

Smittoidea prolifica OSBURN, 1952 (Bryozoa, Cheilostomatida), a Pacific bryozoan introduced to The Netherlands (Northeast Atlantic)

by Hans DE BLAUWE & Marco FAASSE

Abstract

The Pacific bryozoan *Smittoidea prolifica* OSBURN, 1952 has been introduced to the Northeast Atlantic Ocean. Its currently known distribution in the Atlantic is restricted to The Netherlands. All recent records of autochthonous *Smittoidea reticulata* (MACGILLIVRAY, 1842) in The Netherlands probably refer to *S. prolifica*. The most likely route of introduction is via shellfish importations. Morphological differences with congeneric species are discussed to facilitate identification in case of spread in or new introductions to the Northeast Atlantic.

Keywords: introduction, *Smittoidea prolifica*, Bryozoa.

Samenvatting

De Pacifische *Smittoidea prolifica* OSBURN, 1952 (Bryozoa) is geïntroduceerd in de Noordoost-Atlantische Oceaan. De momenteel bekende verspreiding is beperkt tot Nederland. Alle recente vermeldingen van autochtone *Smittoidea reticulata* (MACGILLIVRAY, 1842) in Nederland hebben waarschijnlijk betrekking op *S. prolifica*. De meest aannemelijke introductieroute is via de import van schelpdieren. Morfologische verschillen met andere soorten in het genus worden besproken om de determinatie te vergemakkelijken in het geval van uitbreiding of nieuwe introducties in de Noordoost-Atlantische Oceaan.

Sleutelwoorden: introductie, *Smittoidea prolifica*, Bryozoa.

Introduction

During a faunistic investigation of the bryozoans of the SW-Netherlands we found two species unknown from the Northeast Atlantic. One of them, *Tricellaria inopinata* D'HONDT & OCCHIPINTI AMBROGI, 1985, introduced from the Pacific Ocean, has been previously reported upon (DE BLAUWE & FAASSE, 2000). The other species new to the Northeast Atlantic is *Smittoidea prolifica*, originating from the Pacific as well. In the present article the identification of the latter species is discussed. It is compared to similar *Smittoidea* species worldwide and to Northeast Atlantic *Smittoidea* species.

Older records of the genus *Smittoidea* from The Netherlands are critically reviewed. The ecological and geographical distribution of *S. prolifica* in The Netherlands has been investigated. Possible routes for the introduction of this species and ecological consequences are discussed.

Material & methods

To establish the identity of the unknown *Smittoidea* species, colonies were compared to descriptions of all *Smittoidea* species in the Northeast Atlantic Ocean and descriptions of species worldwide in the literature.

Its distribution was studied by collecting encrusting bryozoans on various substrates for identification under a stereomicroscope. Living mussels and oysters and empty shells were collected integrally and colonies on boulders were dislodged with hammer and chisel. Numerous localities were investigated in the Oosterschelde and Westerschelde and some in the Grevelingen, besides several brackish inland water bodies. At most localities investigated, only samples between tidemarks were taken. For practical reasons the sublittoral zone was investigated at three localities only, with sampling by SCUBA diving.

Collection-keepers of the main zoological museums in The Netherlands (ZMA, Amsterdam; Naturalis, Leiden) were contacted for information on autochthonous material of the genus *Smittoidea*.

The 'grey literature' containing information on marine invertebrates of The Netherlands was screened for records of autochthonous *Smittoidea* colonies.

Results

MATERIAL EXAMINED

Anna Frisopolder, 13.11.1999, 1 colony, coll. FAASSE; Goesse Meer, 26.09.1998, 1 colony, coll. FAASSE; Goesse Meer, 26.04.2001, 1 colony, coll. DE BLAUWE; Goesse Sas,

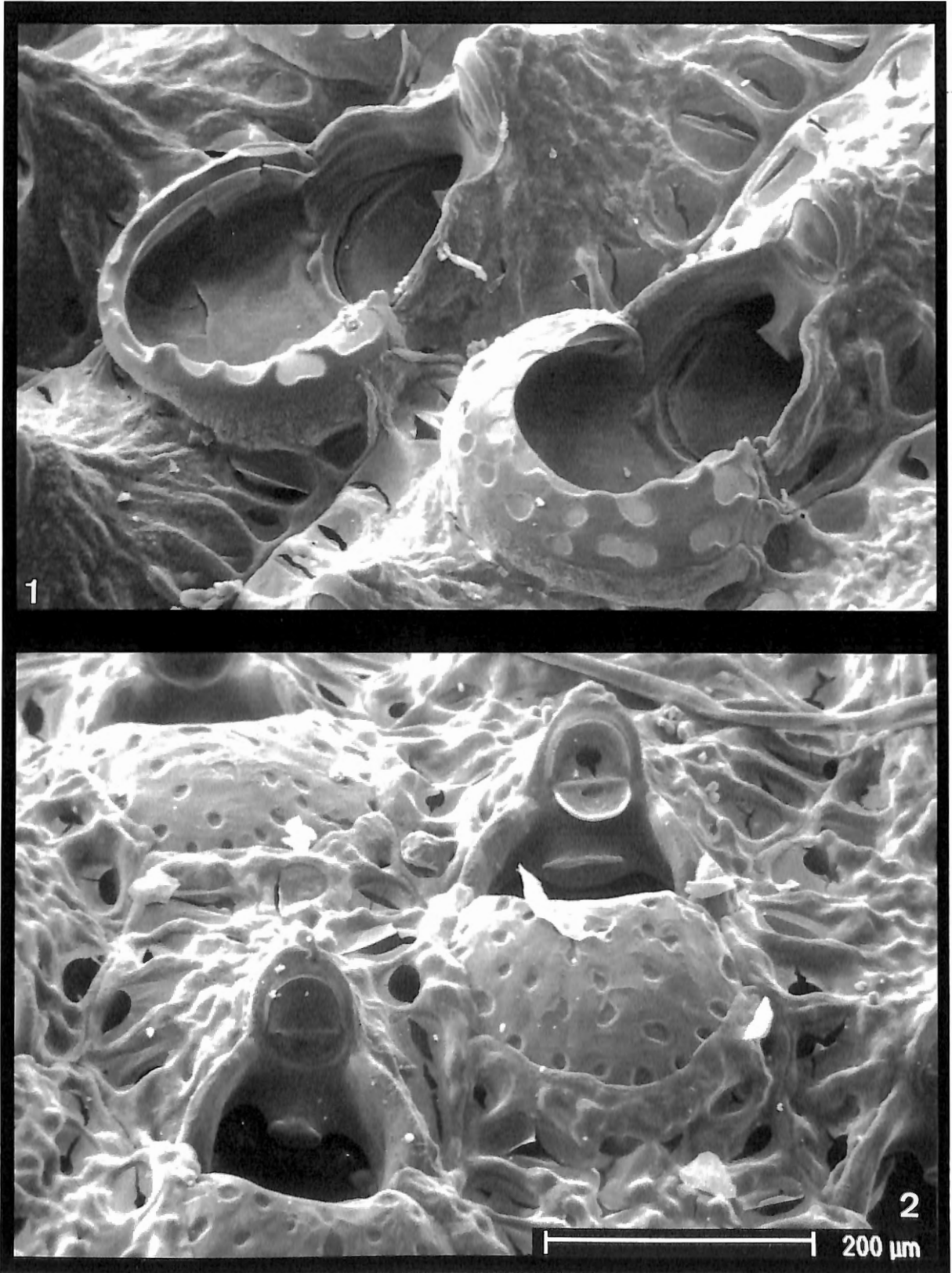


Figure 1. *Smittoidea prolifica*, 14.07.2001, Goesse Meer, oblique lateral view.

Figure 2. *Smittoidea prolifica*, 14.07.2001, Goesse Meer, oblique view at distal side.

19.08.2000, 4 colonies, RMNH Bryozoa 3161, 10 colonies coll. FAASSE; Katse Hoek, 23.06.2001, 1 colony, coll. FAASSE; Neeltje Jans, 22.08.1998, 4 colonies, coll. FAASSE; Zierikzee, 23.08.2000, 1 colony, coll. FAASSE; Westkapelse Kreek, 20.10.2001, 1 colony, coll. FAASSE.

DESCRIPTION OF *SMITTOIDEA PROLIFICA* (Figs 1-3)

Colony small (1-2 cm), round, forming shiny whitish-rose incrustation.

Autozooids oval to quadrate, 0.50-0.70 x 0.20-0.26 mm, frontal walls convex, separated by ridges made by adjacent lateral walls. Frontal wall smooth initially, becoming coarse with continued calcification, imperforate centrally. A distinct row of marginal pores, separated by stout interareolar ridges. Proximal border often with a double series of marginal pores in early ontogeny, later obscured by the ovicell of the proximal autozooid. Primary orifice orbicular, with a lyrula and sharp condyles, directed somewhat proximally (condyles invisible on SEM-photograph, hidden by operculum). The lyrula is of variable width, one fourth to half of the width of the orifice. The peristome is developed only at the lateral borders of the orifice, erect and thin, joining the proximal side of

the ovicell and the distal surface of the suboral umbo. Two to four hollow oral spines are present on the distal border of the orifice only in young zooids. They are lost in later ontogeny and the remains become hidden by the development of an ovicell. A single suboral avicularium is present in the distal side of a prominent umbo, perpendicularly to the plane of the frontal wall. The mandible is semicircular. Ovicells prominent, about 0.20-0.25 mm wide, usually slightly wider than long, flattened frontally and perforated by a number of pores, some round and small but definitely bigger than in *S. reticulata*, some bigger and irregular in shape, as if two or three smaller pores are united. In later ontogeny the lateral and distal sides of the ovicell become covered with a granular calcification. The ovicell rests on the distal zooid. Almost all autozooids, except the youngest two to three rows, bear an ovicell. Embryos orange. Polypide with twelve tentacles.

IDENTIFICATION

On the nearby coast of the United Kingdom three species in the genus *Smittoidea* are recognized (HAYWARD & RYLAND, 1999), i.e. *S. reticulata* (J. MACGILLIVRAY, 1842), *S. marmorea* (HINCKS, 1877) and *S. amplissima* HAYWARD,

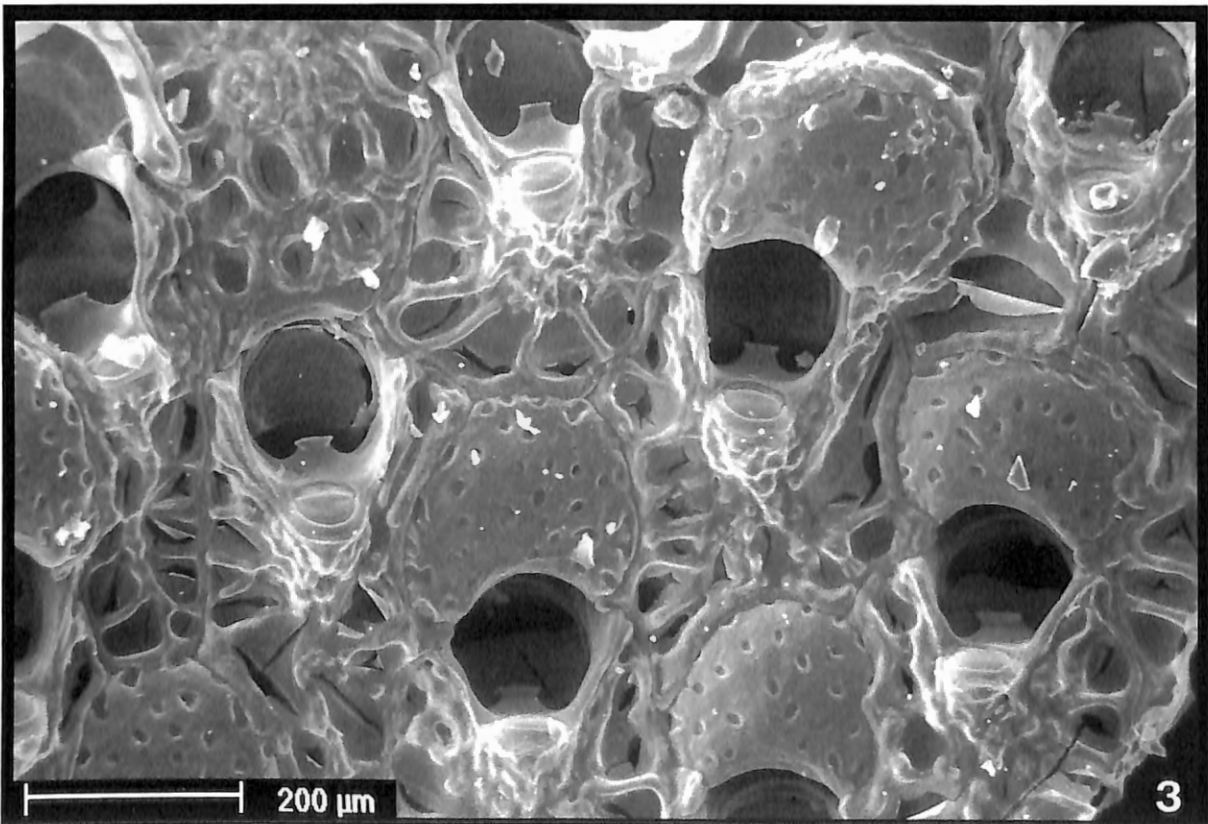


Figure 3. *Smittoidea prolifica*, 14.07.2001, Goesse Meer, frontal view.

1979. The former two species are very different from the present species in several important characters, the most obvious one is the triangular rostrum in the plane of the frontal wall. *S. amplissima* is similar to the present species in the rounded suboral avicularium and the rostrum perpendicular to the frontal wall. However, this species shows several differences, among which are a slender peg-like lyrula and the absence of spines. Spines only occur on the ancestrula and on the periancestrular zooids (REVERTER GIL, FERNANDEZ PULPEIRO & RAMIL BLANCO, 1992). Two more species occur in the NE Atlantic: *S. exilis* HAYWARD, 1994 and *S. microoecia* HAYWARD, 1994, both known from the Faroer. *S. exilis* HAYWARD, 1994 has a rostrum in the plane of the frontal wall and *S. microoecia* HAYWARD, 1994 has a rostrum slightly oblique to the frontal wall, a low and thickened peristome, also developed around the distal border of the orifice and the ovicell is rather small, immersed by granular calcification and becoming indistinct in later ontogeny.

Further, the mediterranean *S. ophidiana* WATERS, 1879 differs in the rostrum in the plane of the frontal wall and in the large, often spatulate or even bifid avicularian mandible. Worldwide some 50 *Smittoidea* species are known. The present species shows a combination of characters which is shared only by a few other *Smittoidea* species: cystid swollen with an apical umbo, large marginal pores separated by stout ridges, peristome developed as paired lateral flaps, single suboral avicularium occupying proximal gap in peristome, rostrum perpendicular to frontal wall. This combination of characters is shared by *S. evelinae* MARCUS, 1937, *S. evelinae* ROGICK, 1956, *S. rynchota* HAYWARD & THORPE, 1990, *S. incucula* HAYWARD & RYLAND, 1995 and *S. prolifica* OSBURN, 1952. Hereafter these species are compared to the species we collected in The Netherlands.

* *S. evelinae* MARCUS, 1937 has up to 5 oral spines, ovicells with large frontal pores and frontal on the lyrula a median conical ridge. Some zooids have two pores proximally to the base of the umbo. *S. evelinae* MARCUS, 1937 is a tropical species, described from Ilha das Palmas, Santos, Brazil (MARCUS, 1937).

* *S. evelinae* ROGICK, 1956: 305, pl. 32 has very large zooids with a mean length over 1 mm and apparently there are no oral spines. Some zooids have a steeply projecting umbo supporting the suboral avicularium. The colony is trumpet shaped. This species is described from Antarctica (ROGICK, 1956).

HAYWARD & TAYLOR (1984) placed *S. evelinae* ROGICK, 1956 into the synonymy of *S. albula* HAYWARD & THORPE, 1989. However, in *S. albula* the suboral avicularium has a proximally directed rostrum in the plane of the frontal wall. Later, HAYWARD & THORPE (1989) regard them as different species because there is a difference in zooid length and in the development of the peristome and they placed *S. evelinae* ROGICK, 1956 into the synonymy of *S. malleata* HAYWARD & THORPE, 1989. In *S. malleata* the colony is erect, developing folded, anastomosing unilaminar or bilaminar sheets, which might resemble the trumpet-shaped colonies of *S. evelinae* ROGICK, 1956. However, in *S. malleata* there is no peristome and the rostrum is directed proximally and in the plane of the frontal wall. The proximally directed rostrum in the plane of the frontal wall in *S. albula* and *S. malleata* is

clearly different from the rostrum perpendicular to the frontal wall in *S. evelinae* ROGICK, 1956. Therefore we regard *S. evelinae* ROGICK, 1956 as a species different from *S. albula* and *S. malleata*, as well as from *S. evelinae* MARCUS, 1937 and consequently it should be renamed.

* *S. rynchota* HAYWARD & THORPE, 1990 lacks condyles and the suboral avicularium is elongate triangular, its rostrum oblique to the frontal wall. One to three additional avicularia may develop on the proxima-lateral edge of the peristome in later ontogeny. Ovicells only have six to eight small, round frontal pores. *S. rynchota* is described from the (sub-)Antarctic (HAYWARD & THORPE, 1990).

* *S. incucula* HAYWARD & RYLAND, 1995 is readily distinguished by its large, anvil-shaped lyrula, downcurved condyles and the six distal oral spines. This species is described from the Great Barrier Reef (HAYWARD & RYLAND, 1995).

* *S. prolifica* OSBURN, 1952 in our opinion is identical to the species we collected in The Netherlands.

SOME NOTES ON THE SYNONYMY OF *SMITTOIDEA PROLIFICA* OSBURN, 1952

OSBURN (1952) considers *Smittoidea reticulata* ROBERTSON, 1908 to be different from *Smittoidea reticulata* (MACGILLIVRAY, 1842) and describes it as *S. prolifica*. *S. prolifica* OSBURN, 1952 is recorded from the Northeast Pacific by SOULE (1961), SOULE & SOULE (1964), SOULE, SOULE & PINTER (1975) and BANTA (1980).

In our opinion all records of *S. prolifica* from the Northwest Pacific are doubtful. The record of *S. reticulata* from Japan by OKADA & MAWATARI (1936) is assumed to pertain to *S. prolifica* by OSBURN (1952): "appears to be the same as they refer to the avicularium as oval or elliptical, placed just below the remule on the median longitudinal axis of the zooecium". However, OSBURN (1952) leaves out the description by OKADA & MAWATARI (1936) of the mandible: "the mandible is acute, pointed downwards". The mandible of *S. prolifica* is definitely not acute, but rounded. "Pointed downwards" may be interpreted as either "directed proximally" or "perpendicular to the frontal plane". The mandible of *S. prolifica* is not directed proximally.

RHO & SEO (1986) record *S. prolifica* from Korea and place *S. reticulata* sensu OKADA & MAWATARI, 1936 into the synonymy. However, their species seems to have a more protracted orifice, the number of the much stronger oral spines always seems to be three and the pores in the ovicells seem larger and less widely separated.

It is necessary to compare material of the aforementioned species from the west Pacific with material of *S. prolifica* from the east Pacific.

RECORDS OF *SMITTOIDEA* FROM THE NETHERLANDS

Localities where *S. prolifica* was collected are indicated in fig. 4. The first record of this species in The Netherlands dates from 08.08.1998. *S. prolifica* was collected in widely differing habitats, ranging from sublittoral boulders and shellgrounds to shallow intertidal pools to brackish water bodies without an open connection to the sea. This species

apparently has a low substrate specificity, as it was collected from wood, the underside of boulders, living bivalves and empty shells and from algae (*Sargassum muticum* (YENDO) FENSHOLT).

The main zoological museums in The Netherlands (ZMA, Naturalis) do not possess any autochthonous colony of the genus *Smittoidea* in their collections, at least no colony labeled with the correct genus name.

In the 'grey literature' several autochthonous records of *Smittoidea reticulata* were found. VAN MOORSEL (1998) reports this species from the locality Schelphoek in the Oosterschelde. This record dates from 1995. DE KLUIJVER (1997) reports this species from several invertebrate communities in the Oosterschelde and the Grevelingen. The localities could not be traced, except for colonies on settlement panels at the Plompetoren and at Zijpe. The dates of these observations could not be traced either.

VAN DER SLEEN (1920) mentions *Lepralia reticulata* JOHNSTON from Den Helder. This record might concern *S.*

reticulata; however, as the material could not be traced in zoological museums, its identity remains uncertain.

Discussion

All autochthonous *Smittoidea* colonies from The Netherlands mentioned in the literature were identified as *S. reticulata* (J. MACGILLIVRAY, 1842). We are not able to verify these records as we could not trace any material mentioned in the literature. In the zoological museums (NNH Naturalis, ZMA) we found only one colony washed ashore the coast of The Netherlands on 12.12.1948 near Bloemendaal on a piece of latex, together with *Microporella ciliata* (PALLAS, 1766) and *Scrupocellaria* cf. *scabra* (VAN BENEDEN, 1848), a species not known to occur autochthonously in Belgium, The Netherlands or nearby coasts of France or the United Kingdom. During our own faunistic investigation we found autochthonous colonies

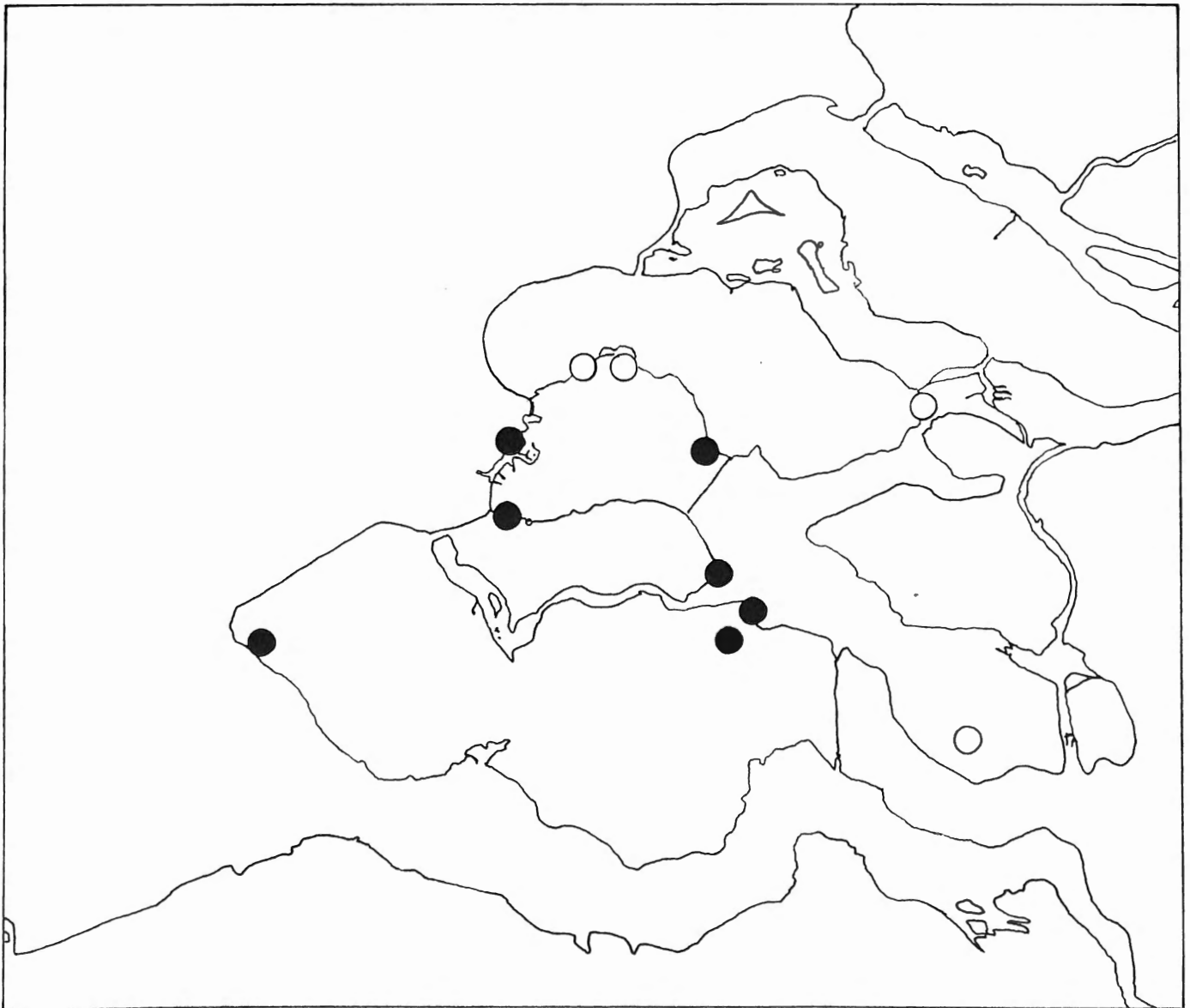


Figure 4. *Smittoidea prolifica*, distribution in the SW-Netherlands. Closed dots: collections by the authors, open circles: records of *S. reticulata* from literature.

only of *S. prolifica*, while *S. reticulata* was only found washed ashore on parts of lobstercages originating from the Channel coasts of the United Kingdom or France. There are no records of autochthonous *Smittoidea* from Belgium and no material is present in the collections of the KBIN (Brussels). Nor could we find any records of autochthonous *S. reticulata* from nearby coasts of the UK and France (eastern Channel and Southern Bight of the North Sea). MIGNÉ & DAVOULT (2001) do not mention it from the French coast between the Cap d'Antifer in the eastern Channel and the Belgian border. On the other hand it is remarkable that DE KLUIJVER (1997) and VAN MOORSEL (1998) do not mention *S. prolifica*, which is now a common species in The Netherlands. Therefore it is likely that in The Netherlands *S. prolifica* has been misidentified as *S. reticulata* previously. It is not uncommon that an introduced marine species is misidentified as a local species initially (e.g. CHAPMAN, 1988).

On 08.08.1998 we collected the first colony of *S. prolifica* in The Netherlands. If our assumption that records of autochthonous *S. reticulata* in The Netherlands actually concern *S. prolifica* is right, then the latter species was collected here as early as 1995 and maybe even before that year. The introduction may have happened much earlier than the first collection. Probably many small introduced species are unrecognized (REISE *et al.*, 1999).

Smittoidea prolifica is known from the Pacific coast and the Gulf of California encrusting stones, shells and stems. It is a common species on piles and floats and along the shore and down to 45 fms. The route of introduction to The Netherlands cannot be deduced with certainty from the data at hand. However, a reasonable guess can be made using the known distribution in The Netherlands. *S. prolifica* has not been found in the waterways to two of the largest ports in the world, Antwerp and Rotterdam, just to the south and the north of its range in The Netherlands. This is remarkable, as especially the mouth of the Westerschelde is a habitat similar to the Oosterschelde. Hence it is less likely that the species reached this country on ship's hulls or in ballast water. On the other hand, all collecting localities except one are situated around the Oosterschelde, the centre of shellfish culture in The Netherlands. In the past oysters have been imported from the Pacific coast of North America, which may explain the introduction to The Netherlands. Up to 32 species are believed to have been introduced to the North Sea with Pacific oysters (REISE *et al.*, 1999). However, the more open nature of the Westerschelde cannot be ruled out as a possible reason for the absence of *S. prolifica*.

It is likely that *S. prolifica* will be introduced or has already been introduced to other regions in Europe. It has a wide ecological amplitude, it is able to grow and reproduce rapidly and has a low substrate specificity. The fact that it settles and grows very well on shellfish may enhance the chances of introduction to other regions with shellfish culture. OSBURN (1952) states that *S. prolifica* "is a common species on piles and floats". Therefore it is likely to settle on ships and in the future (secondary) introductions via ship's hulls may occur as well. It is important to be aware of the presence of this species in Europe to avoid future misidentifications as a local *Smittoidea* species.

At none of the localities in The Netherlands investigated during our survey *S. prolifica* was a dominant species. It never occupied more than a low percentage of the available substrate. Other encrusting bryozoan species always were more numerous. *S. prolifica* was never seen to overgrow other invertebrates. The ecological consequences of its introduction to The Netherlands seem to be negligible at the moment.

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Hans DE BLAUWE

Watergang 6

8380 Dudzele, Belgium

E-mail: deblauwehans@hotmail.com

Marco FAASSE

Schorerstraat 14

4341 GN Arnemuiden, The Netherlands

E-mail: mafaasse@hetnet.nl