertilized eggs may develop directly or indirectly into a juvenile echinoderm. In indirect development a larval stage is present. In direct developing echinoderms maternal care for the brood is not unusual.

Echinoderms feed on detritus or suspended matter, or graze on plants. Asteroids may be carnivorous, in which case they mainly feed on molluscs.

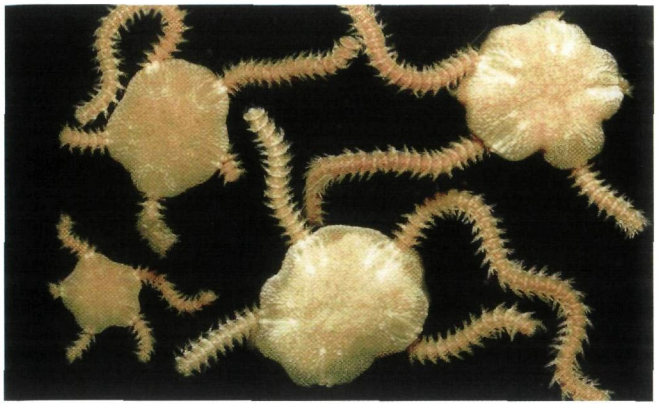
All echinoderm species are marine, living from the upper intertidal down to deep-sea trenches. They normally cannot withstand strong changes in salinity, temperature or light intensity. This means that most species are restricted to specific geographical regions. During the surveys of which data have been used for this atlas, a total of 15 echinoderm species were identified.



Density distribution of Amphiura filiformis



Biomass distribution of Amphiura filiformis



M. LAVALEYE

Amphiura filiformis

O.F. MÜLLER / 1776

Dutch

Draadarmige slangster

Morphology

The disk of *A. filiformis* is covered with scales on the dorsal side only, leaving the ventral side naked. The diameter of disk can be up to 8-10 mm. The long, fine arms are about ten times longer than the diameter of the disk. Its colour is reddish- or greyish-brown (Mortensen, 1927; Southward, 1972; Hayward & Ryland, 1990).

Biology

The larvae of *A. filiformis* are found throughout the summer from July to October. *A. filiformis* belongs to the long-lived species with relatively fast growth in the juvenile stage followed by a much slower growing adult phase. Its life span may be up to 20 years (Mortensen, 1927; Buchanan, 1964; O'Conner *et al.*, 1983; Gage, 1990).

A. filiformis burrows about 5 cm into the substrate. The species must reach a certain size to be able to burrow down into the sediment for it must, using its serpentine arms, keep contact with the sediment surface (O'Conner *et al.*, 1983; Gage, 1990). The arms of the brittle star have three main functions: ventilation and respiration, transport of sediment and waste materials out of the burrow, and collection and transport of food (Ockelmann & Muus, 1978).

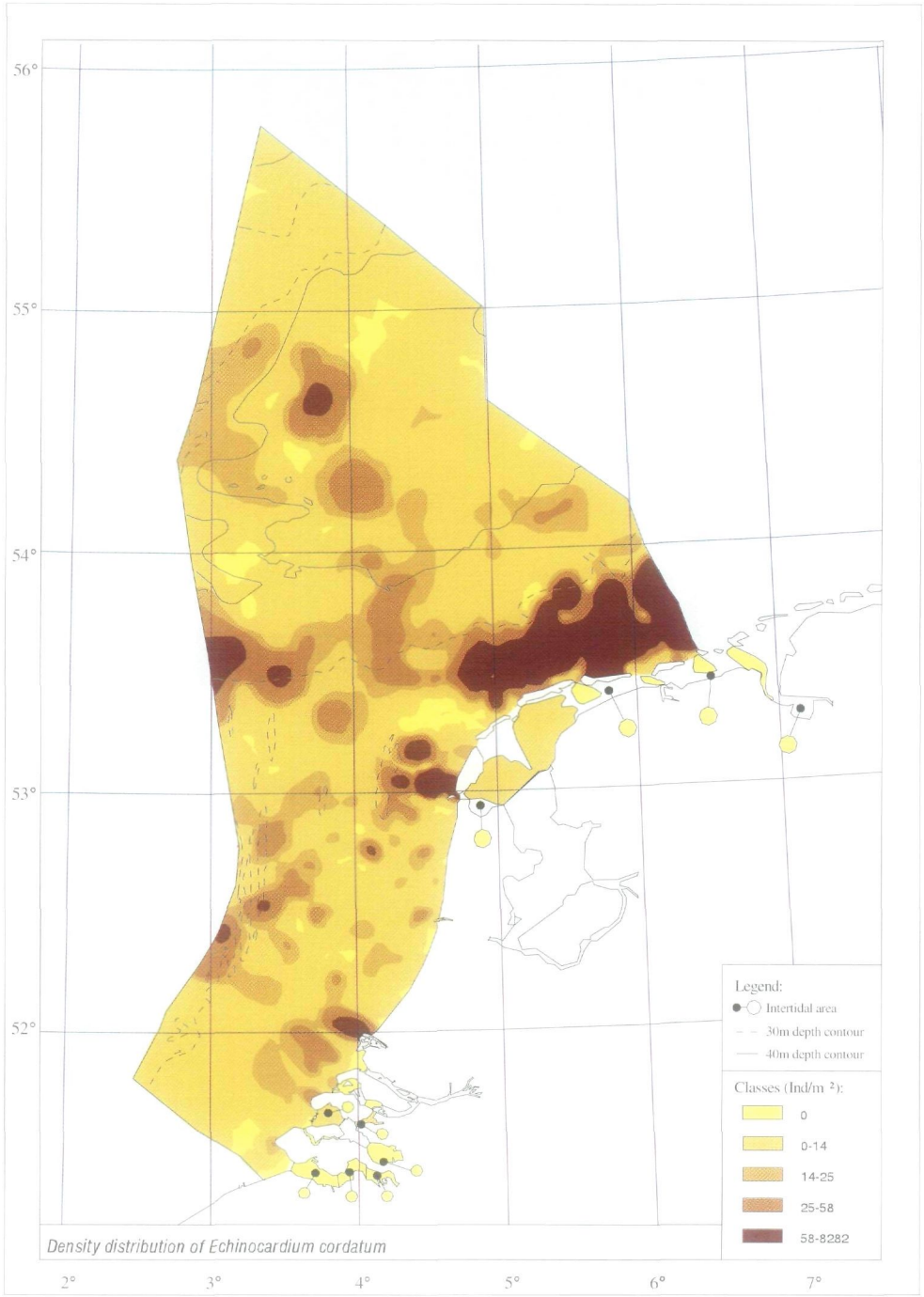
A. filiformis is a suspension feeder, collecting mixed microplankton, resuspended bottom material and detritus. The animals extend their arms into the surrounding water, filtering particles from the water. It is eaten by fish, especially by haddock, plaice and dab. It is also devoured by various asteroids and has been found in the stomach of the burrowing crab *Corystes* spec. (Mortensen, 1927; Woodley, 1975; Ockelmann & Muus, 1978; Hayward & Ryland, 1990).

The mollusc *Mysella bidentata* often lives in association with *A. filiformis* (Ockelmann & Muus, 1978).

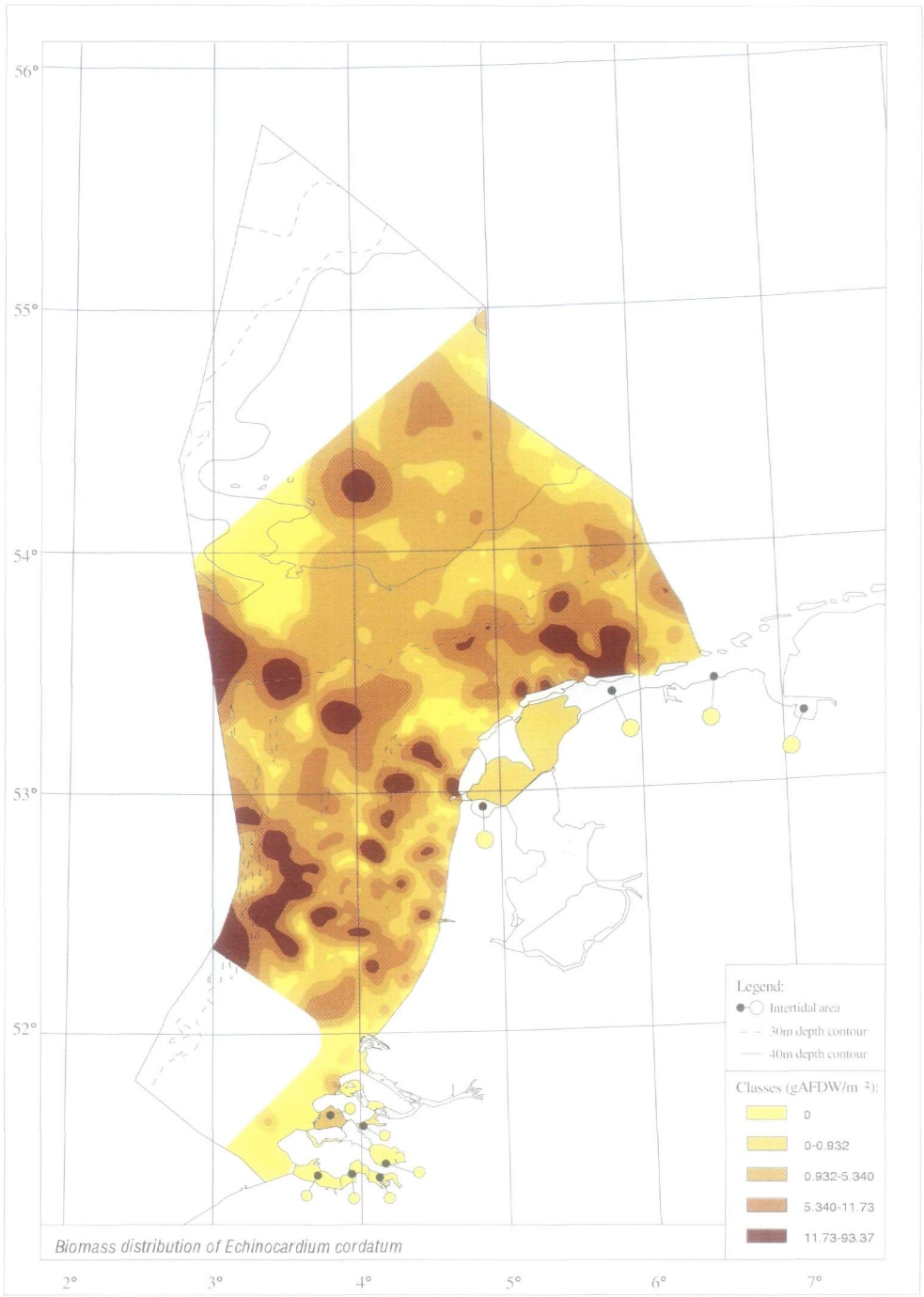
Distribution

A. filiformis is very abundant in the area of the Oyster Ground, north of the 30 m isobath, with the highest biomass in the western part of the Frisian Front area. The species is not present in the sandy Southern Bight and is scarce at the Dogger Bank.

In the Dutch sector of the North Sea *A. filiformis* lives in very fine sand with a mean mud content of 11%. This is in agreement with other investigations, which found high-density populations in muddy deposits (Buchanan, 1964; Woodley, 1975; O'Conner *et al.*, 1983; Gage, 1990; Hayward & Ryland, 1990).



Density distribution of Echinocardium cordatum



Biomass distribution of Echinocardium cordatum

J. VAN DER HOEK

Echinocardium cordatum

PENNANT / 1777

English

Sea-potato, Heart-urchin

Dutch

Hartegel

Zeeklit

German

Kleiner Herzigel

Morphology

This sea urchin has a heart-shaped test, usually 40-50 mm in length. It is covered with a large number of closely set spines, most of them directed backwards. In profile the highest point of the test lies towards the posterior. It is yellow-brown in colour (Mortensen, 1927; Southward, 1972; Fish & Fish, 1989; Hayward & Ryland, 1990).

Biology

Breeding occurs in summer. The pelagic larvae are sometimes found in enormous quantities and likewise the young may be found in large amounts on the sediment surface. The growth rate of *E. cordatum* varies with the environment. It grows faster in shallow, sandy than in deep, muddy areas, possibly under the influence of temperature. The species can live for 10 to 20 years (Mortensen, 1927; Wolff, 1973; Fish & Fish, 1989; Rees & Dare, 1993).

Depending on the temperature, the species digs a few centimetres to about 20 cm deep into the sediment. A respiratory channel (chimney) leads from the hole to the surface and one or two sanitary drains are located horizontally behind the echinoid. The animal is isolated from the sediment by a mucus veil, which plasters the burrow. *E. cordatum* plays an important role in sediment bioturbation (Mortensen, 1927; De Ridder *et al.*, 1987; Fish & Fish, 1989; Rees & Dare, 1993).

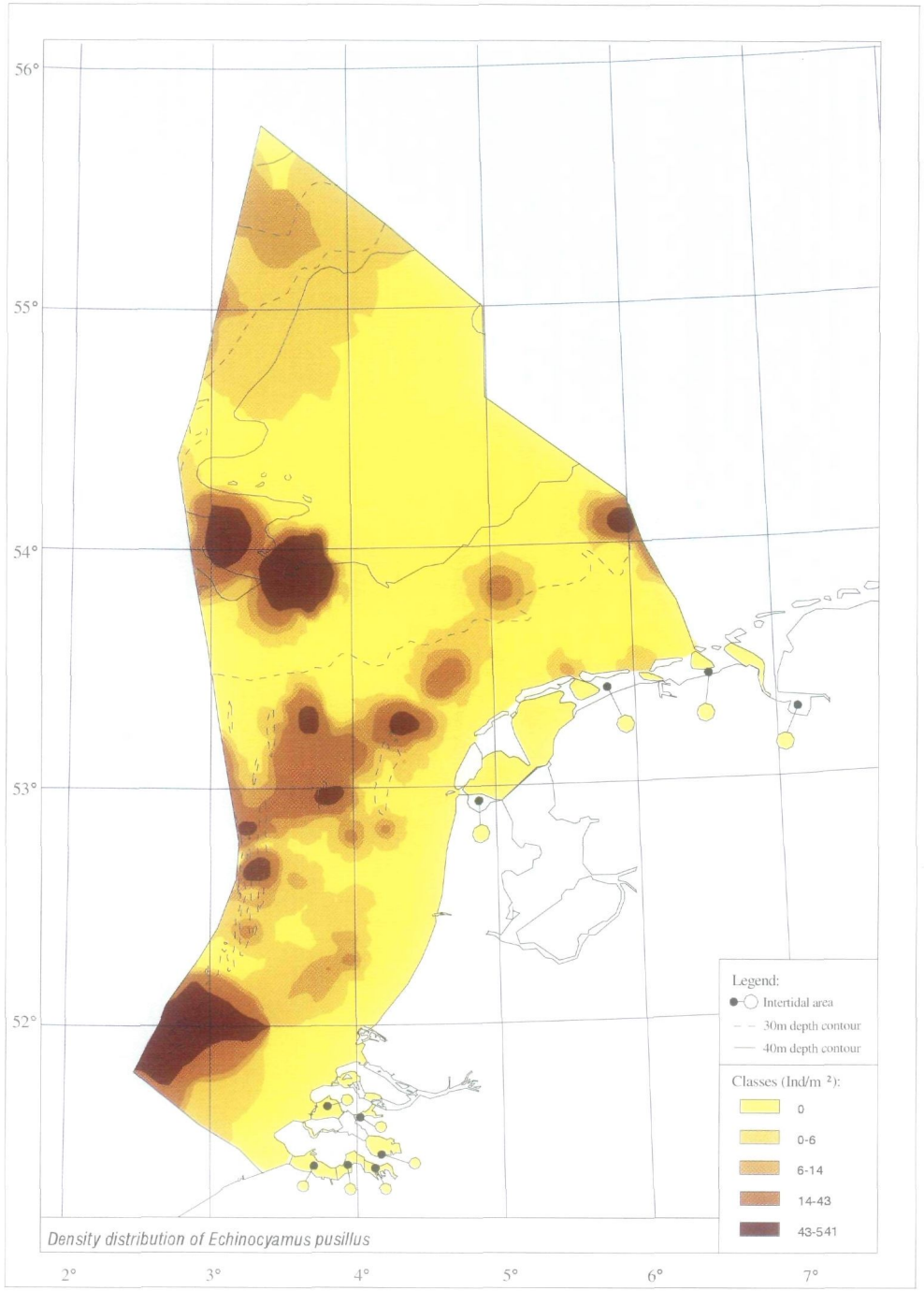
E. cordatum is a non-selective deposit feeder. It collects particles from the sediment surface through the chimney with specialised tube feet, but also feeds on subsurface sediment. The gut consequently includes detritus and small organisms associated with the sediment. The heart-urchin is a component of the diet of a number of demersal fish, especially plaice, and is also eaten by asteroids, notably by *Astropecten* spec. (Wolff, 1973; De Ridder & Lawrence, 1982; Fish & Fish, 1989; Rees & Dare, 1993).

The small amphipod *Urothoe marina* and the bivalve *Montacuta ferruginosa* live as a commensal with this sea urchin (Mortensen, 1972; Fish & Fish, 1989; Hayward & Ryland, 1990).

Distribution

This cosmopolitan echinoderm was found in about half of all samples. The species is very abundant north of the Dutch Wadden islands and is also present in Delta and the western part of the Wadden Sea. The distribution of the biomass is very patchy.

The fact that *E. cordatum* is present in the entire area indicates that the echinoderm is not very selective with regard to the type of sediment, although a slight preference for sandy bottoms can be detected. Earlier investigations suggest that, indeed, sandy substrates may be favoured (Rees & Dare, 1993). In a study along a transect in the central and southern North Sea, Duineveld & Jenness (1984) found *E. cordatum* to account for 50% of the benthic biomass at sandy sites and 5% at muddy sites.


56°
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54°
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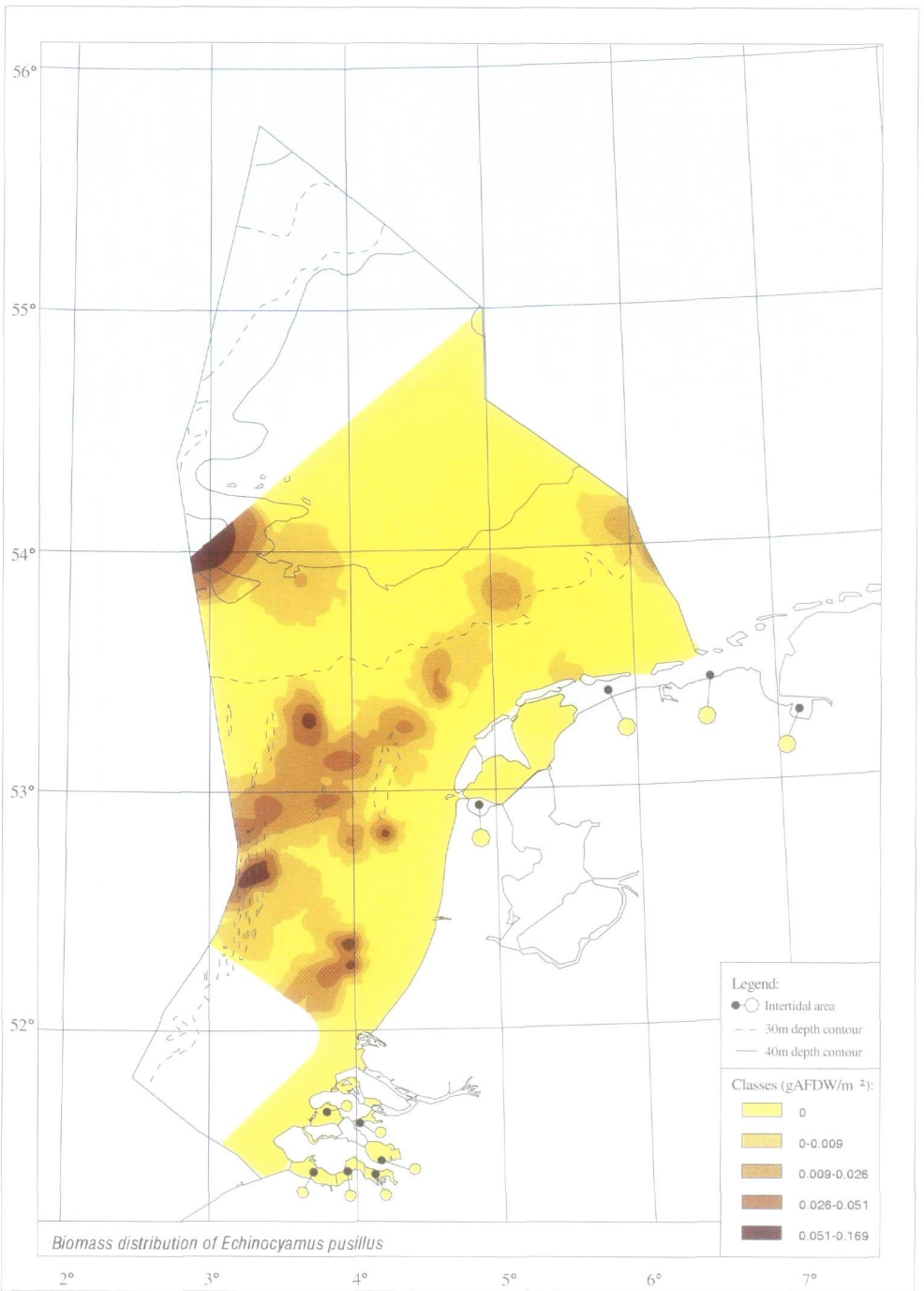
Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (Ind/m ²):
0
0-6
6-14
14-43
43-541
Density distribution of Echinocyamus pusillus


56°
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Legend:
Intertidal area
30m depth contour
40m depth contour
Classes (gAFDW/m ²):
0
0-0.009
0.009-0.026
0.026-0.051
0.051-0.169
Biomass distribution of Echinocyamus pusillus