J. Mar. Biol. Ass. U.K. (2007), **87**, 1441–1458
Printed in the United Kingdom
doi: 10.1017/S0025315407058122

Sponge biodiversity of Rathlin Island, Northern Ireland

B.E. Picton* and C.E. Goodwin*†

*Ulster Museum, Department of Zoology, Ulster Folk and Transport Museum, Cultra, Holywood, County Down, Northern Ireland, BT18 OEU, UK. †Corresponding author, e-mail: claire.goodwin@gmail.com

Sponges from Rathlin Island, Northern Ireland were sampled during a six week SCUBA diving expedition. One hundred and twenty-eight species were recorded, 29 of which were previously undescribed. With previous records a total of 134 species are now known from Rathlin, the richness of its sponge community makes it a key site for sponges in Europe. Eight new species are described: *Axinella parva*, *Spongosorites calcicola*, *Crella plana*, *Phorbas punctata*, *Lissodendoryx* (*Ectyodoryx*) *jenjonesae*, *Antho* (*Antho*) *granditoxa*, *Hymeraphia breeni* and *Hymeraphia elongata* and information is given on the poorly known species *Axinella pyramidata*, *Myxilla* (*Styloptilon*) *ancoratum*, *Antho* (*Antho*) *brattegardi*, *Clathria* (*Microciona*) *laevis* and *Plocamionida tylotata*. Extension of the range of *Hexadella racovitzai* is discussed. A small bay of particularly high nature conservation importance for sponges was identified, many of the rarer species were limited to this area. Sponge populations on the east coast of Rathlin seem to have been damaged by dredging.

INTRODUCTION

There have been few studies on British and Irish sponge biodiversity in recent years with the fauna of many areas last being studied by Bowerbank (1864, 1866, 1872, 1874, 1879), and in Ireland Stephens (1912, 1916, 1917, 1921). There are around 375 sponge species reported from UK and Irish waters but only about 100 of these are well-known (Ackers et al., 1992; Howson & Picton, 1997). There are a few areas where better accounts of the sponge biodiversity are available, namely Plymouth (Burton, 1930, 1957), Lundy (Hiscock et al., 1984), Lough Hyne (van Soest & Weinberg, 1980) and Kilkieran Bay (Könnecker, 1973) but the sponge biodiversity of much of the British Isles, including Northern Ireland remains poorly known.

Rathlin Island has been noted as being of particular biological importance with some 530 species of algae, marine invertebrates and fish recorded from here (60% of the marine species known from Northern Ireland), including many of particular interest (Erwin et al., 1990). It has been identified as one of the key areas for sponges in Europe (van Soest et al., 1999) and is designated as a Special Area of Conservation. Prior surveys by the Ulster Museum had shown it to have a particularly high sponge biodiversity and discovered several species not previously reported from the UK and other species which appear never to have been described in the scientific literature (Bernard Picton, personal observation).

MATERIALS AND METHODS

Specimens were collected by SCUBA diving around Rathlin Island, Northern Ireland. Specimens were selected by eye with the divers attempting to sample species that looked different from those previously sampled. The aim was to sample as many different species as possible, rather than gaining any quantitative information. Once selected, three photographs of each specimen were taken *in situ* using housed digital SLR cameras (Nikon D70 in Ikelite and Subal housings, with Ikelite DS125 substrobe and SB800 flash unit and Fuji S2 Pro in a SeaCam housing with Nikon SB105 flash unit, all with 60 mm macro lenses). A small piece (~1 cm^2 of tissue) was then removed. After collection the samples were kept in seawater for a few hours before being transferred to 95% industrial methylated spirits (IMS) for storage.

Tissue slides were prepared by sectioning a very thin portion of tissue at a 90° angle through the sample, this was then dehydrated in absolute ethanol for 4 min and placed in clove oil for a further 4 min to clarify the tissue before being mounted on a microscope slide in Canada balsam. A

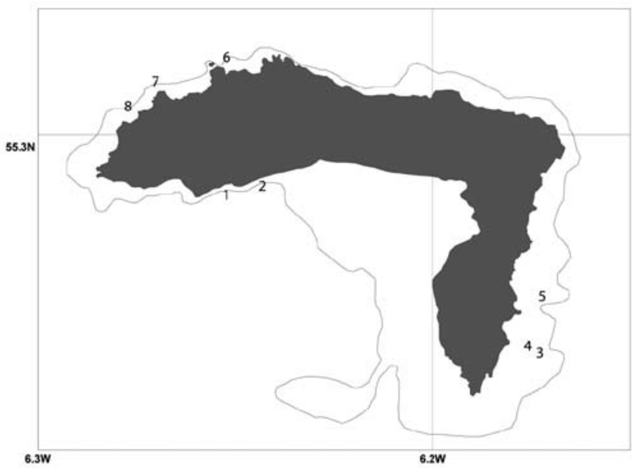

Figure 1. Sampling sites referred to in the text. 1, Damicornis Bay; 2, White Cliffs; 3, Lochgarry; 4, south-east of Doon Point; 5, north-east of Doon Point; 6, Duncan's Bo; 7, Ruecallan; 8, west of Derginan Point. Line around Rathlin is the 30 m depth contour.

Table 1. *List of sponge taxa recorded from Rathlin Island. Where a species is followed by a letter (e.g.* Axinella *sp. A) this indicates that it is a distinct species but it has not yet been possible to find an existing name. Genus followed only by spp. indicates that the specimen has been identified only to genus level. The taxa are arranged in taxonomic, then alphabetical order following that given in* Systema Porifera *(Hooper & van Soest, 2002).*

Class: Calcarea Bowerbank, 1864
Sub-class: Calcinea Bidder, 1898
Order: Clathrinida Bidder, 1898
Family: Clathrinidae
Clathrina coriacea (Montagu, 1818)
Guancha lacunosa (Bean in Johnston, 1842)
Sub-class: Calcaronea Bidder, 1898
Order: Leucosolenida Bowerbank, 1864
Family: Leucosoleniidae Minchin, 1900
Leucosolenia botryoides (Ellis & Solander, 1786)
Leucosolenia complicata (Montagu, 1818)
Family: Sycettidae Dendy, 1892
Scypha spp. Gray, 1821
Order: Baerida
Family: Baeriidae
Leuconia nivea (Grant, 1826)*
Class: Demospongiae Sollas, 1885
Order: Homosclerophorida Dendy, 1905
Family: Plakinidae Schluze, 1880
Oscarella sp. A, W (N Sp.)
Order: Astrophorida Sollas, 1888
Family: Ancorinidae Schmidt, 1870
Stelletta grubii Schmidt, 1862
Stryphnus ponderosus (Bowerbank, 1866)
Family: Geodiidae Gray, 1867
Pachymatisma johnstonia Bowerbank in Johnston, 1842
Family: Pachastrellidae Carter, 1875
Dercitus bucklandi (Bowerbank, 1858)
Order: Hadromerida Topsent, 1894
Family: Clionaidae d'Orbigny, 1851
Cliona celata Grant, 1826
Family: Hemiasterellidae Lendenfeld, 1889
Paratimea constellata (Topsent, 1893)
Paratimea sp. A W (N sp.)
Paratimea sp. B W (N sp.)
Stelligera rigida (Montagu, 1818)
Stelligera stuposa (Montagu, 1818)
Family: Polymastiidae Gray, 1867
Polymastia sp. C N sp.
Polymastia sp. D N sp.
Polymastia boletiformis (Lamarck, 1813)
Polymastia penicillus (Montagu, 1818)
Sphaerotylus Topsent, 1898 N sp.
Family: Suberitidae Schmidt, 1870
Protosuberites sp. W (N sp.) Topsent, 1896
Prosuberites epiphytum (Lamarck, 1815)
Suberites carnosus (Johnston, 1842)
Family: Tethyidae Gray, 1848
Tethya citrina Sara & Melone, 1965
Tethya sp. nov. N sp.
Order: Poecilosclerida Topsent, 1928
Sub-order: Microcionina Hajdu, van Soest & Hooper, 1994
Family: Acarnidae Dendy, 1922
Iophon hyndmani (Bowerbank, 1858) NICP
Iophon nigricans (Bowerbank, 1858)
Family: Microcionidae Carter, 1875
Sub-family: Microcioninae Carter, 1875
Clathria (Clathria) barleei (Bowerbank, 1866) *R
Clathria (*Microciona*) *armata* (Bowerbank, 1866)
Clathria (*Microciona*) *atrasanguinea* (Bowerbank, 1862)
Clathria (Microciona) elliptichela (Alander, 1942) *R
Clathria (*Microciona*) *laevis* (Bowerbank, 1866) NI, R
Clathria (*Microciona*) *spinarca* (Carter & Hope, 1889)
Clathria (*Microciona*) *strepsitoxa* (Carter & Hope, 1889)
Clathria (*Microciona*) sp. A W
Clathria (*Microciona*) sp. B W (N sp.)
Clathria (*Microciona*) sp. C W (N sp.)
Sub-family: Ophlitaspongiinae de Laubenfels, 1936
Antho (Acarnia) coriacea (Bowerbank, 1874)
Antho (Antho) brattegardi van Soest & Stone, 1986 BI, R
Antho (Antho) cf. *inconstans* Topsent, 1925 W (N sp.)
Antho (Antho) involvens (Schmidt, 1864)
Antho (Antho) granditoxa N sp.
Ophlitaspongia kildensis Howson & Chambers, 1999 R
Ophlitaspongia papilla Bowerbank, 1866
Family: Raspailiidae Hentschel, 1923
Sub-family: Raspailiinae Nardo, 1833
Eurypon major Sara & Siribelli, 1960 R
Eurypon sp. 2 N sp.
Eurypon sp. 4 cf. *cinctum* N sp.
Eurypon sp. 5 N sp.
Eurypon sp. 9, *Eurypon clavigera* Bowerbank, 1866? W
Eurypon sp. 13 N sp.
Eurypon sp. 14 N sp.
Eurypon sp. 15 N sp.
Eurypon sp. 16 N sp.
Eurypon sp. 17 N sp.
Hymeraphia stellifera (Bowerbank, 1864)
Hymeraphia breeni N sp.
Hymeraphia elongata N sp.
Raspailia aculeata (Bowerbank, 1866) NI, R
Raspailia hispida (Montagu, 1818)
Raspailia ramosa (Montagu, 1818)
Tricheurypon viride (Topsent, 1889) NI
Sub-order: Myxillina Hadju, van Soest & Hooper, 1994
Family: Coelosphaeridae Dendy, 1922
Lissodendoryx (Ectyodoryx) jenjonesae N sp.
Family: Crellidae Dendy, 1922
Crella rosea (Topsent, 1892) R
Crella plana N sp.
Family: Hymedesmiidae Topsent, 1928
Hymedesmia cf. *coriacea* Fristedt, 1885 W (N sp.)
Hymedesmia hibernica Stephens, 1916 NI, R
Hymedesmia jecusculum (Bowerbank, 1866)
Hymedesmia pansa Bowerbank, 1882
Hymedesmia paupertas (Bowerbank, 1866)
Hymedesmia peachii Bowerbank, 1882 NI, R
Hymedesmia primitiva Lundbeck, 1910 NI, R
Hymedesmia cf. *versicolor* (Topsent, 1893) N sp.
Hymedesmia sp. C N sp.
Hymedesmia sp. D N sp.
Hymedesmia sp. F N sp.
Hymedesmia sp. H N sp.
Hymedesmia sp. I N sp.
Hymedesmia sp. J N sp.
Hymedesmia sp. M N sp.
Hymedesmia sp. P N sp.
Hymedesmia cf. *zetlandica* N sp.

Table 1. *(Continued.)*

Spanioplon armaturum (Bowerbank, 1866) NICP
Hemimycale columella (Bowerbank, 1866)
Phorbas fictitius (Bowerbank, 1866)
Phorbas punctata N sp.
Plocamionida ambigua (Bowerbank, 1866)
Plocamionida tylotata Brøndstedt, 1932 BI
Plocamionida sp. B W (N sp./NI)
Plocamionida sp. C W (N sp./NI)
Family: Myxillidae Dendy, 1922
Myxilla (*Styloptilon*) *ancoratum* Cabioch, 1968 BI, R
Myxilla (Myxilla) fimbriata (Bowerbank, 1866)
Myxilla (Myxilla) incrustans (Johnston, 1842)
Myxilla (Myxilla) rosacea (Lieberkuhn, 1859)
Plocamiancora arndti Alander, 1942 R
Sub-order: Mycalina van Soest & Hooper, 1994
Family: Desmacellidae Ridley & Dendy, 1886
Biemna variantia (Bowerbank, 1858)*
Desmacella cf. *annexa* W
Family: Esperiopsidae Hentschel, 1923
Amphilectus fucorum (Esper, 1794)
Family: Mycalidae Lundbeck, 1905
Mycale (Mycale) lingua (Bowerbank, 1866)*
Mycale (Mycale) rotalis (Bowerbank, 1874)
Order: Halichondrida Gray, 1867
Family: Axinellidae Carter, 1875
Axinella damicornis (Esper, 1794)
Axinella dissimilis (Bowerbank, 1866)
Axinella infundibuliformis (Linnaeus, 1758)
Axinella pyramidata Stephens, 1916 NI
Axinella parva N sp.
Axinella sp. C W (NI/N sp.)
Phakellia Bowerbank, 1862 spp. W (N sp.)
Family: Bubaridae Topsent, 1894
Bubaris vermiculata (Bowerbank, 1866)*
Hymerhabdia typica Topsent, 1892 NICP, R
Halicnemia patera Bowerbank, 1862 NI
Halicnemia sp. A N sp.
Family: Dictyonellidae van Soest, Diaz & Pomponi, 1990
Tethyspira spinosa (Bowerbank, 1874) R
Family: Halichondriidae Gray, 1867
Halichondria spp. Fleming, 1828
Halichondria bowerbanki Burton, 1930
Halichondria panicea (Pallas, 1766)
Hymeniacidon simplicima (Bowerbank, 1874) R
Hymeniacidon perleve (Montagu, 1818)
Spongosorites calcicola W (N sp.)
Order: Haplosclerida Topsent, 1928
Sub-order: Haplosclerina Topsent, 1928
Family: Chalinidae Gray, 1867
Acervochalina limbata (Montagu, 1818) R
Haliclona spp. Grant, 1836 W (N sp.)
Haliclona fistulosa (Bowerbank, 1866)
Haliclona urceolus (Rathke & Vahl, 1806)
Haliclona viscosa (Topsent, 1888)
Order: Dictyoceratida Minchin, 1900
Family: Dysideidae Gray, 1867
Dysidea spp. Johnston, 1842 W (N sp.)
Dysidea fragilis (Montagu, 1818)
Order: Dendroceratida Minchin, 1900
Family: Darwinellidae Merejkowsky, 1879
Aplysilla rosea (Barrois, 1876)
Aplysilla sulfurea Schulze, 1878
Chelonaplysilla noevus (Carter, 1876) R
Darwinellidae sp. A W (N sp.)
Family: Dictyodendrillidae Bergquist, 1980
Spongionella pulchella (Sowerby, 1804) R
Order: Halisarcida Bergquist, 1996
Family: Halisarcidae Vosmaer, 1885
Halisarca spp. Johnston, 1842
Halisarca dujardini Johnston, 1842
Order: Verongida Bergquist, 1978
Family: Ianthellidae Hyatt, 1875
Hexadella racovitzai Topsent, 1896 NI, R

N sp., new species; NI, new record for Northern Ireland; BI, new record for Britain and Ireland; R, rare species of particular interest; W, further work needed to determine status (suspected status in parentheses); NICP, Northern Ireland conservation priority species; *, not collected during this survey but samples from Rathlin present in the Ulster Museum collections from previous trips.

coverslip was then placed on the slide and they were then kept at 50°C for at least 48 h to allow the mountant to dry. Spicule preparations were prepared by dissolving the tissue in concentrated nitric acid, which was heated slightly in a water bath to aid the reaction, distilled water was then added and the preparation left to settle for two hours before the liquid was pipetted off and the process repeated. The spicules were then washed in a series of three washes of distilled water and two washes of 70% ethanol, being left to settle for two hours between each wash. Spicules were then re-suspended in a few drops of absolute ethanol and then either mounted on glass microscope slides in Canada balsam for light microscopy or mounted on stubs and sputter coated with gold-palladium for examination using scanning electron microscope (SEM) (Jeol 6500 FEG). In either case prior to coating, a few drops of the spicule solution were placed on the mount which was then placed on a hot plate at 50°C to allow the ethanol to evaporate.

The tissue slide was used primarily for identification of well known species and to genus level in difficult genera such as *Hymedesmia*. Spicule measurements were taken from the spicule preparations, at least ten spicules of each type were measured—taking care to measure those that appeared near the ends of the size range.

For most samples there was enough material to retain some tissue in industrial methylated spirit (IMS) for the museum collections. However, for very small samples it was necessary to use all the tissue to make the slide preparations.

Due to time constraints it was not possible to identify most calcareous specimens to species level, identification was focused on demosponges, which comprise the majority of taxa. The taxonomy of Calcarea is difficult as they have few morphological characters on which to base identifications, and past trends in systematics have led to 'lumping' of several species (Rapp, 2006).

Specimens were obtained for comparison from the Natural History Museum, London (BMNH) and the National Museum of Ireland, Dublin (NMI). Additional material from the Ulster Museum Porifera collections was also examined, these samples are referred to in the text as Mc for brevity, the full abbreviation for these specimens is BELUM Mc. Unless specified all material is from the Rathlin Sponge Biodiversity Project.

The study site

The specimens were collected from Rathlin Island, a small island six miles off the north coast of Northern Ireland. It is characterized by very strong tidal streams and little silt; turbidity is low (the infralittoral zone extends below 20 m) and temperatures are stable (Erwin et al., 1990). The area sampled can be divided into three main habitats: the north wall, a steep sea cliff reaching depths of 200 m; the east coast, an area of sand and gravel with some boulders and a small area of rocky reef; and the south bays which have a boulder substrate. The various sites referred to in the text are shown in Figure 1. Sampling from as many areas of the coast as possible was attempted, however, some areas proved impossible to sample due to the strong tidal streams.

RESULTS

In total 128 sponge species were recorded. Of these, 29 are previously undescribed species; three are new to Britain and Ireland (*Plocamionida tylotata* Brøndstedt, 1932, *Myxilla* (*Styloptilon*) *ancoratum* Cabioch, 1968, *Antho* (*Antho*) *brattegardi* van Soest & Stone, 1986); nine are new to Northern Ireland (*Axinella pyramidata* Stephens, 1916, *Halicnemia patera* Bowerbank, 1862, *Hymedesmia* (*Stylopus*) *hibernica* Stephens, 1916, *Hymedesmia* (*Hymedesmia*) *peachii* Bowerbank, 1882, *Hymedesmia* (*Stylopus*) *primitiva* Lundbeck, 1910, *Clathria* (*Microciona*) *laevis* Bowerbank, 1866, *Raspailia aculeata* (Johnston, 1842), *Tricheurypon viride* (Topsent, 1889) and *Hexadella racovitzai* Topsent, 1896). A further 19 species require further investigation.

Eight new species are described: *Axinella parva*, *Spongosorites calcicola*, *Crella* (*Pytheas*) *plana*, *Phorbas punctatus*, *Lissodendoryx* (*Ectyodoryx*) *jenjonesae*, *Antho* (*Antho*) *granditoxa*, *Hymeraphia breeni* and *Hymeraphia elongata* and information is given on the poorly known species *Axinella pyramidata*, *Myxilla* (*Styloptilon*) *ancoratum*, *Antho* (*Antho*) *brattegardi*, *Clathria* (*Microciona*) *laevis* and *Plocamionida tylotata*. A further six species have been previously recorded from Rathlin but were not collected in this survey, bringing the total species known from Rathlin to 134. Black and white figures of the described species follow, colour images of these and other sponges collected by the project are available at http://www.habitas.org.uk/marinelife/sponge_guide/. Names of collectors are abbreviated in the text as follows: Claire Goodwin (C.E.G.), David Goodwin (D.G.), Jen Jones (J.J.), Anne Marie Mahon (A.M.), Bernard Picton (B.E.P.) and Louise Scally (L.S.).

Rathlin can be divided into three main habitats: south-west bays and slopes, the east coast and the north wall. The sponge fauna of each is briefly described below.

South-west bays and slopes

This is an area of steep boulder slope with pockets of sediment. The slope descends to >70 m in some areas, in others the boulders stop at around 40 m with soft sediment at the bottom. The upper part of the slope experiences little current but below 30 m moderate currents occur at certain times of the tide (<0.5 knots). All records of *Hymeraphia breeni*, *Hymeraphia elongata*, *Axinella parva*, *Axinella pyramidata*, *Axinella* sp. C and *Tethya* sp. A were from this area and the majority of *Antho* (*Antho*) *brattegardi* (9/10 records), *Eurypon* sp. 2 (3/5 records), *Eurypon* sp. 5 (5/8 records), *Halicnemia* sp. A (24/30 records), *Halicnemia patera* (2/3 records), *Hymeraphia stellifera* (13/22 records), *Hymerhabdia typica* (9/11 records) and *Paratimea constellata* (6/8 records). Many of the rare species occurred in one small bay; as this has no local name that we have been able to find we have termed it 'Damicornis Bay' after *Axinella damicornis* which is abundant here, but rare in Northern Ireland. The bay is very narrow and steep sided, the boulder slopes rapidly drop down to over 70 m. In previous surveys *A. damicornis* was only recorded from this bay but this survey also found one specimen on the north wall.

The east coast

The east coast comprises a large gently sloping area (between approximately 20 and 35 m in depth). The substrate is mainly sand, cobbles and pebbles with small pockets of boulders. It appears to have changed considerably since the Northern Ireland Sublittoral Survey, possibly as a result of scallop dredging. The wreck of the 'Lochgarry', which is a largely intact wreck upright on the seabed, occurs on this coast. The wreck is surrounded by large boulders with encrusting animal turf, including many sponges. Another area of note on the east coast is a small bedrock reef north-east of Doon Point (approximate position 55°16.46'N 6°10.37'W), which ranges from approximately 20–40 m in depth. This reef, in contrast to the surrounding sand and gravel seabed, is heavily encrusted with sponges and other animal turf, including species such as the hydroids *Diphasia alata* and *Polyplumaria flabellata*. The east coast was less diverse in sponges than other areas of Rathlin Island, probably mainly due to the lack of stable hard substrate. However, the only records for *Hymedesmia* sp. F, *Hymedesmia* sp. H, *Clathria* (*Microciona*) *laevis*, were from here. Additionally two out of three of the records of *Clathria* (*Microciona*) *atrasanguinea* were from this area.

The north wall

The north wall is a steeply sloping wall, which in places can reach over 200 m; it is the deepest underwater cliff in the British Isles. The western area of the wall is not as steep and areas around the West Lighthouse include some shallow sloping ledges and gullies between 20 and 40 m in depth. The eastern areas of the wall are more steeply sloping with big vertical sections. An area of particular note is a series of limestone arches in the cliff face just east of the Western Lighthouse. There are also a few caves along the length of the cliff face, and it is likely there are more undiscovered caves present in this area. The area is extremely exposed to the tides and can only be dived on the ebb tide; at certain states of the tide downcurrents can develop on the cliffs. The

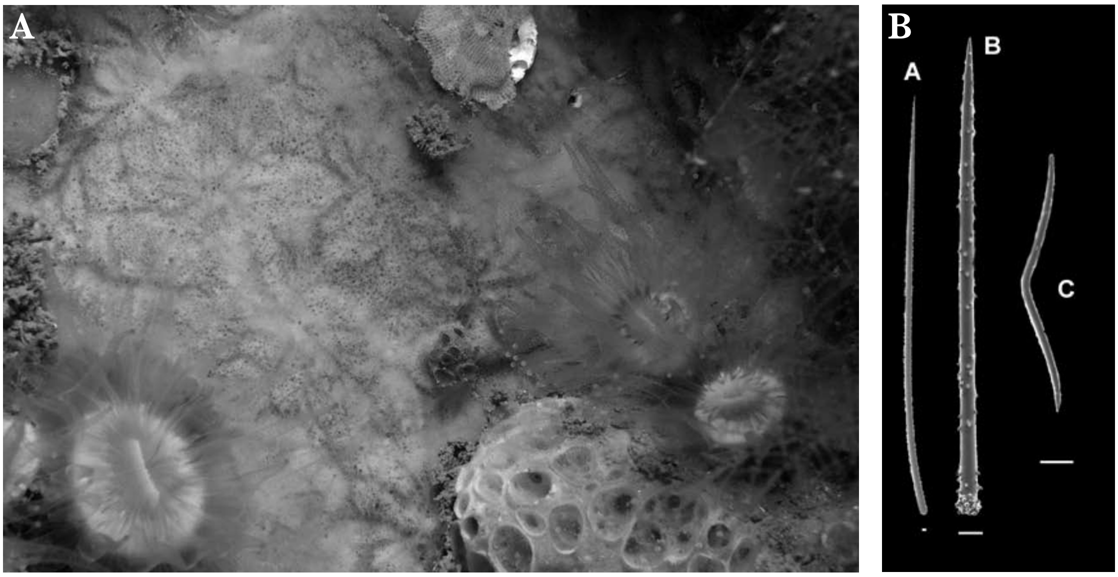

Figure 2. *Clathria* (*Microciona*) *laevis* (Bowerbank, 1866). (A) Surface; (B) spicules: (A) choanosomal style, (B) acanthostyle, (C) toxa (ectosomal style not pictured). Scale bars: 10 µm.

western areas of the cliff are slightly out of the main tidal stream and have a bigger slack window, the eastern area has a smaller slack window and this becomes progressively shorter until the eastern half of the north coast which can rarely be dived. For this reason little sampling was carried out towards the eastern extent of this coast. The majority of records for *Antho* (*Acarnia*) *coriacea* (21 of 37 records), *Antho* (*Antho*) *inconstans* (6 of 8 records), *Aplysilla rosea* (3 of 4 records), *Crella* (*Pytheas*) *plana* (5 of 6 records), *Desmacella* cf. *annexa* (5 of 7 records), *Hymedesmia* (*Hymedesmia*) *pansa* (5 of 7 records), *Myxilla rosacea* (13 of 16 records), *Plocamionida ambigua* (14 of 24 records), *Spanioplon armaturum* (7 of 9 records) and the only records for *Plocamionida tylotata* and *Plocamionida* sp. B, *Protosuberites* spp., and *Tethyspira spinosa* were from this area.

SYSTEMATICS

Order POECILOSCLERIDA Topsent, 1928
Suborder MICROCIONINA Carter, 1875
Family MICROCIONIDAE, Carter, 1875
Subfamily MICROCIONINAE, Carter, 1875
Clathria (*Microciona*) *laevis* (Bowerbank, 1866)

Specimen

[Mc2660]. Sample in IMS, section and spicule preparation; Lochgarry (55°15.956'N 006°10.411'W; water depth: 28–33 m); coll. by B.E.P. and C.E.G., 9 July 2005.

External morphology

Cream coloured thin crust approximately 5 cm in diameter. The surface has obvious excurrent channels converging on transparent osculae which are not raised above the surface. The whole surface between the channels is covered with small ostia (Figure 2A).

Skeleton

Two categories of acanthostyles projecting from the basal layer of spongin. The large acanthostyles project beyond the surface of the sponge. There are brushes of the ectosomal styles at the sponge surface. Numerous toxa are scattered through the choanosome.

Spicules (Figure 2B)

(1) Styles: 350–1000 by 8–10 µm. Long smooth styles, no development of the head.

(2) Acanthostyles: 65–240 by 4–8 µm. Slightly tylote head. Entirely spined with small spines.

(3) Ectosomal styles: 340–750 by 2–3 µm. Smooth with a slightly tylote head.

(4) Toxas: 50–80 by 0.5–3 µm. Distinctively shaped, with a small central flexion and thickened in the mid portion, similar to those of *Ophlitaspongia kildensis* Howson & Chambers, 1999. The majority are in the thicker part of the range but there are also some very thin, hair-like, toxas.

Remarks

One specimen found on vertical steel plates of the 'Lochgarry' wreck. There are few prior records, it seems to be mainly a northern species. First described by Bowerbank (1866) from Shetland. Recorded by Stephens (1917) from the west coast of Ireland and Vosmaer (1935) and Burton (1959) from Iceland. Also from the Skager Rak (fairly common) and Väderö Fjord (common 50–70 m) in Sweden (Alander, 1942). This is a new species to Northern Ireland.

Subfamily OPHLITASPONGIINAE de Laubenfels, 1936
Antho (*Antho*) *granditoxa* sp. nov.

Type material

Holotype: [Mc2538] Sample in IMS, section and spicule preparation; White Cliffs (55°17.539'N 006°14.549'W; water depth: 28–33 m); coll. by B.E.P. and A.M., 4 July 2005.

Paratypes: all samples in IMS and tissue sections. [Mc2527] Damicornis Bay (55°17.460'N 006°15.238'W; water depth: 30–35 m); coll. by B.E.P. and A.M., 8 July 2005. [Mc2547] East of Altacarry Head (55°17.936'N 006°09.923'W; water depth: 29–34 m); coll. by B.E.P. and

https://doi.org/10.1017/S0025315407058122 Published online by Cambridge University Press

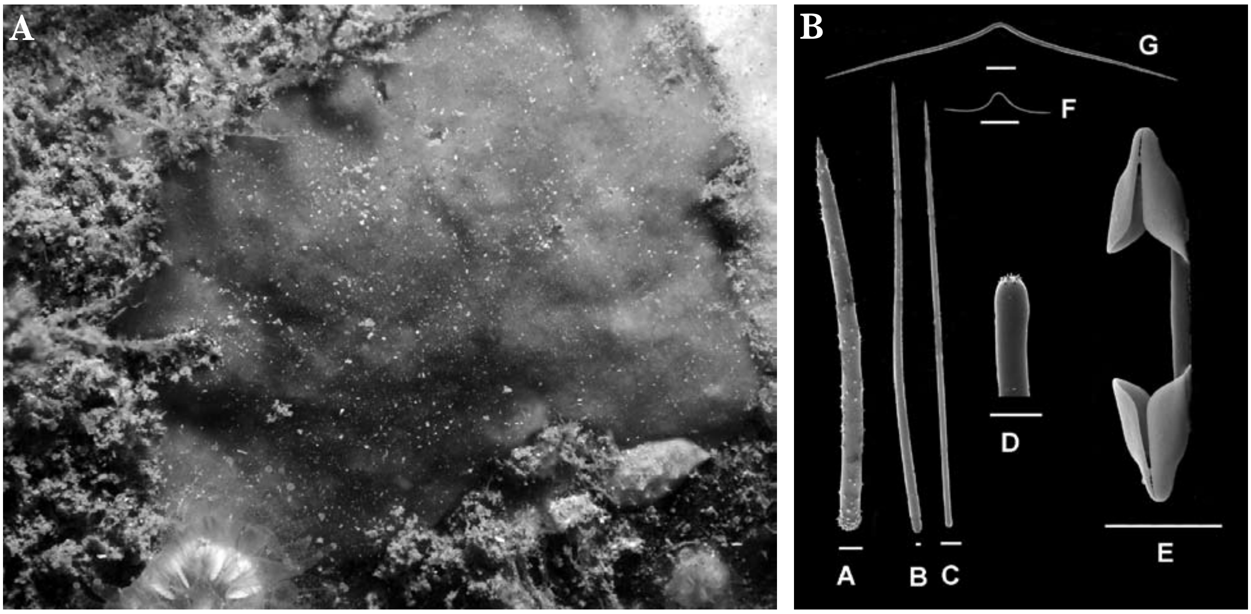

Figure 3. *Antho* (*Antho*) *granditoxa* sp. nov. (A) External appearance; (B) spicules: (A) choanosomal acanthostyle, (B) choanosomal smooth style, (C) ectosomal style, (D) ectosomal style head, (E) chelae, (F) small toxa, (G) large toxa. Scale bars: 10 µm.

A.M., 5 July 2005. [Mc2779] Damicornis Bay (55°17.433'N 006°15.137'W; water depth: 27–32m); coll. by B.E.P. and C.E.G., 5 September 2005. [Mc3140] South-east of Doon Point (55°15.890'N 006°10.471'W; water depth: 29–34 m); coll. by B.E.P. and J.J., 25 August 2005. [Mc3146] Lochgarry (55°15.956'N 006°10.411'W; water depth: 27–32 m); coll. by B.E.P. and J.J., 26 August 2005.

Etymology

From the latin *grand* meaning large, referring to the large toxas which are a distinctive feature.

External morphology

Forms bright orange/red patches with no excurrent channels visible and very inconspicuous osculae. Surface has hispid appearance and is sometimes lightly silted. Patches very variable in size, from 3–20 cm maximum diameter (Figure 3A).

Skeleton

Choanosome has ascending fibres of bundles of three or four smooth styles with a reticulation of acanthostyles. Toxas of three sizes and chelae present in choanosome, small toxas very abundant. Splayed bundles of thin subtylostyles form the ectosome, these echinate the surface.

Spicules (Figure 3B)

(1) Choanosomal smooth styles: vary widely in size, 240–850 by 6–14 µm.

(2) Choanosomal acanthostyles: 150–180 by 10–12 µm. Entirely spined with small gritty spines, these are denser on the head.

(3) Ectosomal styles: 410–500 by 2–3 µm. Head very slightly tylote and microspined.

(4) Toxas: two categories, 30–100 by 0.5–2 µm. Very abundant in the choanosome. The second, larger category is much scarcer, these measure 210–540 by 8–12 µm.

(5) Palmate isochelae: 16–18 µm.

Remarks

This species is most similar in spiculation to *A.* (*Antho*) *involvens*. It is distinguished by the presence of very large thick toxas (>500 by 12 µm), the ectosomal and choanosomal styles also reach much greater lengths than those found in *A.* (*A.*) *involvens*. The only species with similar giant toxa (termed toxiform oxeas by Lévi (1960)) is *Antho paradoxa*, orginally described by Babic (1922) from Croatia as *Artemisina paradoxa*. However, this species is described as branching and 5.5 cm in height, there is a much larger range in the size of the chelae and acanthostyles, and the choanosomal and ectosomal styles are much shorter. A further encrusting specimen from Roscoff was attributed by Lévi (1960) to *Antho paradoxa*. The spicule sizes given for this and the encrusting habit described are much more similar to the Rathlin specimens and it may be that they are the same species, unfortunately the slides of Lévi's material cannot currently be located, and Lévi (1960) states that the specimen was lost.

Antho (*Antho*) *brattegardi* van Soest & Stone, 1986

Specimens

Fourteen specimens, samples in IMS and tissue sections. [Mc2468], White Cliffs, 55°17.550'N 006°14.477'W, 32 m; [Mc2473], White Cliffs, 55°17.532'N 006°14.628'W, 30 m; [Mc2565], White Cliffs, 55°17.539'N 006°14.549'W, 31 m; [Mc2613], White Cliffs, 55°17.542'N 006°14.507'W, 33 m; [Mc2627], White Cliffs, 55°17.542'N 006°14.507'W, 33 m; [Mc2655], White Cliffs, 55°17.542'N 006°14.507'W, 33 m; [Mc2841], White Cliffs, 55°17.529'N 006°14.609'W, 32 m; [Mc2860], White Cliffs, 55°17.527'N 006°14.672'W, 33 m; [Mc2866], White Cliffs, 55°17.527'N 006°14.672'W, 33 m; [Mc2888], Damicornis Bay, 55°17.433'N 006°15.137'W, 32.5 m; [Mc3002], White Cliffs, 55°17.542'N 006°14.608'W, 27.5 m; [Mc3093], Damicornis Bay, 55°17.459'N 006°15.233'W, 32 m; [Mc3122], north-east of Doon Point, 55°16.454'N 006°10.296'W, 38.7 m; [Mc3190], Damicornis Bay, 55°17.463'N 006°15.235'W, 30.5 m.

https://doi.org/10.1017/S0025315407058122 Published online by Cambridge University Press

External morphology

Thinly encrusting species, yellow in colour, has a smooth surface with a few, prominent, large oscules. Patches between 5–10 cm maximum diameter.

Spicules

(1) Choanosomal smooth styles: 490–650 by 10 μm.

(2) Choanosomal reinforcing acanthostyles: 160–180 by10 μm.

(3) Strongyles and styles of reticulation: 100–110 by 2–7 μm.

(4) Palmate isochelae: 18–20 μm.

(5) Toxas: one class most between 30 and 125 μm. Occasionally as large as 157 μm or as small as 18 μm.

(6) Crocae: 7.5–10 μm.

Remarks

One previous record from Norwegian fjords (van Soest & Stone, 1986). Described by van Soest & Stone (1986) as orange but all Rathlin specimens appear to be yellow (this helps in distinguishing from other *Antho* and *Clathria* (*Microciona*) sp.). Possesses tiny walking-stick like spicules, termed crocae, as microscleres, these are found in only one other sponge species, *Antho jia* from California (van Soest & Stone, 1986). Spicules sizes broadly agree with those described by van Soest & Stone, 1986, although the crocae appear slightly smaller (7.5–10 μm rather than 10–14 μm) and the toxas are in one size-class rather than two, although they encompass a similar size-range as those in the Norwegian specimen. All records were from stable boulders on the south coast of Rathlin, outer Church Bay, apart from one from the east coast. This species was not found on the bedrock sites at the north wall.

Family RASPAILIIDAE Hentschel, 1923
Subfamily RASPAILIINAE Nardo, 1833
Hymeraphia breeni sp. nov.

Type material

Holotype: [Mc2486]. Sample in IMS, section and spicule preparation, Damicornis Bay (55°17.453'N 006°15.180'W; water depth: 24–29 m); coll. by J.J. and L.S., 14 June 2005.

Paratypes: 21 further specimens all from Rathlin Sponge Biodiversity Project, specimens in IMS and tissue sections. [Mc2404], White Cliffs, 55°17.515'N 006°14.682'W, 30.4 m; [Mc2420], Damicornis Bay, 55°17.460'N 006°15.219'W, 30 m; [Mc2448], White Cliffs, 55°17.550'N 006°14.477'W, 32 m; [Mc2544], Damicornis Bay, 55°17.433'N 006°15.137'W, 29.3 m; [Mc2546], Damicornis Bay, 55°17.433'N 006°15.137'W 29.3 m; [Mc2556], Damicornis Bay, 55°17.433'N 006°15.137'W, 29.3 m; [Mc2598], Damicornis Bay, 55°17.433'N 006°15.137'W, 33 m; [Mc2603], Damicornis Bay, 55°17.433'N 006°15.137'W, 33 m; [Mc2701], White Cliffs, 55°17.527'N 006°14.672'W, 33 m; [Mc2767], Damicornis Bay, 55°17.464'N 006°15.128'W, 30 m; [Mc2800], White Cliffs, 55°17.526'N 006°14.656'W, 32.5 m; [Mc2806], Damicornis Bay, 55°17.451'N 006°15.208'W, 30.6 m; [Mc2818], Damicornis Bay, 55°17.451'N 006°15.208'W, 30.6 m; [Mc2878], Damicornis Bay, 55°17.437'N 006°15.196'W, 35 m; [Mc2901], White Cliffs, 55°17.527'N 006°14.672'W, 33 m; [Mc2911], Damicornis Bay, 55°17.437'N 006°15.196'W, 35 m; [Mc2918], Damicornis Bay, 55°17.433'N 006°15.137'W, 32.5 m; [Mc3018], Damicornis Bay, 55°17.460'N 006°15.238'W, 32 m; [Mc3040], Damicornis Bay, 55°17.438'N 006°15.190'W, 36 m; [Mc3048], Damicornis Bay, 55°17.438'N 006°15.190'W, 36 m; [Mc3066], Lochgarry, south-east of Doon Point, 55°15.956'N 006°10.411'W, 33 m; [Mc3088], Damicornis Bay, 55°17.429'N 006°15.098'W, 33.5 m; [Mc3095], Damicornis Bay, 55°17.459'N 006°15.233'W, 32 m; [Mc3182], Damicornis Bay, 55°17.446'N 006°15.200'W, 33 m.

Etymology

Named for Joe Breen, head of marine biodiversity in the Environment and Heritage Service Northern Ireland who has supported this work and many other marine conservation projects in the province.

External morphology

Bright red/orange thin crust with a hispid appearance, caused by the projection of long styles. Silt is often present over sponge surface. Oscules are present at the end of raised papillae, these are fairly evenly spaced over the surface but are less prominent and may not be easily visible when closed (Figure 4A).

Skeleton

Hymedesmoid with heads of tylostyles and acanthostyles embedded in a thin basal layer of spongin. The longer tylostyles penetrate the surface of the sponge and the ectosomal spicules form bouquets around their points. The ectosomal spicules are asymmetrical with the thicker end being embedded in the sponge surface.

Spicules

(1) Tylostyles: these have tylote heads and are entirely smooth, 240–1850 by 5–12 μm. The longest spicules tend to break on sectioning and therefore the length given is of the longest intact spicules visible in the tissue sections.

(2) Ectosomal styles: 215–400 by 0.5–1 μm. Very thin styles, head rounded but not tylote.

(3) Acanthostyles: distinctive acanthostyles with stellate spined points, 60–125 by 8–12 μm. The shafts are straight and their points are irregularly spined with a few large spines. Unlike *Hymeraphia stellifera* these stellate ends are not neat and aster-like in form, the spines are large, comparatively few in number and may straggle down the length of the shaft (Figure 4B).

Remarks

Differs from *H. stellifera*, the only other species with this form of spicule, in the form of the acanthostyle. These are straight, whereas in *H. stellifera* the head is curved back from the shaft, giving the spicule a hockey-stick like form. The spines on the tips are much larger, sparser, and less regular in position.

https://doi.org/10.1017/S0025315407058122 Published online by Cambridge University Press

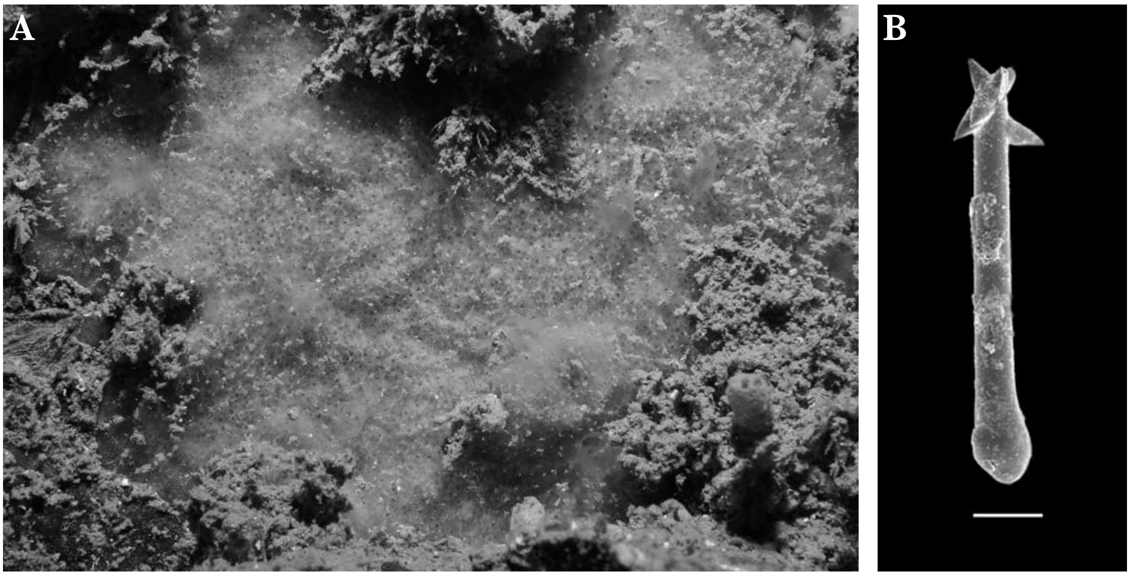

Figure 4. *Hymeraphia breeni* sp. nov. (A) External appearance; (B) acanthostyle. Scale bar: 10 µm.

Hymeraphia elongata sp. nov.

Type material

Holotype: [Mc3129]. Sample in IMS, section and spicule preparation; Damicornis Bay (55°17.429'N 006°15.098'W; water depth: 29–34 m); coll. by J.J. and L.S., 16 August 2005.

Etymology

From the latin *elongat* meaning long, named for the elongated acanthostyles.

Figure 5. *Hymeraphia elongata* sp. nov. acanthostyle. Scale bar: 10 µm.

Comparative material examined

Hymeraphia stellifera, BMNH 1877.5.21.460, Shetland, Bowerbank collection, spicule preparation. *Hymeraphia stellifera* UM Mc1666, Loch Scridain, Mull, Outer Hebrides, Scotland, section and spicule preparation. *Hymeraphia stellifera* UM Mc1451, Skomer Marine Nature Reserve, Pembrokeshire, Wales, section and spicule preparation.

External morphology

Yellow, hispid, thin, non-descript crust.

Skeleton

Hymedesmoid with heads of tylostyles and acanthostyles embedded in a thin basal layer of spongin. The longer tylostyles penetrate the surface of the sponge and the ectosomal spicules form bouquets around their points. The ectosomal spicules are asymmetrical with the thicker end being embedded in the sponge surface.

Spicules

(1) Tylostyles: 260–1450 by 5–12 µm. Tylote head, similar in form to that of the acanthostyles. Sometimes shaft near head is straight but most often slightly curved.

(2) Ectosomal spicules: 300–330 by <0.5–2.5 µm. Very thin hair-like spicules. Head rounded but not tylote, tapering to the other end which is often rounded—strongyle in form.

(3) Acanthostyles: 90–145 by 7–10 µm. Base tylote and slightly curved. Tip spined but spines are often poorly developed, small and rounded. Most are towards the larger end of this size-range, only a few short ones are present. Occasionally acanthostyles like those of *H. stellifera* are present (Figure 5).

Remarks

This is distinguished from both *Hymeraphia stellifera* and *H. breeni* by the long length and narrower width of the acanthostyles and the form of the spines at their tips. It is yellow in colour whereas *H. breeni* is always orange, however, some yellow specimens of *H. stellifera* were collected so colour is not likely to be a reliable characteristic. It does not have

https://doi.org/10.1017/S0025315407058122 Published online by Cambridge University Press

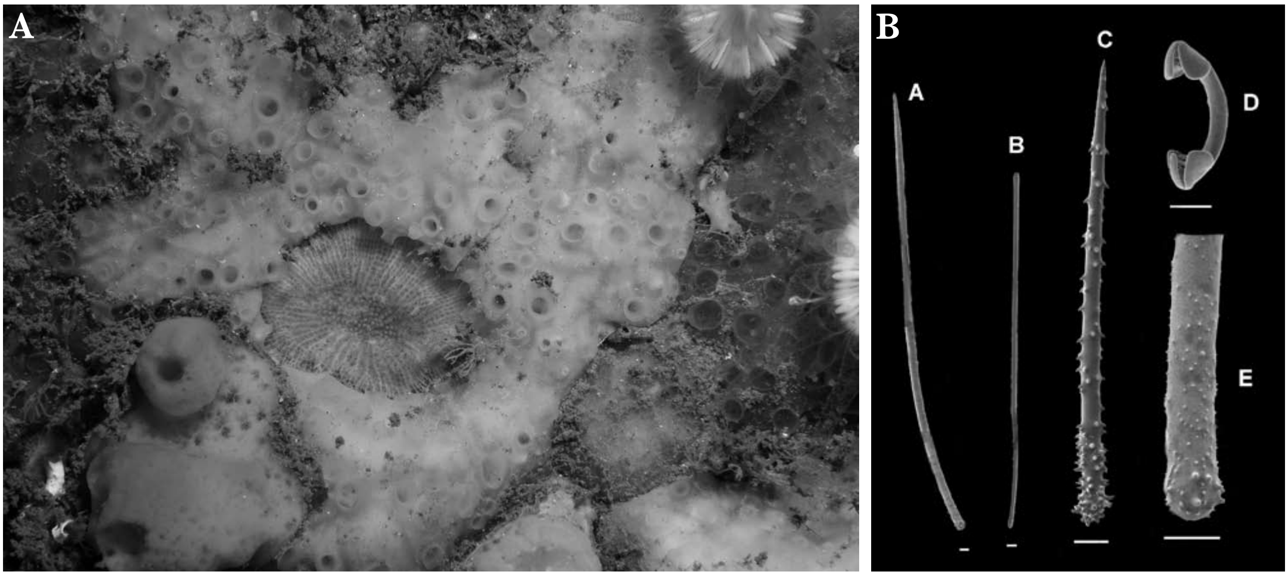

Figure 6. *Lissodendoryx* (*Ectyodoryx*) *jenjonesae* sp. nov. (A) External appearance; (B) spicules: (A) primary acanthostyle, (B) tornote, (C) secondary acanthostyle, (D) chelae, (E) head of primary acanthostyle. Scale bars: 10 µm.

the papillae with oscules on their ends that are typical of the two other *Hymeraphia* species. One specimen was collected from a stable boulder.

Suborder MYXILLINA Hadju, van Soest & Hooper, 1994
Family COELOSPHAERIDAE Dendy, 1922
Lissodendoryx (*Ectyodoryx*) *jenjonesae* sp. nov.

Type material

Holotype: [Mc2742]. Sample in IMS, section and spicule preparation, White Cliffs (55°17.527'N 006°14.672'W; water depth: 28–33 m); coll. by B.E.P. and C.E.G., 19 August 2005.

Paratypes: 14 further specimens all from Rathlin Island Sponge Biodiversity project, samples in IMS and tissue sections: [Mc2403], south-east of Doon Point, 55°15.950'N 006°10.542'W, 30 m; [Mc2639], Lochgarry, south-east of Doon Point, 55°15.956'N 006°10.411'W, 35 m; [Mc2754], west of Derginan Point, 55°18.283'N 006°16.774'W, 31.5 m; [Mc2794], west of Derginan Point, 55°18.290'N 006°16.677'W, 33 m; [Mc2847], Farganlack Point, 55°18.678'N 006°15.425'W, 32 m; [Mc2905], White Cliffs, 55°17.527'N 006°14.672'W, 33 m; [Mc2935], west of Derginan Point, 55°18.290'N 006°16.677'W, 33 m; [Mc2957], Damicornis Bay, 55°17.433'N 006°15.137'W, 32.5 m; [Mc2959], Damicornis Bay, 55°17.450'N 006°15.184'W, 32 m; [Mc2960], west of Derginan Point, 55°18.290'N 006°16.677'W, 33 m; [Mc3011], north-west of Farganlack Point, 55°18.718'N 006°15.163'W, 29 m; [Mc3134], south-east of Doon Point, 55°15.890'N 006°10.471'W, 34.3 m; [Mc3168], Lochgarry, south-east of Doon Point, 55°15.956'N 006°10.411'W, 34 m; [Mc3171], north-east of Doon Point, 55°16.461'N 006°10.302'W, 32 m.

Comparative material examined

Ectyodoryx atlanticus Stephens type specimen. NMI S.R.480.7.1916, tissue section and spicule preparation.

Etymology

Named after Jen Jones, one of the collectors for this project and a fellow sponge taxonomist.

External morphology

Yellow crust with prominent pore sieves with raised edges. Patches can be quite large (>10 cm maximum diameter) (Figure 6A).

Skeleton

The choanosomal skeleton consists of a loose reticulation of columns of primary acanthostyles, 3–10 spicules in width, which arise from a basal layer of spongin. These columns are sparingly echinated by secondary acanthostyles, these are rare and occur mainly adjacent to the spongin at the base of the columns. Chelae are present in small numbers throughout the tissue. The ectosomal skeleton consists of a layer of ectosomal strongyles and a dense layer of chelae. The edges of the pore sieves are supported by columns of the ectosomal spicules.

Spicules (Figure 6B)

(1) Primary acanthostyles 500–550 by 5–10 µm. A few very thin individuals (2 µm). Most do not have any development of the head, and appear completely smooth under the light microscope, although a few very small spines are usually present around the head when viewed under SEM. In a few individuals the head is very slightly tylote and the spines are more pronounced.

(2) Secondary acanthostyles 110–150 by 5–7 µm. Head heavily spined, shaft less densely so. Head not tylote.

(3) Ectosomal spicules. Strongyles 375–420 by 2–5 µm. Usually asymmetrical, tapering from a thicker end to a thinner one. One or both ends may be swollen.

(4) Chelae. 30–40 µm arcuate chelae.

Remarks

This species can be separated from other *Lissodendoryx* (*Ectyodoryx*) species by the lack of sigmas. Although the form

https://doi.org/10.1017/S0025315407058122 Published online by Cambridge University Press

Table 2. *Comparison of spicule sizes of* Lissodendoryx jenjonesae *sp. nov.,* L. atlanticus *(Stephens, 1920) and* L. atlanticus sensu *Caboich (1968).*

	L. jenjonesae sp. nov. Rathlin	*L. atlanticus* (Stephens, 1920) Ireland	*L. atlanticus sensu* Cabioch, 1968, Roscoff
Primary acanthostyles	500–500 by 5–10 µm	660–950 by 15–20 µm	440–560 by 2–11µm
Secondary acanthostyles	110–150 by 5–7 µm	100–140 by 10 µm	120–160 by 9 µm
Ectosomal spicules	375–420 by 2–5 µm	400–500 by 6 µm	270–410 by 4–5 µm
Chelae	30–40 µm	45–60 µm	35–45 µm

of the spicules and the lack of sigmas is superficially similar to those of *Lissodendoryx* (*Ectyodoryx*) *atlanticus* (Stephens, 1920) the spicule sizes are substantially different: the primary acanthostyles, tornotes and chelae are much shorter (Table 2). Additionally, the strongyles in *L. atlanticus* tend to be symmetrical and not swollen at the ends, the large acanthostyles mainly have tylote heads and the chelae have very broad shafts. The chelae of *L. jenjonesae* have a proportionally longer shaft compared to the alae than *L. atlanticus*, and the alae tend towards being palmate with more of the edge joined to the shaft, whereas in *L. atlanticus* they are clearly separated. The spicule sizes of our specimens agree with those given by Cabioch (1968) for a specimen of *L. atlanticus* (Table 2) and it may be that his specimen is actually *L. jenjonesae*.

Family CRELLIDAE Dendy, 1922
Crella (*Pytheas*) *plana* sp. nov.

Type material

Holotype: [Mc2746]. Sample in IMS, section and spicule preparation, Duncan's Bo (55°18.718'N 006°15.123'W; water depth: 37–42 m); coll. by B.E.P. and C.E.G., 8 September 2005.

Paratypes: four further samples all from Rathlin Sponge Biodiversity Project. Sample in IMS and tissue section: [Mc2451], White Cliffs, 55°17.550'N 006°14.477'W, 32 m; [Mc2715], Duncan's Bo, 55°18.720'N 006°15.083'W, 31.5 m; [Mc2875], north-east of Farganlack Point, 55°18.711'N 006°15.237'W, 34 m; [Mc2886], west of Derginan Point, 55°18.351''N 006°16.533'W, 32 m.

Etymology

From the latin *plan* meaning flat. In contrast to other *Crella* species which tend to form colonies in the shape of low mounds *C. plana* patches are steep sided with a level top.

External morphology

Thick peach encrusting sponge with numerous pore sieves, these have raised rims. Forms quite small patches on bedrock, maximum patch diameter ranged between 2 and 6 cm (Figure 7A).

Skeleton

The choanosomal skeleton consists of plumose bundles of tornotes between 50 and 80 µm in diameter rising from a basal layer of spongin in which acanthostyles are embedded, shaft upwards. Acanthoxea and fusiform acanthostyles are scattered through the choanosome and chelae are also present in small numbers. The ectosome is a multiple layered crust of tangential acanthostyles, up to 120 µm thick.

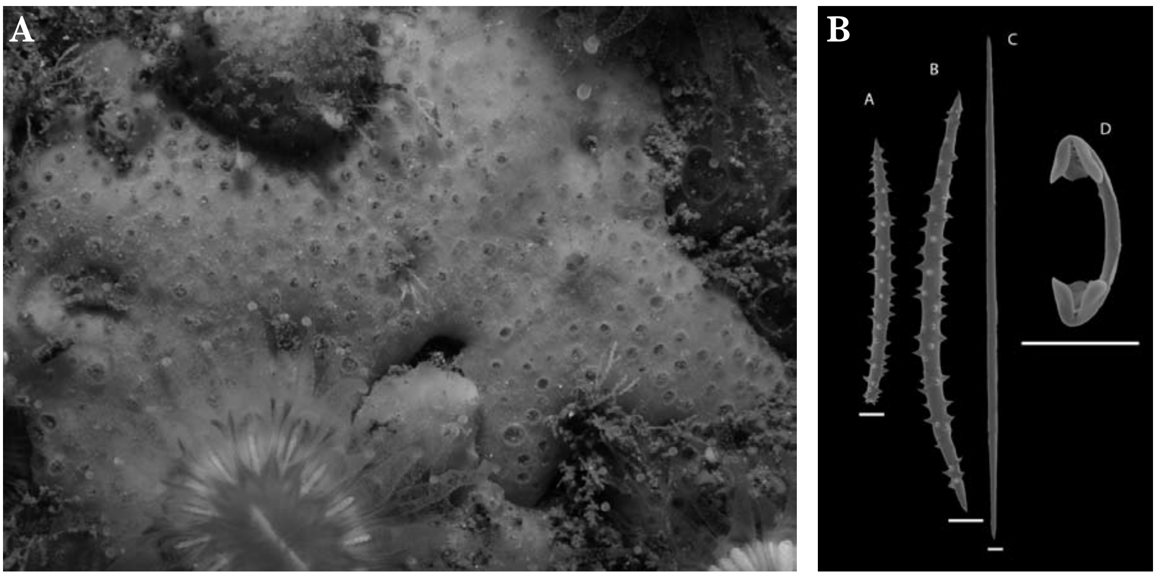

Figure 7. *Crella plana* sp. nov. (A) External appearance; (B) spicules: (A) acanthostyle, (B) acanthoxea, (C) tornote, (D) chelae (basal acanthostyle not pictured). Scale bars: 10 µm.

https://doi.org/10.1017/S0025315407058122 Published online by Cambridge University Press

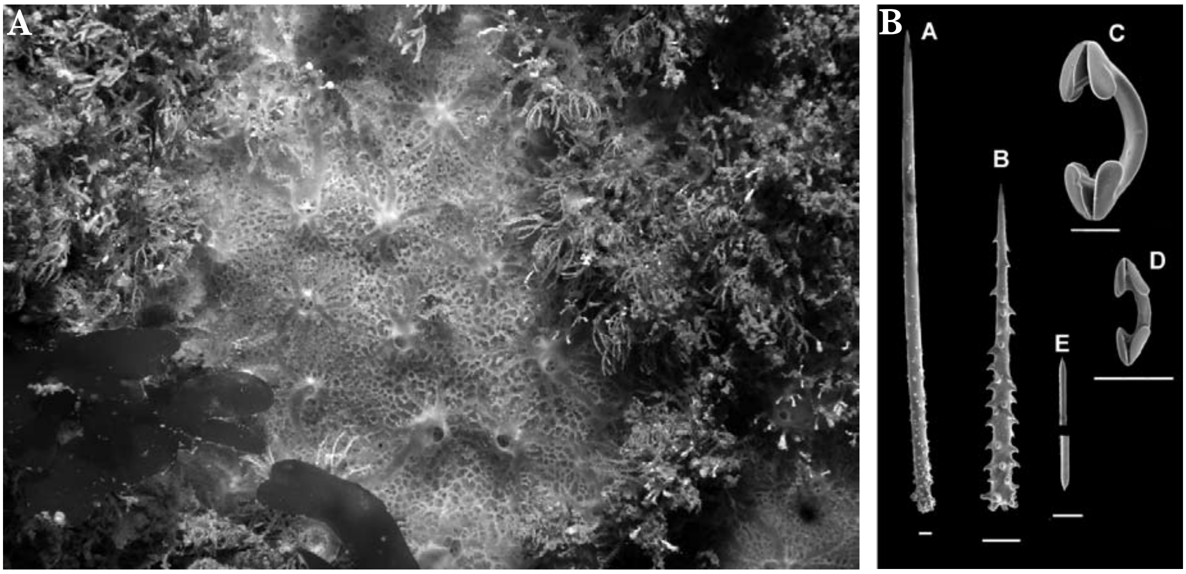

Figure 8. *Phorbas punctata* sp. nov. (A) External appearance; (B) spicules: (A) primary acanthostyle, (B) echinating acanthostyle, (C) large chelae, (D) small chelae, (E) ends of tornote. Scale bars: 10 µm.

Spicules (Figure 7B)

(1) Acanthoxeas: 105–165 by 2–8 µm. Fusiform oxeas entirely spined with large robust spines. Many of the spicules are bent in the middle. Most are between 4 and 8 µm in width but a few much thinner ones are present.

(2) Fusiform acanthostyles: 120–175 by 2–8 µm. Very similar in appearance to the acanthoxeas, fusiform with large, robust spines. Most are between 4 and 8 µm in width but a few much thinner ones are present. One end tapers abruptly to a sharp point, the other is rounded but not tylote.

(3) Basal acanthostyles: 185–230 by 4–8 µm. Tapering acanthostyles with a tylote head. Entirely spined but the spines are much sparser and slightly smaller than those of the acanthoxea.

(4) Tornotes: 310–370 by 5–7 µm. Smooth oxea, many slightly fusiform. Pointed at both ends but one end tends to be more sharply pointed. Some have mucronate ends.

(5) Chelae: 15–18 µm, arcuate.

Remarks

Occurs on bedrock exposed to strong tidal streams. The spiculation does not match any existing *Crella* species, this species is unusual in possessing both acanthoxeas and fusiform acanthostyles in the choanosome. It is most similar in spiculation to *Crella* (*Pytheas*) *schottlaenderi* Arndt, 1913 but this does not have choanosomal acanthoxeas. In some of the tissue sections (Mc2746) embryos were visible, these contained smaller versions of the spicules in the main tissue (acanthoxeas 50–75 by 1 µm) and additionally fine sigmas (12–14 µm), these embryonal spicules were not present on the SEM preparations so it was not possible to examine them in detail, it is possible that they are embryonal chelae.

Family HYMEDESMIIDAE Topsent, 1928
Phorbas punctata sp. nov.

Type material

Holotype: [Mc2445]. Sample in IMS, section and spicule preparation, Farganlack Point (55°18.685'N 006°15.480'W; water depth: 28–33 m); coll. by J.J. and L.S., 17 June 2005.

Paratype: [Mc2465]. Sample in IMS, section and spicule preparation, Farganlack Point (55°18.685'N 006°15.480'W; water depth: 28–33 m); coll. by B.E.P. and C.E.G., 17 June 2005.

Etymology

From the latin *punctat* meaning marked with pricks or punctures, named for the spotted appearance of the surface.

External morphology

Encrusting species, forming patches up to 10 cm in diameter on bedrock. Yellow–pale orange in colour. Oscules surrounded by 5–8 radiating oscular channels, these channels may be grouped in pairs. Ostia seem to be grouped in patches which gives the surface a spotted appearance (Figure 8A).

Skeleton

Choanosome has a basal layer of acanthostyles and columns of large and small acanthostyles. Thick ectosomal layer of tornotes and chelae, chelae very abundant.

Spicules (Figure 8B)

(1) Primary acanthostyles 250–430 µm (mean 366 µm) long and 10–15 µm thick. Taper fairly abruptly at the end to a sharp point. Spined only in bottom third to half of their shaft with small spines. The head is not tylote but may be marked by heavier spination than the rest of the shaft, may be straight or slightly curved.

(2) Echinating acanthostyles 80–160 µm (mean 120 µm) and 6–10 µm thick. Entirely spined with larger spines than the primary acanthostyles, there is no development of the head. The spicules taper to a sharp point and may be straight or slightly curved.

(3) Tornotes 165–180 by 2–4 16–23 µm (mean 170 µm), 2–4 µm thick. Ends tend towards being mucronate, one, occasionally both, ends usually slightly swollen.

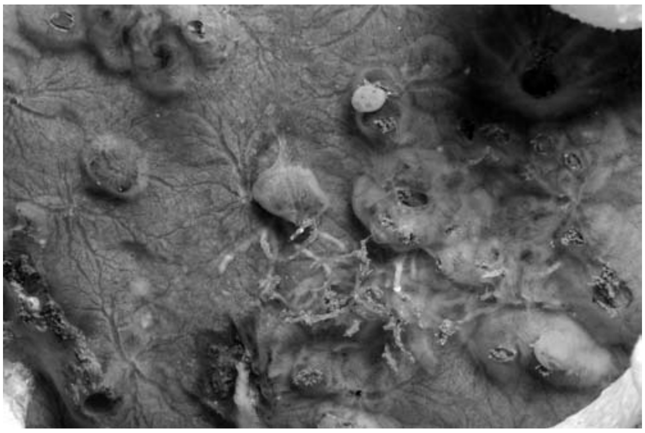

Figure 9. *Myxilla* (*Styloptilon*) *ancoratum* (Cabioch, 1968) external appearance.

(4) Chelae: two size-classes present, the larger 30–40 μm and the smaller between 12 and 15 μm.

Remarks

The closest described species is *Phorbas lieberkuehni* (Burton, 1930), however, this is described as a bright red brown crust; although it has two classes of acanthostyles of a similar appearance the larger class range only from 250–360 μm in length; the tornotes are larger and have a larger size range (180–270 μm); and although the chelae occur in two size-categories they are much smaller (10–15 μm and 18–22 μm respectively). There is no information on the form of the skeleton of this species. Most other species of *Phorbas* lack two size-classes of chelae, in those where there are two sizes present either sigmas are present (e.g. *Phorbas roemeri* (Hentschel, 1929) or the spicules are much larger (e.g. *Phorbas perarmatus* Bowerbank, 1866).

Plocamionida tylotata Brøndsted, 1932

Specimen

[Mc3086] Section and spicule preparation from tissue sample, no remaining sample, Damicornis Bay (55°17.459'N 006°15.233'W; water depth: 27–32 m); coll. by C.E.G. and D.G., 15 August 2005.

External morphology

Thin, pale orange sponge encrusting on boulder. Some raised oscules and oscular channels visible but not in a regular pattern.

Skeleton

The skeleton consists of a basal reticulation of acanthostrongyles lying tangential to the substratum and ascending acanthostyles oriented with their points towards the surface of the sponge. There is a surface layer of tornotes.

Spicules

(1) Acanthostrongyles 90–110 by 5–6 μm.

(2) Acanthostyles 95–600 by 5–10 μm. The shorter individuals are entirely spined and similar in form to the acanthostrongyles. The longer are almost smooth with a slight roughening around the head. Shaft above head wider than head, then tapers to a point.

(3) Ectosomal spicules 180–230 by 2–3 μm. Strongyles with tylote ends. Most are asymmetrical with one end wider than the other.

(4) Arcuate chelae 17.5–20 μm. Have a straight shaft and small alae giving an appearance under the light microscope similar to a *Clathria* (*Microciona*) chela.

Remarks

Described from the Faeroes as *Plocamionida ambigua* var. *tylotata* by Brøndsted. Alander (1942) found specimens matching Brøndsted's description in south-west Sweden and elevated it to species rank. Distinguished from the more common *Plocamionida ambigua* (Bowerbank, 1866) by having chelae with a straight rather than curved shaft and the shape of the tornotes which are strongyles rather than oxea.

Family MYXILLIDAE Dendy, 1922

Myxilla (*Styloptilon*) *ancoratum* (Cabioch, 1968)

Specimens

Thirty-one specimens collected from all Rathlin coasts during sponge biodiversity project. Samples in IMS and tissue sections: [Mc2461], north-west of Bull Point, 55°17.780'N 006°17.506'W, 33 m; [Mc2522], west of Derginan Point, 55°18.392'N 006°16.452'W, 32 m; [Mc2558], White Cliffs, 55°17.539'N 006°14.549'W, 31 m; [Mc2576], Ruecallan, 55°18.481'N 006°16.197'W, 27 m; [Mc2594], Ruecallan, 55°18.473'N 006°16.206'W, 32 m; [Mc2609], east of Altacarry Head, 55°17.834'N 006°9.9963'W, 25 m; [Mc2610], Ruecallan, 55°18.481'N 006°16.197'W, 27 m; [Mc2617], White Cliffs, 55°17.543'N 006°14.517'W, 29.4 m; [Mc2628], Farganlack Point, 55°18.678'N 006°15.425'W, 29 m; [Mc2632], White Cliffs, 55°17.543'N 006°14.517'W, 29.4 m; [Mc2641], west of Derginan Point, 55°18.392'N 006°16.452'W, 33.1 m; [Mc2659], White Cliffs, 55°17.542'N 006°14.507'W, 33 m; [Mc2697], White Cliffs, 55°17.546'N 006°14.554'W, 26 m; [Mc2700], White Cliffs, 55°17.546'N 006°14.554'W, 26 m; [Mc2712], north-east of Doon Point, 55°16.466'N 006°10.374'W, 33.7 m; [Mc2718], north-east of Doon Point, 55°16.462N 006°10.352'W, 35 m; [Mc2756], west of Derginan Point, 55°18.283'N 006°16.774'W, 31.5 m; [Mc2808], White Cliffs, 55°17.529'N 006°14.609'W, 32 m; [Mc2826], north-east of Farganlack Point, 55°18.711'N 006°15.237'W, 33 m; [Mc2829], White Cliffs, 55°17.526'N 006°14.656'W, 32.5 m; [Mc2856], White Cliffs, 55°17.527'N 006°14.672'W, 33 m; [Mc2870], White Cliffs, 55°17.527'N 006°14.672'W, 33 m; [Mc2871], White Cliffs, 55°17.527'N 006°14.672'W, 33 m; [Mc2907], White Cliffs, 55°17.527'N 006°14.672'W, 33 m; [Mc2912], north-east of Farganlack Point, 55°18.711'N 006°15.237'W, 34 m; [Mc2925], west of Derginan Point, 55°18.358'N 006°16.530'W, 31 m; [Mc3026], Ruecallan, 55°18.466'N 006°16.157'W, 28 m; [Mc3062], Ruecallan archway, 55°18.473'N 006°16.152'W, 32 m; [Mc3127], Farganlack Point, 55°18.685'N 006°15.480'W, 35 m; [Mc3139], Farganlack Point, 55°18.685'N 006°15.480'W, 35 m; [Mc3141], Farganlack Point, 55°18.685'N 006°15.480'W, 35 m. Also previously unidentified specimens from Ulster Museum collection: 5 from Rathlin, 1 from Strangford Lough, 1 from Kintyre, Scotland, 1 from Skomer, Wales,

https://doi.org/10.1017/S0025315407058122 Published online by Cambridge University Press

and 1 from Mulroy Bay, Donegal, Ireland. Samples in IMS and tissue sections.

External appearance

Thinly encrusting, bright yellow, sponge on bedrock and boulders. Often raised oscules are visible, surrounded by radiating oscular channels. Sometimes overgrowing bryozoan colonies (such as *Cellepora* spp.) (Figure 9).

Skeleton

Choanosomal skeleton consists of plumose columns of acanthostyles, arising from a basal layer of spongin with the acanthostyles pointing towards the surface. They are very bushy with some spicules sticking out almost at right angles to the column. The horizontally protruding spicules overlap between columns creating a loose mesh. Bushes of ectosomal oxeas join on to the ends of these columns and splay out to create a surface layer. Microscleres are present fairly commonly throughout the choanosome and a layer is also scattered over the surface oxea.

Spicules

(1) Acanthostyles: entirely spined with small spines, head not tylote, 140–260 by 5–10 μm in two size-categories, 110–150 μm and 200–260 μm.

(2) Ectosomal spicules: 140–200 by 2.5–5 μm. Fusiform tornotes.

(3) Chelae: two size-categories of anchorate chelae, 12–17 μm and 35–40 μm.

(4) Sigmas: 35–45 μm, very abundant.

Remarks

This species was first described by Cabioch (1968) from one specimen dredged from 85 m, seven miles off the coast of the Îsle de Batz, near Roscoff, in Brittany. It was previously only known from the type locality, but is fairly common on Rathlin Island. New to the UK and Ireland. Specimens were collected from between 8 and 40 m from bedrock and boulders. The spicules match the description of the type specimen well, although there is a slight difference in the size-ranges.

Order HALICHONDRIDA Gray, 1867
Family AXINELLIDAE Carter, 1875
Axinella parva sp. nov.

Type material

Holotype: [Mc2819]. Sample in IMS, section and spicule preparation, Damicornis Bay (55°17.446'N 006°15.200'W; water depth: 30–35 m); coll. by B.E.P. and L.S., 17 August 2005.

Paratypes: sample in IMS, section and spicule preparation from tissue: [Mc2528] Damicornis Bay (55°17.432'N 006°15.170'W; water depth: 20–25 m); coll. by J.J. and C.E.G., 8 July 2005. [Mc2614] Damicornis Bay (55°17.433'N 006°15.137'W; water depth: 28–33 m); coll. by B.E.P. and A.M., 6 July 2005. [Mc2987] Damicornis Bay (55°17.437'N 006°15.196'W; water depth: 30–35 m); coll. by B.E.P. and C.E.G., 19 August 2005. [Mc1574], Ulster Museum collection; Damicornis Bay (55°17.45'N 006°15.09'W; water depth: 32 m); coll. by B.E.P., 26 August 1989. [Mc1624], Ulster Museum collection, Damicornis Bay (55°17.45'N 006°15.09'W; water depth: 32 m); coll. by B.E.P., 27 August 1989.

Etymology

From the latin *parv* meaning small. Named for its diminutive size.

Comparative material examined

Axinella pyramidata Stephens material noted below; *Axinella flustra* (Topsent, 1892) Mc1315.

External morphology

In shape this species consists of rounded lobes with a slightly narrower base, 1–2 cm in width and height. Pale brown in colour with a grooved or sulcate appearance to the surface. The oscules are inconspicuous, at the tip of small transparent chimneys of tissue (Figure 10A).

Skeleton

There is a basal skeleton of oxeas, with ascending plumose columns of styles, oriented with their points towards the surface. There is no axial column, just a condensation of spicules at the centre of the base of the sponge. At the surface

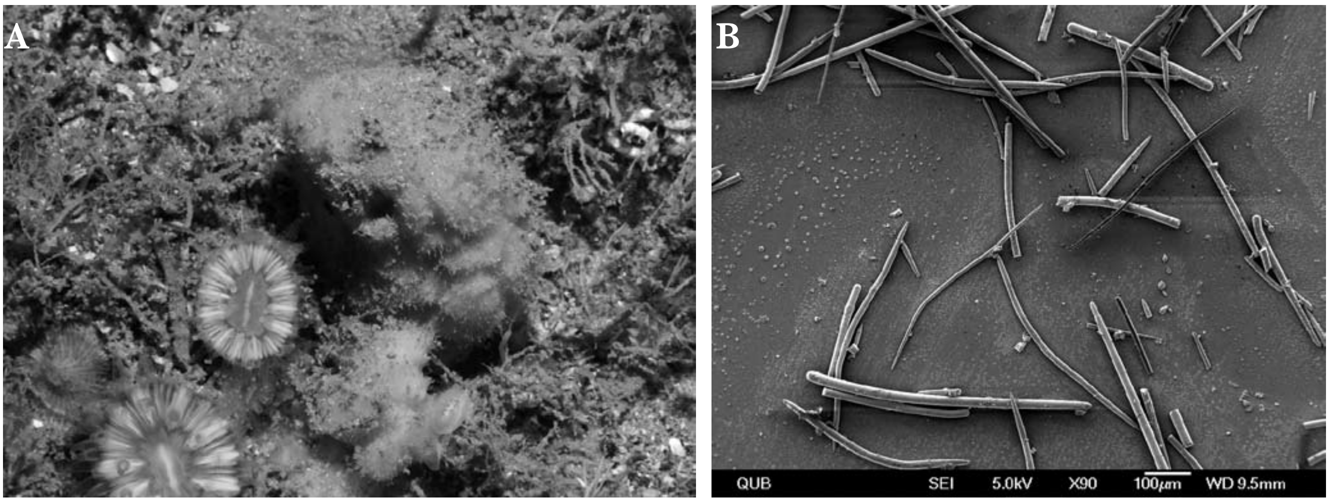

Figure 10. *Axinella parva* sp. nov. (A) External appearance; (B) spicules.

https://doi.org/10.1017/S0025315407058122 Published online by Cambridge University Press

a few styles penetrate a short distance, but the surface does not appear hispid. Oxeas occur within the plumose columns, typically oriented across the columns.

Spicules (Figure 10B)

(1) Styles mostly 600–900 μm by 16–23 μm (but with a few extremes to 250–1070 μm). Usually smoothly bent about 1/4 of the way down the shaft. Some styles have rounded ends and many have telescoped ends, the rest taper smoothly to sharp points.

(2) Oxea 300–500 μm (with a few to 710 μm) by 10–16 μm, typically half the diameter of the styles. Usually bent twice, often in different directions and at different angles, somewhat contorted in appearance. The ends taper smoothly and are frequently telescoped. Occasional oxea are centrotylote or appear to be formed by fusion of two styles, with rounded swellings on opposite sides of the spicule.

Remarks

Many *Axinella* species have a spicule complement of only oxeas and styles, this species differs from others in the north-east Atlantic area in the sizes of these spicules. It is small and inconspicuous and occurs with *Axinella pyramidata* on Rathlin Island. This is also a small species, but has abundant trichodragmata and smaller, thinner styles. It is easy to recognize *in situ* by its shape and colour and the sulcate grooves in the surface.

Axinella pyramidata Stephens, 1916

Sample

Sample in IMS, section and spicule preparation: [Mc2702], Damicornis Bay (55°17.435'N 006°15.163'W; water depth: 25–30 m); coll. by B.E.P. and C.M., 22 August 2005. [Mc1527], Ulster Museum Collection, Damicornis Bay (55°17.55'N 006°14.46'W; water depth: 35 m); coll. by B.E.P., 14 July 1989; [Mc3385], Sublittoral Survey Northern Ireland, Damicornis Bay (55°17.435'N 006°15.163'W; water depth: 25–30 m); coll. by B.E.P., 8 June 2006.

Comparative material examined

Axinella pyramidata type specimen. Spicule preparation and tissue section. NMI W.141.15.1916. Also SEM preparation prepared from the type specimen.

External morphology

In shape this species is somewhat like a three-sided pyramid standing on its apex, except that the sides are deeply cut vertically into a series of flattened lobes. Height 15 mm, diameter 17–30 mm. In colour it is grey or off-white with some adhering silt. The upper surface is flat overall, dissected into small knob-like elevations. The oscules are inconspicuous, at the tip of small transparent chimneys of tissue, usually at the convergence of surface grooves (Figure 11).

Spicules

(1) Styles 330–910 by 5–10 μm. Some are bent about 1/3 down the shaft, others are completely straight. They taper very gradually in the distal 2/3 of the spicule.

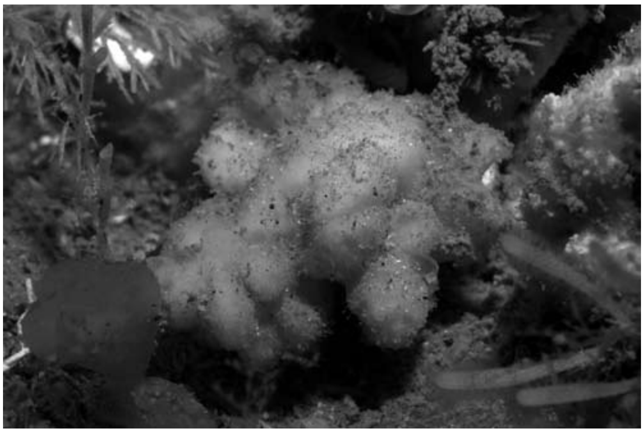

Figure 11. *Axinella pyramidata* external appearance.

(2) Oxea 370–850 by 6–10 μm. Bent either once or twice in one direction, their ends taper to sharp points.

(3) Trichodragmata 1–11 by <0.2 μm.

Remarks

After re-examination of the Stephens' material it was found that the type specimen did contain trichodragmata, contrary to the original description. These are abundant and range between approximately 1 and 10 μm in length. They were obvious under the electron microscope and easily seen under light microscope examination at 400× magnification. It seems likely that *Axinella alba* which has been described from one specimen from the west coast of France (Descatoire, 1966) is a synonym of *A. pyramidata* as the main reason for the distinction between the species was the lack of these spicules; however, examination of the type material would be needed in order to confirm this.

The oxeas of the Rathlin specimens differ slightly in size-range from the Stephens' description, she reports a range of 300–600 μm. They are also slightly thinner. There are few previous records of this species reported from the west coast of Ireland (Stephens, 1921), Faeroes (Brøndsted, 1932), Roscoff (Cabioch, 1968). It has also been reported by Burton from the west coast of Africa but this record is doubtful.

Family HALICHONDRIIDAE Gray, 1867

Spongosorites calcicola sp. nov.

Type material

Holotype: [Mc2482]. Sample in IMS, section and spicule preparation, White Cliffs (55°17.499'N 006°14.762'W; water depth: 27–32 m); coll. by B.E.P. and C.E.G., 15 June 2005.

Paratype: [Mc2849]. Sample in IMS, section and spicule preparation, Ruecallan archway (55°18.473'N 006°16.152'W; water depth: 26–31 m); coll. by B.E.P. and C.E.G., 9 June 2005.

Comparative material examined

Amorphina genitrix O. Schmidt, Norman Collection slides 10.1.1.1236 (spicule preparation) and 10.1.1.1237 (tissue section) BMNH, labelled Greenland Copenhagen Museum.

https://doi.org/10.1017/S0025315407058122 Published online by Cambridge University Press

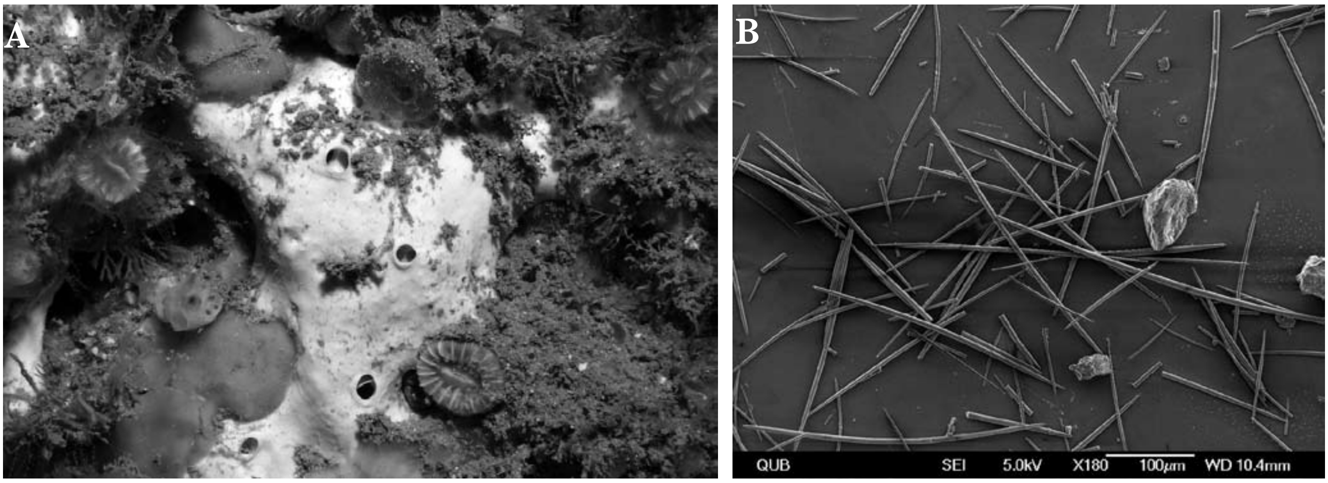

Figure 12. *Spongosorites calcicola* sp. nov. (A) External appearance; (B) spicules.

Etymology

From the latin *calci* meaning limestone and *cola* meaning to dwell. Named for its apparent association with limestone bedrock.

External morphology

Bright, lemon yellow, massive sponge with large oscules. Forms a thick crust with a shiny, rubbery appearance. Patches can be fairly large, some >20 cm maximum diameter. Unlike many other species in this genus it does not undergo a colour change when removed from water (Figure 12A).

Skeleton

Thick ectosomal layer >1000 μm in some places, a dense mesh mainly composed of smaller oxea (<200 μm). Choanosome is a disordered mass of oxea of both large and small sizes, mesh is less dense than that of the ectosome.

Spicules (Figure 12B)

There is a single type of spicule, slightly bent oxea (50–410 by 4–10 μm) most of which have bluntly pointed, mucronate ends. In a few of these one or both ends are rounded, giving these spicules a style or strongyle like form. The width of the spicules is generally proportional to the length with the shorter ones being substantially thinner than the longest, however, occasionally long thin spicules are present. The spicules are straight or slightly curved.

Remarks

The taxonomy of *Spongosorites* is confused, mainly because the subtle differences in the spicules are hard to determine and there are few good records of external appearance. The small size of the largest oxea separates this species from many others in the genus, in many other species these reach over 500 μm. It also lacks centrotylote oxea which are present in several species. The spicule range is similar to that of *S. difficilis* (Lundbeck, 1902), which has oxea (60–370 by 4–10 μm). However, it may be distinguished from *S. difficilis* as this is grey when alive and undergoes a colour change to black when exposed to air, the spicules also appear more sharply pointed and style like forms are not present. *Spongosorites genitrix* (Schmidt, 1870) is similar in appearance, being described as a yellowish massive sponge, but undergoes a colour change when brought above water, and has a larger spicule size-range (90–600 μm). From examination of the BMNH slides, there could be much variation in *S. genitrix*; the drawing in Schmidt shows only spicules with elbow like centrotylote joins, but although some spicules in the slides examined are centrotylote and irregular in shape the majority are smooth oxea with sharp points, many having a sharp bend in the middle. The spicules of *S. calcicola* are much less sharply pointed than those of *S. genitrix*, much smaller and lack a pronounced bend.

Spongosorites coralliophaga (Stephens, 1914), originally described as *Cliona coralliophaga*, was originally described from deep water coral reefs off the west coast of Ireland and has also been recorded from coral reefs at Rockall Bank and Mingulay, near the Hebrides, relatively close to Rathlin (van Soest, 2006). It has oxea of a similar size-range (80–550 by 2.5–11 μm). However, these are described as tapering to long points and are bent twice in the same direction, Stephens says 'bi-angulated', whereas the majority of those in *S. calcicola* are only slightly curved and have rounded ends. It is also described as undergoing a colour change in spirit whereas none is observed in *S. calcicola*. Furthermore, *S. coralliophaga* is formed of small lobes (7 mm by 5 mm), rather than being massive, and has much smaller oscules (4–5 mm diameter).

This species appears to be closely associated with limestone, the only records are from areas of limestone bedrock. There are other, previously unidentified, records from Ballintoy, County Antrim, Northern Ireland and St John's Point, County Donegal, Republic of Ireland, also Altachuile Bay, north-east of Farganlack Point, north-west of Derginan Point on Rathlin.

Order VERONGIDA Bergquist, 1978
Family IANTHELLIDAE Hyatt, 1875
Hexadella racovitzai Topsent, 1896

This is a Mediterranean species, with very few records from the Atlantic (Roscoff, Canary Islands, Azores and Skomer). It was first recorded from the British Isles from the Aran Islands, Galway (Morrow & Picton, 1996) and has

https://doi.org/10.1017/S0025315407058122 Published online by Cambridge University Press

since also been recorded from Kerry Head shoals, Kerry; Aran Islands, Galway and Rathlin Island (Picton & Costello, 1998). This sponge is thickly encrusting and rose coloured. It does not have spicules and may be distinguished from *Aplysilla* by the absence of fibres (van Soest et al., 1999). Seven specimens were collected during the survey, six of these were from the Southwest Bays.

DISCUSSION

In total 134 sponge species are now known from Rathlin Island. This number represents approximately a third of the number of sponges currently known for the British Isles and is far greater than the number of species recorded in intensive surveys of the sponges of other areas. In comparable studies in Lough Hyne, County Cork, 90 species have been recorded (Lilly et al., 1953; van Soest & Weinberg, 1980; Picton, 1991), and a study of Kilkieran Bay on the west coast of Ireland (Könnecker, 1973) identified 66 species as being present in the area. This demonstrates that Rathlin Island is one of the most important sites in the British Isles, and probably in Europe, for sponges. In biogeographical terms the sponge fauna of Rathlin is interesting, combining both boreal and Mediterranean species. Populations of other invertebrate groups on Rathlin represent species at the limits of their range (for example the colonial anemones *Parazoanthus axinellae*, a southern species and *Parazoanthus anguicomus*, a northern species, co-exist here (Erwin et al., 1990)). It is probable that this is also the case for some of the sponge species, studies of other areas in the British Isles would help put this into a biogeographical context.

The number of new and rare species was unexpectedly large, although this is in part due to richness of the communities sampled, the sampling methodology may have been a contributing factor. Sponge samples have been collected from this area previously (Erwin et al., 1990) but there has never been a survey targeted solely at Porifera, and inadequate resources meant that sponge material collected was sometimes not identified to species level, particularly for genera such as *Hymedesmia* where this can be time consuming. Dedicated sampling for sponges allowed the collection of many more sponges than would have been possible on a general survey where sponges, particularly crusts, tend to be overlooked.

Most prior sampling of UK and Irish sponge populations has been by dredging, frequently from deep water. Sampling by SCUBA diving resulted in collection of material from the little sampled circalittoral depth range (30–50 m). Additionally, habitats such as overhangs and crevices in bed rock were sampled which would have been difficult to get specimens from by other methods. SCUBA diving surveys have been shown to provide good records of sponge biodiversity (Boury-Esnault, 1971; Wiedenmayer, 1977; Pansini, 1987), particularly in areas where many species are small and in habitats which are difficult to sample by other means (Vacelet & Perez, 1998; Perez et al., 2004).

The use of digital underwater photography to get information on appearance of specimens *in situ* provided additional characteristics to confirm identification. For many of the rarer species these are the first records of live appearance. Some species have a very distinctive external appearance and in some cases it is possible to identify to species level solely on the basis of this.

Rathlin was last extensively sampled during the Northern Ireland Sublittoral Survey (Erwin et al., 1990). Since this time populations of the conspicuous pink sponge *Hexadella racovitzai* have increased. *Hexadella racovitzai* is common in the Mediterranean but was only reported for the British Isles in 1996 (Morrow & Picton, 1996). It has since also been recorded from Kerry Head shoals, Kerry; Aran Islands, Galway (Picton & Costello, 1998). There was one prior record from Rathlin Island (Picton & Costello, 1998) but in this survey seven specimens were recorded. As it is large and conspicuous it is unlikely to have been missed in prior surveys. It may be that the increased numbers are due to warmer water temperatures, these readily identifiable sponges may prove to be a good monitoring organism. However, before sponges can be used for monitoring purposes good baseline data is essential. For example, re-examination of Ulster Museum voucher specimens revealed that *Styloptilon ancoratum* which was frequent in this survey but appeared not to have been previously recorded from the British Isles, had been collected during prior Rathlin surveys but was not identified at the time. The Rathlin sponge biodiversity data set will provide a good baseline for future monitoring.

It was noted that the east coast of Rathlin, previously a boulder strewn area with a rich associated sponge and hydroid fauna, appeared to have been significantly altered since the 1980s. Many of the boulders had apparently disappeared and the previously abundant rare hydroid communities were greatly reduced. Previous records of the east coast habitat describe an apparently unfished habitat with sediment distributed by the current and many large boulders; large sponges, mainly *Axinella infundibuliformis* were present, these are likely to have been over 50 years old (Picton & Costello, 1998). In 1989 scallop dredging commenced in this area and subsequently boulders were observed to have been turned and the gravel had a harrowed appearance (Bernard Picton, personal observation). It is believed that this dredging has impacted the sponge communities. Trawling may significantly affect sponge biomass. Sainsbury (1987) and Sainsbury et al. (1993) reported that catch rate of sponges in a bottom fished area decreased over the course of the fishery from over 500 kg h^{-1} to only a few kg h^{-1}. Trawling may also displace important substrate such as boulders (Freese et al., 1999). Whereas sponges in warm water may recover relatively quickly from bottom fishing damage (van Dolah et al., 1987), in cold water environments the process may be much slower; a study of deepwater sponge communities in Alaska showed that recovery had not taken place after 11 months, with lowered sponge densities and level of damage to individuals persisting (Freese et al., 1999; Freese, 2003). In order to conserve the biodiversity of sponges and other fragile benthos we recommend that fishing in Rathlin SAC be regulated. Many of the rare species recorded from Rathlin occurred in one small bay, as this has no local name that we have been able to find we have termed it 'Damicornis Bay' after *Axinella damicornis* which is abundant here. The site is unique in biodiversity terms and as such is a site of high nature conservation importance.

https://doi.org/10.1017/S0025315407058122 Published online by Cambridge University Press

There is a need for other similar studies of the UK and Irish sponge fauna. Many sponge species remain poorly known and there is little information on their distribution and ecology. As well as contributing to knowledge on marine biodiversity, knowledge regarding sponge communities may be useful in marine monitoring. Sponges have great potential for the monitoring of benthic communities; many species are long lived and sensitive to even small changes in environmental parameters (Fowler & Laffoley, 1993). It has been demonstrated that shifts in species composition in sponge/ascidian communities can be used to indicate disturbance (Carballo & Naranjo, 2002). As sponges bio-accumulate various environmental contaminants (Perez, 2000) they may be useful as biomonitors of contaminants such as polychlorobiphenyl (Perez et al., 2003).

Sponges produce a variety of chemicals for, amongst other uses, defence against predators (McClintock et al., 2005), as anti-foulants (Tsoukatou et al., 2002). There is increasing interest in the potential of these for medical use, although historically such work has focused on tropical species, it was previously believed that sponge toxicity decreased with latitude due to lower predator numbers (Bakus & Green, 1974), this is now known not to be the case (Becerro et al., 2003). The common British intertidal sponge *Hymeniacidon perlevis* (Montagu, 1818) has recently been found to produce chemicals which act as highly potent growth inhibitors on human breast and lung cancer cells (White et al., 2005). British sponges, and their medicinal properties, are largely unexplored and have untapped potential for the discovery of new drugs (White et al., 2005). Knowledge of sponge taxonomy and biogeography is vital for this 'bio-prospecting' work, it is essential in order to identify which species produce particular chemicals and may help target investigation of closely related species. Further studies on UK and Irish sponge biodiversity are essential for this new area of research.

The 'Sponge Biodiversity of Rathlin Island project' was part funded by European Union strategic funds from the EU Building Sustainable Prosperity programme. Work in Copenhagen on the genus *Hymedesmia* was supported by a grant from the European Commission's (FP 6) Integrated Infrastructure Initiative programme SYNTHESYS (DK-TAF), and we thank Ole Tendal for his assistance during this visit. The authors would like to thank all the fieldwork team, particularly Jen Jones, Anne Marie Mahon and Louise Scally. Samples of other species for comparison were provided by the National Museum of Ireland and the Natural History Museum, London. We also thank the curators of these collections Mark Holmes and Clare Valentine for facilitating access to the material.

REFERENCES

Ackers, R.G., Moss, D. & Picton, B.E., 1992. *Sponges of the British Isles (Sponge V)*. Ross–on–Wye: Marine Conservation Society.

Alander, H., 1942. *Sponges from the Swedish west coast and adjacent waters*. PhD thesis, Lund University, Sweden.

Babic, K., 1922. Monactinellida und Tetractinellida des Adriatischen Meeres. *Zoologische Jahrbücher*, **46**, 217–302.

Bakus, G.J. & Green, G., 1974. Toxicity in sponges and holothurians—geographic pattern. *Science, New York*, **185**, 951–953.

Becerro, M.A., Thacker, R.W., Turon, X., Uriz, M.J. & Paul, V.J., 2003. Biogeography of sponge chemical ecology: comparisons of tropical and temperate defenses. *Oecologia*, **135**, 91–101.

Boury-Esnault, N., 1971. Spongiaires de la zone rocheuse de Banyuls-sur-Mer. 2. Systématique. *Vie et Milieu*, **22**, 287–350.

Bowerbank, J.S., 1864. *A monograph of the British Spongiadae*, vol. I. London: Robert Hardwicke.

Bowerbank, J.S., 1866. *A monograph of the British Spongiadae*, vol. II. London: Robert Hardwicke.

Bowerbank, J.S., 1872. Contributions to a general history of the Spongiadae. 1. *Proceedings of the Zoological Society of London*, **1872**, 115–129.

Bowerbank, J.S., 1874. *A monograph of the British Spongiadae*, vol. III. London: Robert Hardwicke.

Bowerbank, J.S., 1879. *A monograph of the British Spongiadae*, vol. IV. London: Robert Hardwicke.

Brøndsted, H.V., 1932. Marine Spongia. In *The zoology of the Faeroes*, vol. 1 (ed. S. Jensen et al.), pp. 9–34. Copenhagen: Andr. Fred. Høst og Søn.

Burton, M., 1930. Additions to the sponge fauna at Plymouth. *Journal of the Marine Biological Association of the United Kingdom*, **16**, 489–507.

Burton, M., 1957. Porifera. In *Plymouth marine fauna*, pp. 26–32. Plymouth: Marine Biological Association.

Burton, M., 1959. Spongia. In *The zoology of Iceland, 2(3–4)*, (ed. A. Fridriksson and S.L Tuxen), pp. 1–71. Copenhagen and Reykjavik: Ejnar Munksgaard.

Cabioch, L., 1968. Contribution à la connaissance de la faune des spongiaires de la Manche occidentale. Démosponges de la région de Roscoff. *Cahiers de Biologie Marine*, **9**, 211–246.

Carballo, J.L. & Naranjo, S., 2002. Environmental assessment of a large industrial marine complex based on a community of benthic filter-feeders. *Marine Pollution Bulletin*, **44**, 605–610.

Descatoire, A., 1966. Sur quelques démosponges de l'Archipel de Glénan. *Cahiers de Biologie Marine*, **7**, 231–246.

Dolah, R.F. van, Wendt, P.H. & Nicholson, N., 1987. Effects of a research trawl on a hard-bottom assemblage of sponges and corals. *Fishery Research*, **5**, 39–54.

Erwin, D.G., Picton, B.E., Connor, D.W., Howson, C.M., Gilleece, P. & Bogues, M.J., 1990. *Inshore marine life of Northern Ireland*. Belfast: HMSO.

Fowler, S. & Laffoley, D., 1993. Stability in Mediterranean–Atlantic sessile epifaunal communities at the northern limits of their range. *Journal of Experimental Marine Biology and Ecology*, **172**, 109–129.

Freese, J.L., 2003. Trawl-induced damage to sponges observed from a research submersible. *Marine Ecology Progress Series*, **63**, 7–13.

Freese, L., Auster, P.J., Heifetz, J. & Wing, B.L., 1999. Effects of trawling on seafloor habitat and associated invertebrate taxa in the Gulf of Alaska. *Marine Ecology Progress Series*, **182**, 119–126.

Hiscock, K., Stone, S.M.K. & George, J.D., 1984. The marine fauna of Lundy, Porifera (sponges): a preliminary study. *Reports of the Lundy Field Society*, **34**, 16–37.

Hooper, J.N.A. & Soest, R.W.M. van ed., 2002. *Systema Porifera: a guide to the classification of sponges*. New York: Kluwer Academic/Plenum Publishers.

Howson, C.M. & Chambers, S.J., 1999. *Ophlitaspongia* and *Ophlitaspongia papilla* re-instated, and a new species of *Ophlitaspongia* described (Porifera: Demospongia: Microcionidae). *Journal of the Marine Biological Association of the United Kingdom*, **79**, 609–620.

Howson, C.M. & Picton, B.E., 1997. *The species directory of the marine fauna and flora of the British Isles and surrounding seas*. Belfast and Ross-on-Wye: Ulster Museum and The Marine Conservation Society.

Könnecker, G., 1973. Littoral and benthic investigations on the west coast of Ireland. 1. (Section A: faunistic and ecological studies). The sponge fauna of Kilkieran bay and adjacent areas. *Proceedings of the Royal Irish Academy*, B, **73**, 451–472.

Lévi, C., 1960. Les démosponges des côtes de France. 1. Les Clathriidae. *Cahiers de Biologie Marine*, **1**, 47–87.

Lilly, S.J., Sloane, J.F., Bassindale, R., Ebling, F.J. & Kitching, J.A., 1953. The ecology of the Lough Ine rapids with special reference to water currents. IV. The sedentary fauna of sublittoral boulders. *Journal of Animal Ecology*, **22**, 87–122.

McClintock, J.B., Amsler, C.D., Baker, B.J. & Soest, R.W.M. van, 2005. Ecology of Antarctic marine sponges: an overview. *Integrative and Comparative Biology*, **45**, 359–368.

Morrow, C.C. & Picton, B.E., 1996. An aplysillid sponge *Hexadella racovitzai* Topsent, 1896, new to the British Isles with notes on its habitat and distribution. *Irish Naturalists Journal*, **25**, 218–221.

Pansini, M., 1987. Littoral demosponges from the banks of the Strait of Sicily and the Alboran Sea. In *Taxonomy of Porifera from the northeast Atlantic and Mediterranean Sea*, vol. 13 (ed. J.B.-E. Vacelet and N. Boury-Esnault), pp. 149–186. Berlin: Springer-Verlag.

Perez, T., 2000. Evaluation of coastal areas quality by sponges: state of the art. *Bulletin de la Société Zoologique de France*, **125**, 17–25.

Perez, T., Vacelet, J., Bitar, G. & Zibrowius, H., 2004. Two new lithistids (Porifera: Demospongiae) from a shallow eastern Mediterranean cave (Lebanon). *Journal of the Marine Biological Association of the United Kingdom*, **84**,15–24.

Perez, T., Wafo, E., Fourt, M. & Vacelet, J., 2003. Marine sponges as biomonitor of polychlorobiphenyl contamination: concentration and fate of 24 congeners. *Environmental Science and Technology*, **37**, 2152–2158.

Picton, B.E., 1991. The sessile fauna of sublittoral cliffs. In *The ecology of Lough Hyne* (ed. C. Little and A. Myers), pp. 139–142. Dublin: Royal Irish Academy.

Picton, B.E. & Costello, M.J., 1998. *BioMar biotope viewer: a guide to marine habitats, fauna and flora of Britain and Ireland*. Dublin: Environmental Sciences Unit, Trinity College.

Rapp, H.T., 2006. Calcareous sponges of the genera *Clathrina* and *Guancha* (Calcinea, Calcarea, Porifera) of Norway (north-east Atlantic) with the description of five new species. *Zoological Journal of the Linnean Society*, **147**, 331–365.

Sainsbury, K.J., 1987. Assessment and management of the demersal fishery on the continental shelf of north-western Australia. In *Tropical snappers and groupers: biology and fisheries management* (ed. J.J. Polovina and S. Ralston), pp. 465–503. Boulder, Colorado: Westview Press.

Sainsbury, K.J., Campbell, R. & Whitelaw, A.W., 1993. Effects of trawling on the marine habitat on the north-west shelf of Australia and implications for sustainable fisheries management. In *Sustainable fisheries through sustainable fish habitats. Australian Society for Fish Biology workshop, Australian Bureau of Resource Sciences Proceedings*, vol. 17, pp. 137–145, (ed. D.A. Hancock). Canberra: AGPS.

Soest, R.W.M. van., 2006. Report on the Porifera of Mingulay. In *Biology and ecosystem functioning of cold water coral bioherms at Mingulay (Hebrides), NE Atlantic. Cruise report, BIOSYS 2006 cruise on R/V Pelagia* (ed. C. Mayer), pp. 25–28. The Netherlands: Royal Netherlands Institute for Sea Research.

Soest, R.W.M. van, Picton, B.E. & Morrow, C.C., 1999. Sponges of the North East Atlantic. In *World biodiversity database CD-ROM series, Windows/Mac version 1.0*. Amsterdam: ETI, University of Amsterdam.

Soest, R.W.M. van & Stone, S.M.K., 1986. *Antho brattegardi* sp. n. (Porifera: Poecilosclerida), with remarks on and a key to the clathriids of Norwegian waters. *Sarsia*, **71**, 41–48.

Soest, R.W.M. van & Weinberg, S., 1980. A note on the sponges and octocorals from Sherkin Island and Lough Ine, Co. Cork. *Irish Naturalists Journal*, **20**, 1–15.

Stephens, J., 1912. Clare Island survey: marine Porifera. *Proceedings of the Royal Irish Academy*, **31**, 1–41.

Stephens, J., 1916. Preliminary notice of some Irish sponges. The Monaxellida (suborder Sigmatomonaxellida) obtained by the Fisheries Branch of the Department of Agriculture and Technical Instruction, Ireland. *Annals and Magazine of Natural History*, **8**, 232–242.

Stephens, J., 1917. Sponges collected by the dredging expeditions of the Royal Irish Academy and the Royal Dublin Society. *Proceedings of the Royal Irish Academy*, **34**, 1–16.

Stephens, J., 1921. Sponges of the coast of Ireland. 2. The Tetraxonida (concluded). *Annual Report of Fisheries, Ireland, Scientific Investigations*, **1920**, 1–75.

Tsoukatou, M., Hellio, C., Vagias, C., Harvala, C. & Roussis, V., 2002. Chemical defense and antifouling activity of three Mediterranean sponges of the genus *Ircinia*. *Zeitschrift für Naturforschung C—a Journal of Biosciences*, **57**, 161–171.

Vacelet, J. & Perez, T., 1998. Two new genera and species of sponges (Porifera, Demospongiae) without skeleton from a Mediterranean cave. *Zoosystema*, **20**, 5–22.

Vosmaer, R., 1935. *The sponges of the Bay of Naples: Porifera: Incalcaria with analyses of genera and studies in the variations of species*. The Hague: Martinus Nijhoff.

White, A.W., Lottin, J.R.P., Barrow, D. & Nicholson, R.I., 2005. Anti-proliferative extracts from a Welsh sponge. British Pharmaceutical Conference, Manchester. *Journal of Pharmacy and Pharmacology*, BPC Science Abstracts supplement 2005, 70.

Wiedenmayer, F., 1977. *Shallow-water sponges of the western Bahamas*. Basel & Stuttgart: Birkhäuser.

Submitted 27 April 2007. Accepted 28 August 2007.