Sponges of the Eastern Shore Islands, Nova Scotia: A Field and Laboratory Guide

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ABSTRACT

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This report describes sponges collected from the Eastern Shore Islands Area of Interest (ESI AOI). Samples were collected during SCUBA surveys in 2021 and 2022. In total 54 dives were conducted, covering 42 sites within the ESI AOI, sites ranged in depth from 10 to 33 m BSL. Two hundred and twenty sponge samples were collected. Identifications were confirmed by undertaking morphological taxonomic work on a subset of specimens, including microscopic examination of the skeleton. Sponges were identified to species where possible. This guide provides information on 23 taxa. These comprise three taxa in Class Calcarea, spanning two orders and three families; and six orders of Class Demospongiae, representing twelve families. The majority of species recorded were encrusting. There has been little work done on these in Atlantic Canada and the SCUBA surveys were an efficient way to collect species which encrust bedrock and are therefore hard to collect by trawling or dredging. This survey provided important new knowledge on species present including three new records for Canada (*Hymedesmia jecusculum, Hymedesmia stellifera*, and *Plocamiancora arndti*) and a range extension for a species (*Crellomima mehqisinpekonuta*) recently described from the Bay of Fundy. One species new to science has recently been described from a specimen from this survey: *Halichondria akesa*. There may also be three additional species new to science (*Hymedesmia* sp., *Sphaerotylus* sp., and *Protosuberites* sp.).

RÉSUMÉ

Goodwin, C.E, Cooper, J.A., Brydges, T., Cronier, M., Lawton, P. 2026. Sponges of the Eastern Shore Islands, Nova Scotia: A Field and Laboratory Guide. Can. Manuscr. Rep. Fish. Aquat. Sci. 3357: vii + 93 p. https://doi.org/10.60825/921r-0162

Ce rapport décrit les éponges collectées dans la zone d'intérêt des îles de la côte Est. Les échantillons ont été prélevés lors de plongées sous-marines menées en 2021 et 2022. Au total, 54 plongées ont été effectuées, couvrant 42 sites dans la zone d'intérêt des des îles de la côte Est, à des profondeurs comprises entre 10 et 33 m BSL. Deux cent vingt échantillons d'éponges ont été collectés. Les identifications ont été confirmées par un travail taxonomique morphologique sur les spécimens, y compris un examen microscopique du squelette. Les éponges ont été identifiées par espèce dans la mesure du possible. Ce guide fournit des informations sur 23 taxons. Ceux-ci comprennent trois taxons de la classe Calcarea, couvrant deux ordres et trois familles, et six ordres de la classe Demospongiae, représentant douze familles. La majorité des espèces répertoriées étaient incrustantes. Peu de travaux ont été menés à ce sujet dans le Canada atlantique et les relevés en plongée sous-marine ont constitué un moyen efficace de collecter des espèces qui encroûtent le substrat rocheux et sont donc difficiles à collecter par chalutage ou dragage. Cette étude a permis d'acquérir de nouvelles connaissances importantes sur les espèces présentes, notamment trois nouvelles espèces pour le Canada (*Hymedesmia jecusculum*, *Hymedesmia stellifera* et *Plocamiancora arndti*) et une extension de l'aire de répartition d'une espèce (*Crellomima mehqisinpekonuta*) qui a été récemment décrite dans la baie de Fundy. Une espèce nouvelle pour la science a récemment été décrite à partir d'un spécimen issu de cette étude : *Halichondria akesa* . Il pourrait également y avoir trois autres espèces nouvelles pour la science (*Hymedesmia* sp., *Sphaerotylus* sp. et *Protosuberites* sp.).

1. INTRODUCTION

This report describes sponges collected SCUBA surveys of the Eastern Shore Islands Area of Interest[1] (ESI AOI). SCUBA sampling was undertaken in 2021 and 2022 in the ESI AOI in Nova Scotia (Goodwin *et al.* 2025a). Objectives of the survey were to provide information on sublittoral habitats and associated species including authoritative identification for sponges that were previously observed, yet poorly known, and perceived as a potentially important biodiversity component. Many encrusting sponges are difficult to identify *in-situ* through diver observation and imagery. This report serves as an identification resource providing an authoritative list of sponges known to occur within the ESI AOI and guidance to future surveys on best approaches to their identification.

2. SCUBA SURVEY METHODOLOGY

Sponges were collected over 54 dives covering 42 sites within the ESI AOI. Sites ranged in depth from 10 to 33 m below sea level (BSL) and were selected based on previous sponge records from within the AOI and high slope features identified from high resolution bathymetry data (Goodwin *et al.* 2025a). Dive teams conducted a roving diver species habitat survey and collected voucher samples of as many different sponge species at each sampling site as possible. Overall sponge abundance and abundance of particular species were recorded along with substrate features, depth, and water quality (Goodwin *et al.* 2025a). Sponge samples were photographed *In situ* using a digital still camera fitted with a macro lens in most cases. Three photographs of each specimen were taken (this improves the likelihood of a good picture and indicates that a sample was taken as images of non-sampled sponges and other species were also captured). A small piece of sponge was then cut off using a knife and placed in a sequentially numbered Whirl Pak bag so the specimen could be matched to the photograph. Sponges were preserved in 95% ethanol. Where possible, a small subsample was preserved separately for genetic analysis.

Specimens were taken to Huntsman Marine Science Centre for identification. Specimens were prepared as detailed in the following identification guide. Selected representative specimens were archived in the Atlantic Reference Centre Museum (ARC) and some have been molecularly sequenced. Successful sequences will soon be available via the Barcode of Life Database (https://boldsystems.org/).

[1] https://www.dfo-mpo.gc.ca/oceans/aoi-si/easternshore-ilescoteest-eng.html

3. SCUBA SURVEY RESULTS SUMMARY

In total, 27 species were recorded at 42 sites based on 220 physical samples and records from photos and video. Due to the regional classification requiring review, the seven Calcarea species recorded have been left at genus level for this guide. Consequently only 23 taxa are described. These comprise three taxa in Class Calcarea, spanning two orders and three families; and six orders of Class Demospongiae, representing twelve families. The family Halichondriidae was the most abundant, being represented by four species.

3.1 DATA MANAGEMENT

Data from this survey is available from OBIS (Goodwin *et al.* 2025b). Atlantic Reference Centre Museum Specimens referenced in the text (using ARC followed by catalogue number) are available for loan from the Atlantic Reference Museum, St. Andrews, New Brunswick. Some of the specimens collected have been molecularly sequenced; these will soon be made publicly available through the Atlantic Canadian Marine Invertebrates project on The Barcode of Life Database (https://boldsystems.org/), associated macro imagery is also available through this platform.

4. FIELD AND LABORATORY GUIDE INTRODUCTION

4. 1 RECOMMENDED METHODS FOR COLLECTION AND ANALYSIS OF SPONGES

4.1.1 Sponge collection

1. Sponge should ideally be photographed either *In situ* (for SCUBA surveys) or when freshly collected if this is not possible. A scale bar should be included in the photo if possible.
2. A small piece of the sponge is usually sufficient for identification but it is desirable to preserve whole individuals if possible. Sponges can be frozen at –20^{o}C, or placed in ethanol >70%.
3. Sponge samples should be clearly labelled with a sample number both inside the container (on waterproof paper) and outside the container. Associated metadata should be recorded (location, depth, time, etc.).
4. If sponge is to be used for molecular work it is desirable to preserve a small subsample in 95% ethanol. This is because the water in the sponge's tissues dilutes the preserving alcohol. The ethanol in this sample should be changed after 24 hours and further changes may be required if the ethanol becomes discoloured. Genetic subsamples should be kept cool (they can be placed in a freezer if available).

4.1.2 Laboratory methods

To confirm sponge identification it is necessary to make microscope slides to examine the spicules and the skeleton arrangement.

Tissue section for examination of skeleton

1) Slice a very thin cross section from the sponge using a scalpel blade including both choanosome (inner layers of sponge) and ectosome (outer layers of sponge).
2) Dehydrate tissue in 95% or higher ethanol for 2-3 minutes.
3) Place in clove oil for 2-3 minutes or until the tissue becomes translucent.
4) Mount in Canada Balsam or other mountant on a microscope slide. Allow to dry before examining it with a microscope.

Spicule preparation

1) Cut a very small piece of sponge, include both choanosome and ectosome.
2) Dissolve tissue in household bleach. This usually takes up to 30 minutes, but may take several hours. Shake occasionally to aid the process.
3) When dissolved, leave for 15 minutes so spicules settle to the bottom of the vial. Then pipette off most of the liquid carefully, trying not to disturb the spicule layer.
4) Add water, shake vial to rinse spicules, leave for 15 minutes to settle. Then pipette off most of the liquid carefully.
5) Repeat above with one more water rinse, two with 70% ethanol, and one 95% ethanol.
6) Finally add 95% ethanol to the vial and shake the spicules to suspend.
7) Place a microscope slide on a hotplate.
8) Place a few drops of the spicule suspension on the slide and allow the alcohol to evaporate off.
9) Cover with Canada Balsam or other mountant. Allow to dry before examining on a microscope.

Microscope examination

Examine slides on a compound microscope. You will need an eyepiece graticule or camera system to take measurements of spicules as these are an important feature for sponge identification.

4.2 MORPHOLOGICAL CATEGORIES USED IN THE GUIDE

We have divided sponges into morphological categories to aid in identification. These have been adapted from those in Bowen *et al.* (2018) and Dinn (2020). Sponge growth form has no taxonomic significance, many growth forms can be found within one family and growth form can vary even within some species.

Calcareous tubes	White or grey sponges either formed of a single tube or many connected tubes.
Cups, vases and tubes	Non-calcareous sponge with cup, vase or tube form.
Fan-shaped	Erect sponge in the form of a fan.
Finger-shaped	Sponge with finger-like branches. May consist of one finger or might be branched.

Balls and lobes	Sponge which might be stalked or only have a little of the base attached to the substrate. Globular or irregular lobe.
Thinly encrusting	Very thinly encrusting sponge < 0.5 cm high, often much thinner.
Thickly encrusting/massive	Thicker encrusting sponge, generally several cm thick. Upper portions may have mounds and lobes but the majority of the area of the sponge is attached to the substrate.
Cushion with projections	Thickly encrusting sponge with many erect papillae or other projections.

4.3 BRIEF GUIDE TO MAJOR TERMINOLOGY USED IN SPONGE TAXONOMY

This is only intended to be a brief introduction. For a comprehensive guide to sponge taxonomy terms please see Boury-Esnault and Rützler (1997) and for spicules Lukowiak *et al.* (2022), see also the website deriving from the latter publication: https://www.spicules.org/.

Sponges have skeletons composed of calcium carbonate or silica spicules and/or spongin fibres. Laboratory identification of sponges is based on the arrangement of their skeleton and the types and size ranges of their spicules.

The skeleton can usually be divided into an outer layer known as the ectosome (Fig. 1C) (or cortex (Fig. 1B) in some groups of sponges such as the Family Polymastiidae) and the inner layer or choanosome. These often have different spicules so it is very important to sample both layers when making spicule preparations or sections.

Fibres and spicules within the skeleton may have different arrangements. They can be arranged in a mesh or net, a reticulate (Fig. 1A) skeleton. Or they may have a plumose (Fig. 1C) skeleton, with columns of spicules with tufts of spicules fanning out from them, columns may be joined into a network (plumo-reticulate). In the ectosome spicules can sometimes be arranged upright with tips pointing outwards in a layer or palisade (Fig. 1B).

Spicules are divided into megascleres (Fig. 1), the larger category of spicules, usually over 100 µm, and microscleres (Fig. 2), smaller spicules, usually 10-100 µm but can be smaller or larger. It may be necessary to search carefully to find microscleres as they can be rare.

Megascleres can have two points (diactines, Fig. 1I, J), one point (monoactines, Fig 1E, H) or even three (triactines, Fig. 1D) or four points (tetractines).

Styles are monactinal megascleres with a pointed and rounded end. If the rounded end is swollen we call them tylostyles (Fig. 1F, G) or subtylostyles (Fig. 1G). If the styles are spiny we call them acanthostyles (Fig. 1H). Oxea (Fig. 1I) are megascleres with two pointed ends. Tornotes (Fig. 1J) also have two pointed ends but are usually thinner than oxea and are often ectosomal spicules found in association with styles. Strongyles have two rounded ends, if the ends are swollen they are called tylotes (Fig. 1K).

Microscleres (Fig. 2) come in a very wide variety of forms. Chelae are some of the most common. These may have the alae separate from the shaft (arcuate, Fig. 2A, B) or joined onto the shaft (palmate, Fig. 2C). Chelae may be symmetrical with both ends the same size (isochelae, Fig. 2A, B, C) or asymmetrical with one end larger (anisochelae, Fig. 2D, E). Bow shaped spicules (toxa, Fig. 2I, J), star shaped spicules (asters, Fig. 2L), and c-shaped sigmas (Fig. 2H) are also common types. Bipocilla (Fig. 2G, F) are found in the genus *Iophon.*

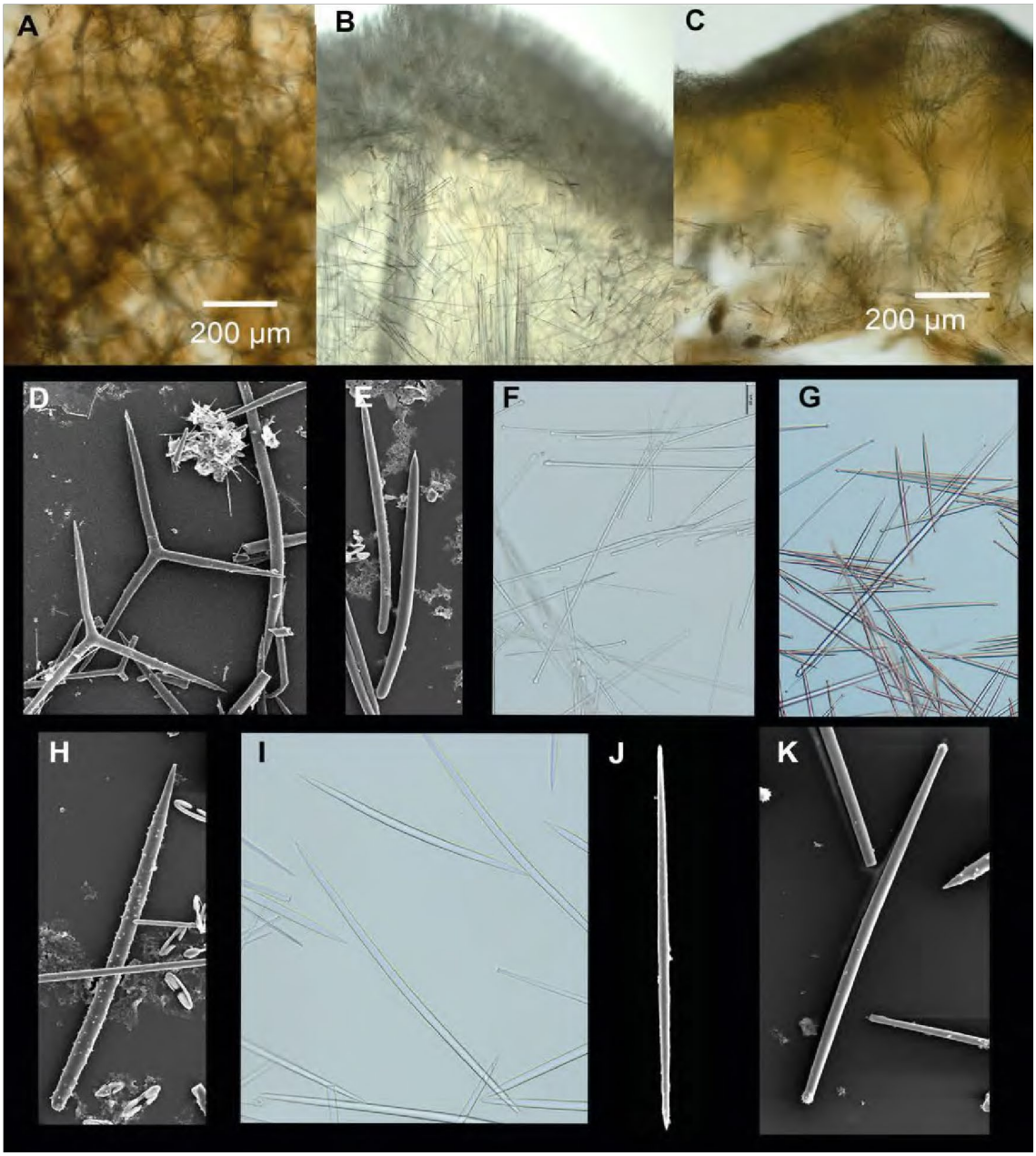


Figure 1. Terms used in sponge description of skeleton and megascleres. A. Reticulate skeleton; B. Skeleton with thick cortical layer (top) and choanosomal skeleton; C. Plumose choanosome with ectosomal crust of oxea; D. Triactines; E. Style; F. Tylostyle; G. Tylostyles and subtylostyles; H. Acanthostyle; I. Oxea; J. Tornote; K. Tylote.

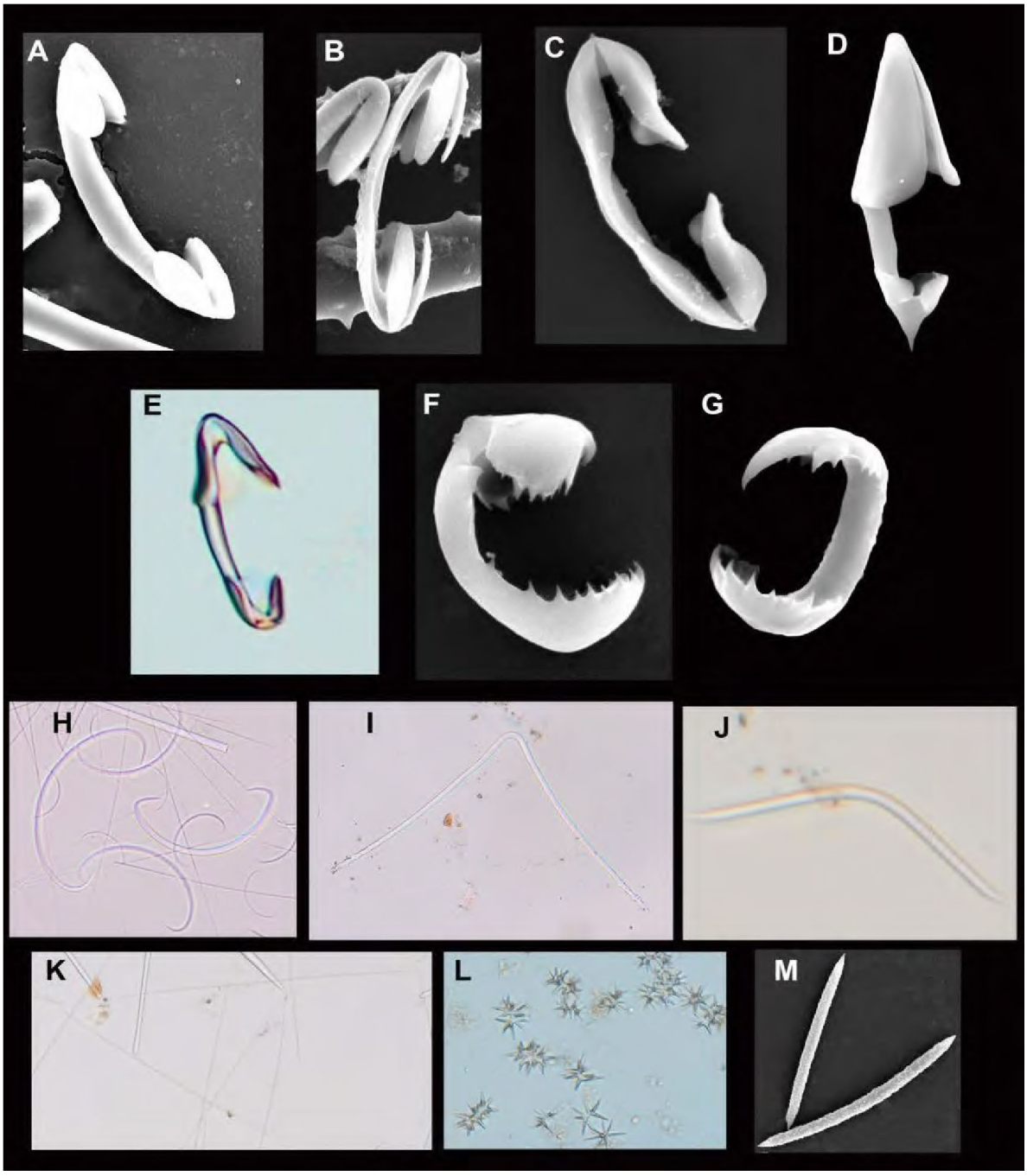


Figure 2. Terms used in sponge description of microscleres. A. Arcuate isochela; B. Unguiferate arcuate isochela (Myxillid type); C. Palmate isochela; D. Palmate anisochelae with spurred end; E. Palmate anisochela; F. Bipocillum; G. Bipocillum; H. Sigmata; I. Toxa with spined ends; J. Oxhorn toxa; K. Onychaetes; L. Asters; M. Spined microxea.

4.4 KEY TO SPONGE GROUPS FOUND IN THE LOCAL AREA

This is not intended to be a comprehensive key to sponges. For more complete keys see Systema Porifera (Hooper and Van Soest 2002). This key aims to help those with little experience in sponge taxonomy find the right section in this guide. Some taxa occurring in adjacent waters are included in

the key; those which were not reported during this survey and hence are not included in the descriptive section are indicated as NR (not recorded). These have been left in the key to highlight their occurrence in the region and reduce identification issues. This guide is organised in taxonomic order. You may also use the quick reference guides to aid in identification if you have good field pictures. Once you have found the right section, compare the information regarding spicule complement, sizes and skeleton form carefully with your specimen to ensure accurate identification.

1	Spicules not present.	2
	Spicules present.	4
2	No spongin fibres, sponge thinly encrusting.	*Halisarca,* p. 21
	Spongin fibres present.	3
3	Sponge fibres have debris core, sponge white and bumpy.	*Dysidea* cf. *fragilis, NR*
	Sponge fibres have no debris core. Sponge thinly encrusting and bright yellow.	*Aplysilla sulfurea,* p. 24
4	Triactines present.	Class Calcarea, pp. 12, 15, 18
	Triactines not present.	6
6	No microscleres present.	7
	Microscleres present (Chelae, Sigmata, Toxas, Bipocilla, Microxea, etc.).	12
7	Spicules oxea.	8
	Spicules styles.	9
8	Oxea are all under 270 µm long.	Family Chalinidae *Haliclona*, p 27
	Some oxea over 270 µm long, oxea often bent.	Family Halichondriidae, pp. 66, 69, 72
9	Styles have a neat pin-like head.	Family Suberitidae, p. 78

	Head may be tylote or sub-tylote but not pin like.	10
10	Several categories of styles, sponges have a thick cortex, specimens massive, with papillae.	Family Polymastiidae, pp. 60, 63
	Only one category of styles.	11
11	Styles 180 – 550 µm. Stalked, vase shaped sponge.	*Semisuberites cribrosa, NR*
	Styles all under 300 µm.	Family Halichondriidae *Hymeniacidon,* p. 75
12	Bipocilla present (caution! these may be very small and can be rare).	*Iophon,* pp. 30, 33
	No bipocilla.	13
13	Onychaetes present (thin, hair-like microspined spicules).	*Tedania suctoria, NR*
	No onychaetes present.	14
14	Asters present.	Order Tetractinellida, NR
	Asters not present.	15
15	Chelae not present.	16
	Chelae present.	17
16	Microscleres include sigmas and raphides.	*Biemna varianta, NR*
	Microscleres include fat oxhorn toxa and sigmas.	*Hemigellius arcofer, NR*
	Microscleres include microxea.	*Stylocordyla borealis, NR*
17	Chelae arcuate or polydentate.	18
	Chelae palmate.	19
18	Chelae normal arcuate chelae. Skeleton with basal layer of acnathostyles and ascending columns of ectosomal megascleres.	Family Hymedesmiidae, pp. 41, 44, 47

	Chelae are ‘Myxillid’ type chelae with long alae, skeleton reticulate.	Family Myxillidae, pp. 54, 57
	Chelae arcuate or polydentate, ectosomal crust of spined acanthostyles or oxeas.	Family Crellidae. *Crellomima mehquisinpekonuta,* pg. 35
19	Palmate isochelae (equal ends).	20
	Palmate anisochelae (unequal ends).	21
20	Chelae very small, all under 20 µm long.	Family Microcionidae, NR
	Chelae over 20 µm long.	Family Isodictyidae *Isodictya,* pg. 51
21	Chelae only microsclere and all under 30 µm long.	Family Esperiopsidae *Amphilectus ovulum,* pg. 38
	Some chelae much larger that 30 µm long. Other microscleres present.	Family Mycalidae *Mycale lingua, NR*

5. TAXONOMIC GUIDE TO SPECIES RECORDED

5.1 CALCAREOUS TUBES

Clathrina Gray, 1867

APHIA ID: 131729; CLASS: Calcarea; ORDER: Clathrinida; FAMILY: Clathrinidae

External appearance (Fig. 3A, 3B): Anastomosing mass of thin white to cream tubes. No external layer covering the cormus tubes. Water collecting tubes converge towards the centre of the sponge ending in apical oscula.

Skeleton (Fig. 3C): The tubes forming the body are composed of several layers of parasagittal triactines.

Spicules (Fig. 3D): Triactines—measurements given in Table 1.

Table 1. Measurements of specimens of *Clathrina* from the Eastern Shore Islands.

Specimen	**Triactines** **Unpaired actine µm**	**Triactines** **Paired actines µm**
ARC 82108	109(123)149 by 6(9)11	61(73)89 by 5(8)9
ARC 82109	38(96)135 by 7(11)12	28(63)90 by 4(7)10
ARC 82095	23(68)127 by 5(8)10	14(54)99 by 4(7)10
ARC 82129	96(113)124 by 6(8)10	70(87)99 by 6(7)8
ARC 82122	100(117)133 by 8(9)11	79(93)107 by 7(8)9
Rapp (2015) Greenland specimens of *C. arnesenae.*	90 (132) 151 by 1 (body) 117(136)168 by 11 peduncle	51(75)129 by 8 – body 50(64)83 - peduncle

Remarks: Recorded at seven locations during this survey (Fig. 4), it is possible these specimens represent several species of *Clathrina,* some of which may be undescribed. Calcareous sponges of this region are very poorly known. Additional sampling, molecular sequencing and a complete revision of the Calcarea species present in the region is required. *C. arnesenae* is the only *Clathrina* species present in the northwest Atlantic with only parasagittal triactines (Rapp 2015). *Brattegardia nanseni* (Breitfuss, 1896) is also present in the region and is widely distributed in the Arctic with records from north-east Canada, Spitzbergen, the Barents Sea, Murman Coast and northern Norway (Rapp, 2006, 2015). *B. nanseni* was formerly regarded as a species of *Clathrina* and has recently been recorded from the Scotian Shelf (Goodwin *et al.* 2026), but possesses tetractines which are not present in these specimens.

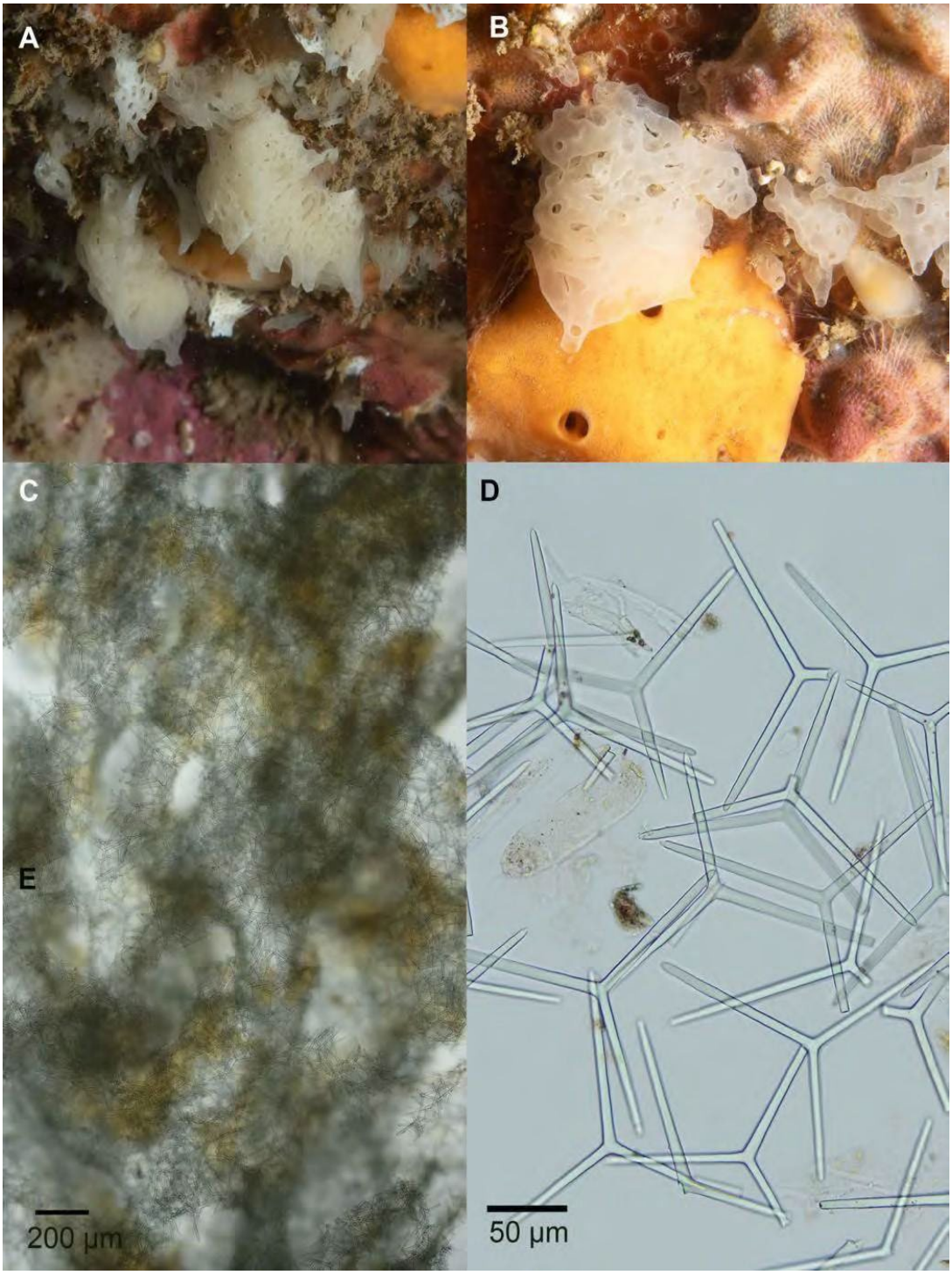


Figure 3. *Clathrina* sp. A. *In situ* appearance, specimen ARC 82129; B. *In situ* appearance, specimen ARC 82109; C. Skeleton, specimen ARC 82129; D. Spicules, Specimen ARC 82129.

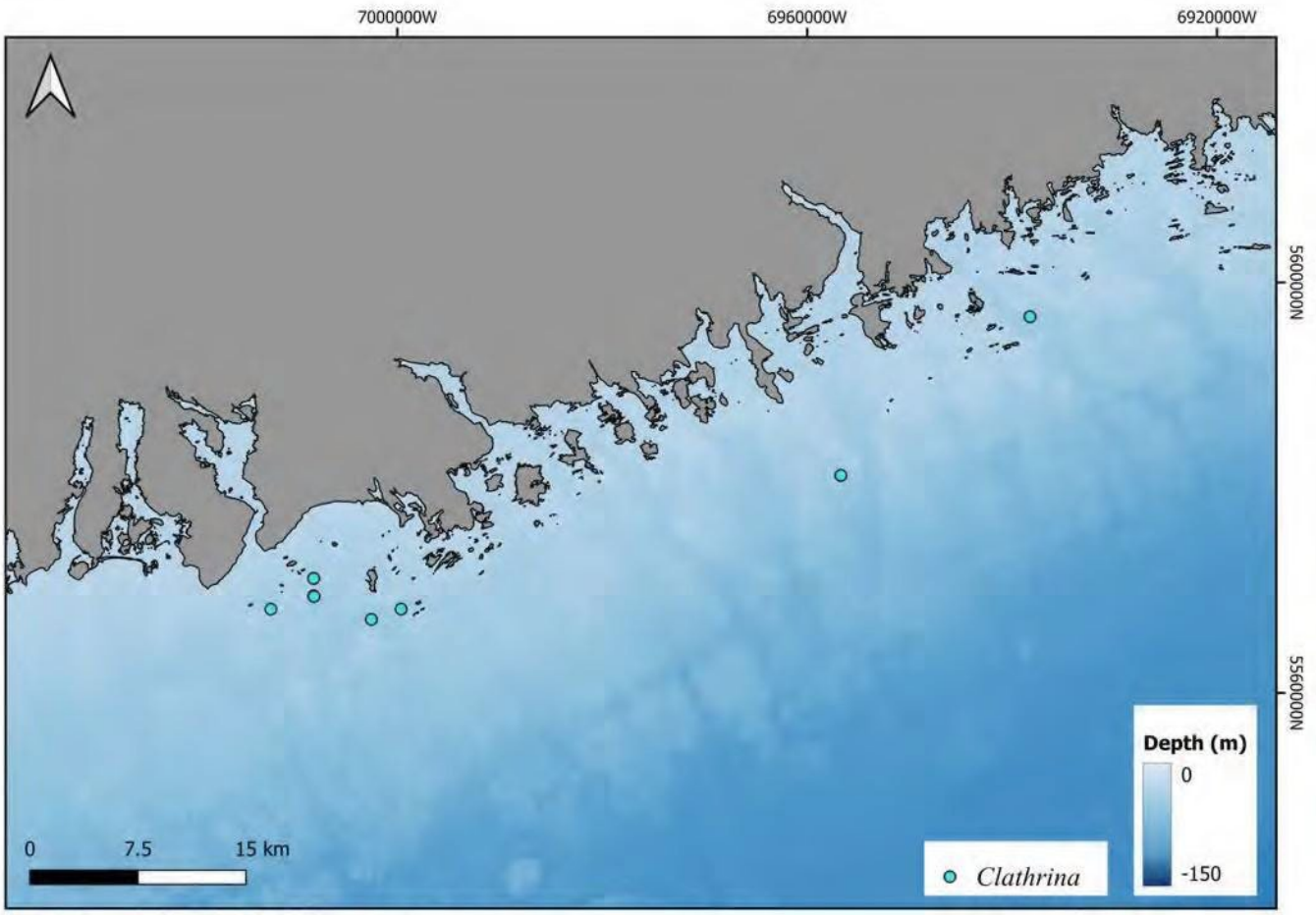


Figure 4. Records of *Clathrina* from this survey.

Grantia Fleming, 1828

APHIA ID: 131703 ; CLASS: Calcarea; ORDER: Leucosolenida; FAMILY: Grantiidae

External appearance (Fig. 5A, B): Small, white or grey, tube shaped sponge with a single terminal osculum. There is a fringe of spicules around the osculum. The sponge surface is hispid due to projecting diactines.

Skeleton (Fig. 5C,D): Sponge body wall is made up of radial chambers, each ornamented by a turf of diactines that protrude through the body wall. The cortical skeleton is comprised of small irregular triactines. The tubular skeleton is composed of several rows of t-shaped sagittal triactines. The atrial skeleton is a thick layer of sagittal triactines.

Spicules (Fig. 5E): Large diactines and sagittal triactines and tetractines.

Remarks: Many specimens from the area previously identified as *Sycon*, including *Sycon protectum,* (Lambe, 1896) may in fact be *Grantia,* see Rapp (2015) for discussion. The *Grantia* present in the region require revision. Recorded at two locations in this survey (Fig. 6), some of our specimens may correspond to *Grantia arctica* (Haeckel, 1872) which is widely distributed around Greenland.

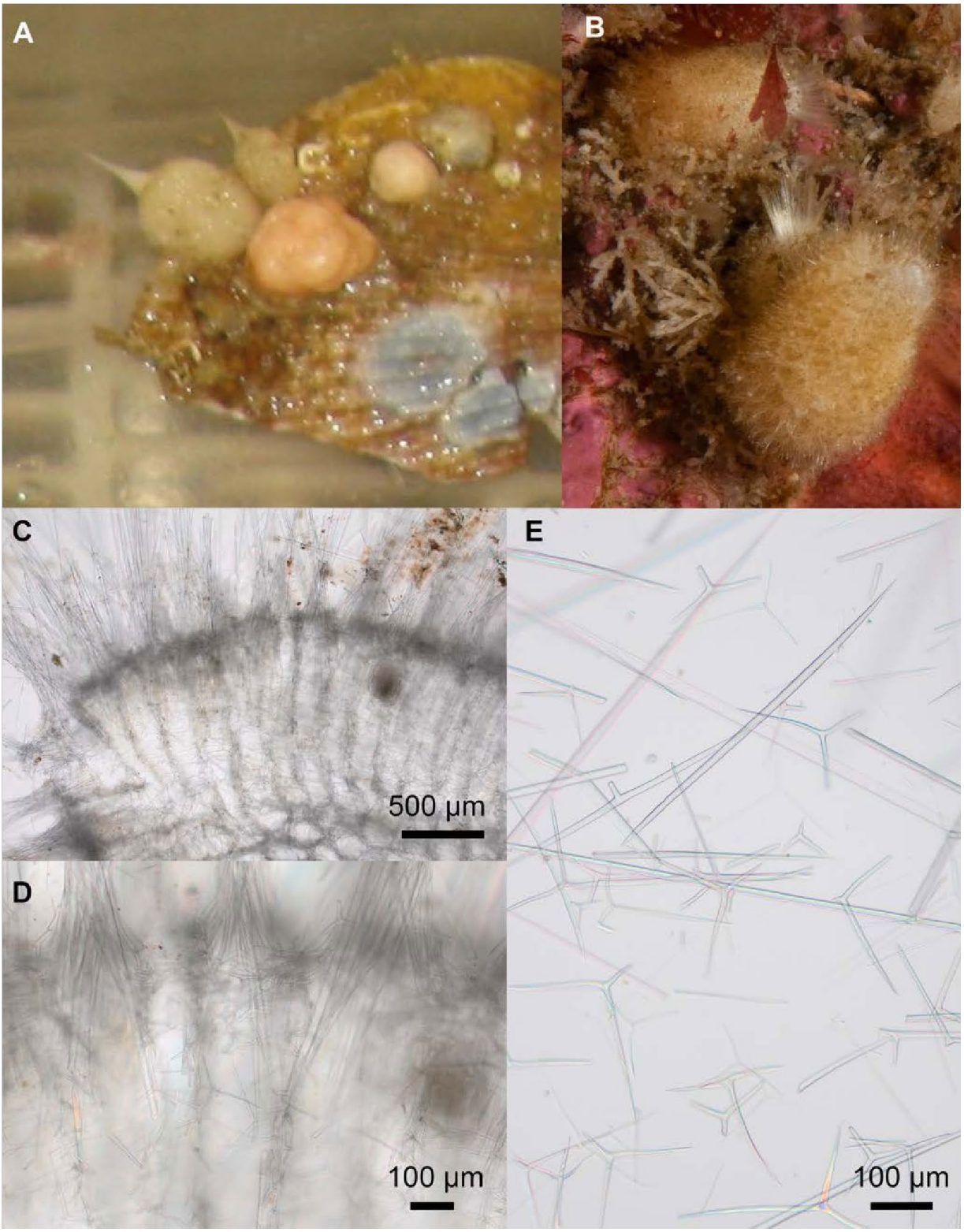


Figure 5. *Grantia* A. ARC 81466 collected specimen; B. ARC 82253 *In situ* specimen; C. Skeleton; D. Cortical skeleton; E. Spicules, all ARC 81466.

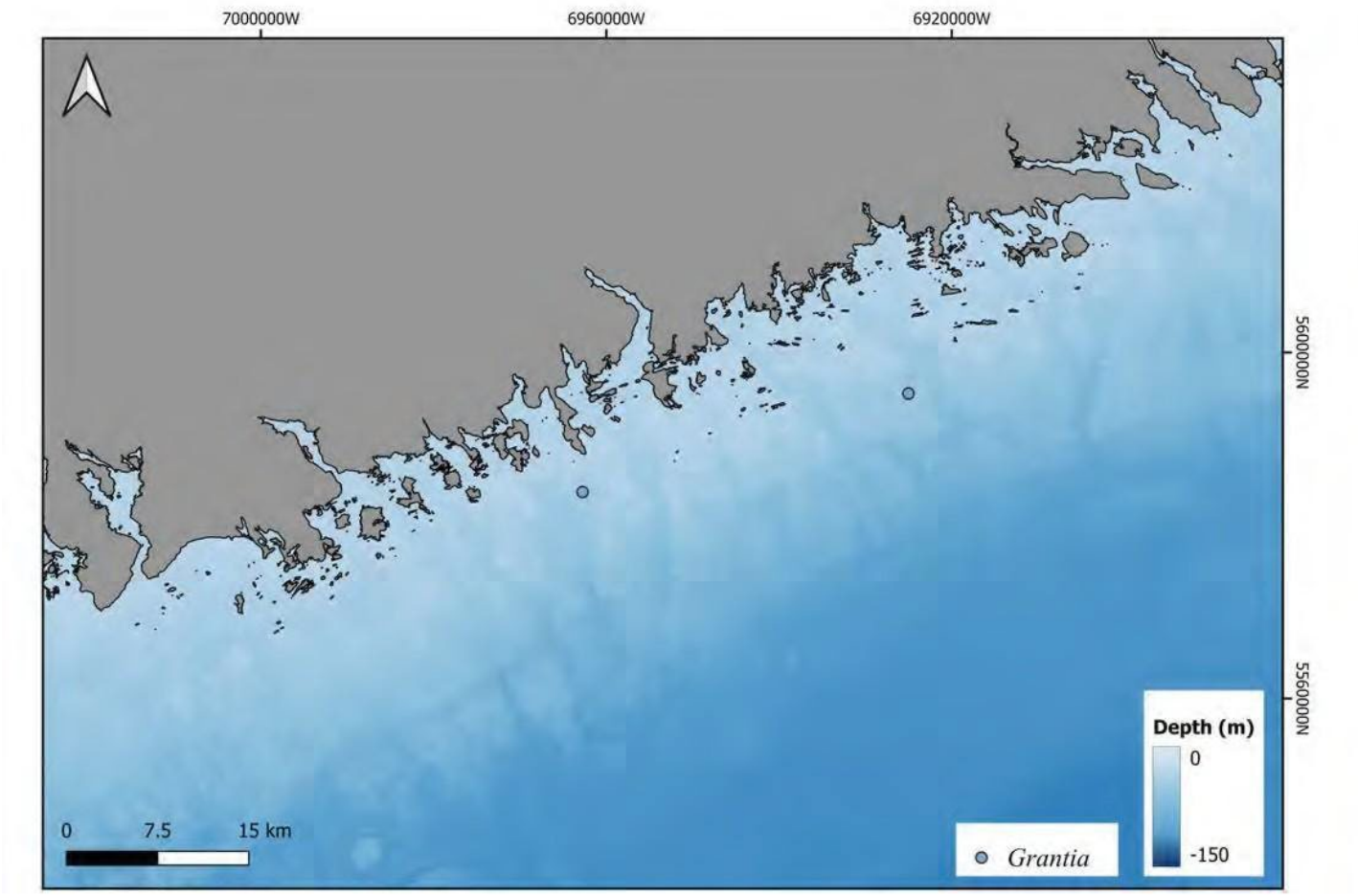


Figure 6. Records of *Grantia* from this survey.

Leucosolenia Bowerbank, 1864

APHIA ID: 131571; CLASS: Calcarea; ORDER: Leucosolenida ; FAMILY: Leucosoleniidae

External appearance (Fig. 7A, B): White or buff sponge composed of a basal reticulation of tubes from which erect oscular tubes with lateral diverticular (side branches) arise.

Spicules (Fig. 7C): Diactines and sagittal triactines and tetractines.

Remarks: Recorded at six locations (Fig. 8). Using Rapp's (2015) key some of our specimens key out as *Leucosolenia complicata*. However, *Leucosolenia* species present in the North Atlantic require a thorough revision. We plan to use molecular sequencing and additional morphological taxonomic work to resolve the identity of these specimens.

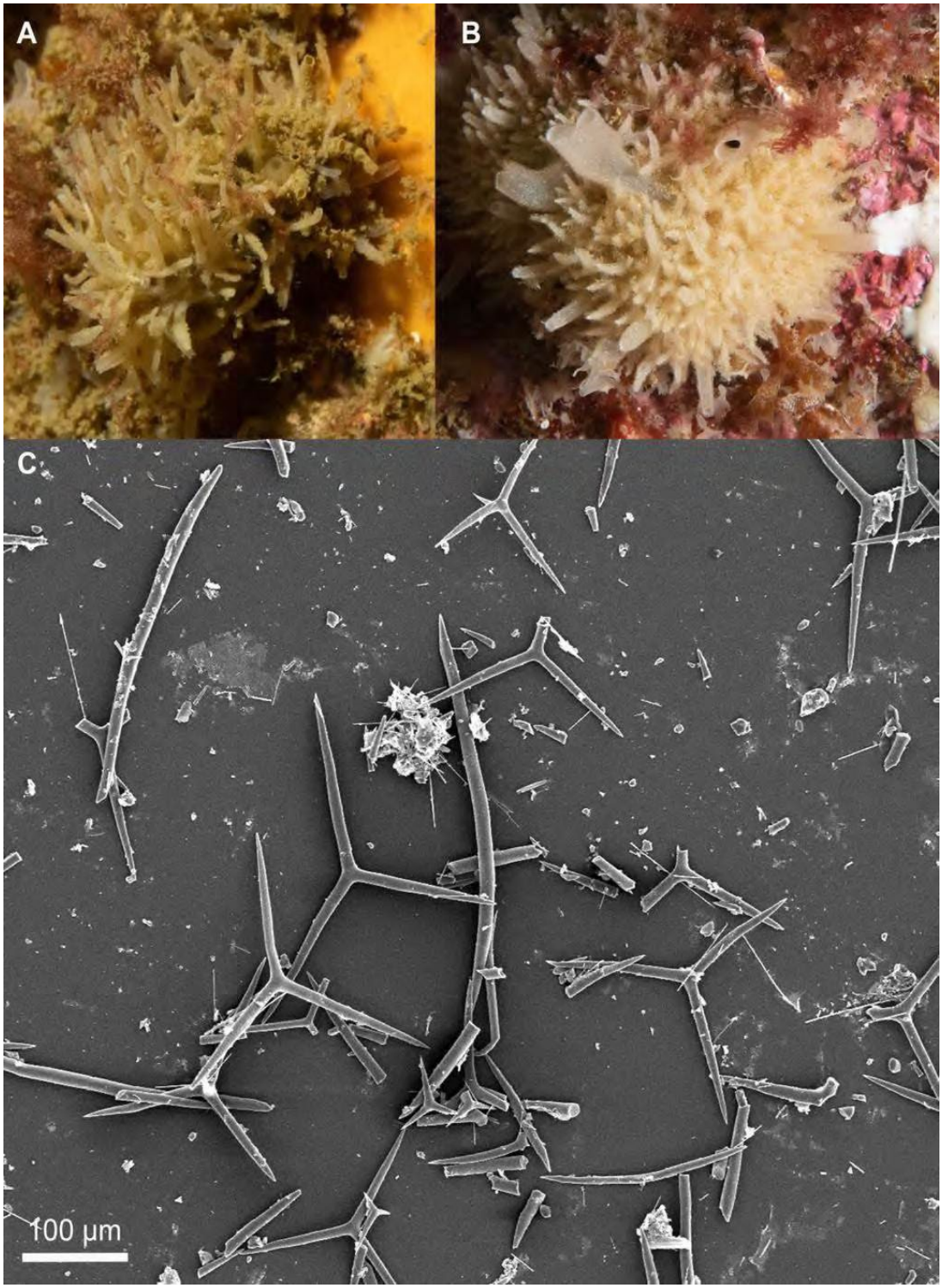


Figure 7. *Leucosolenia*. *In situ* appearance. A. ARC 82175, B. ARC 82192; C. SEM of spicules ARC 82192.

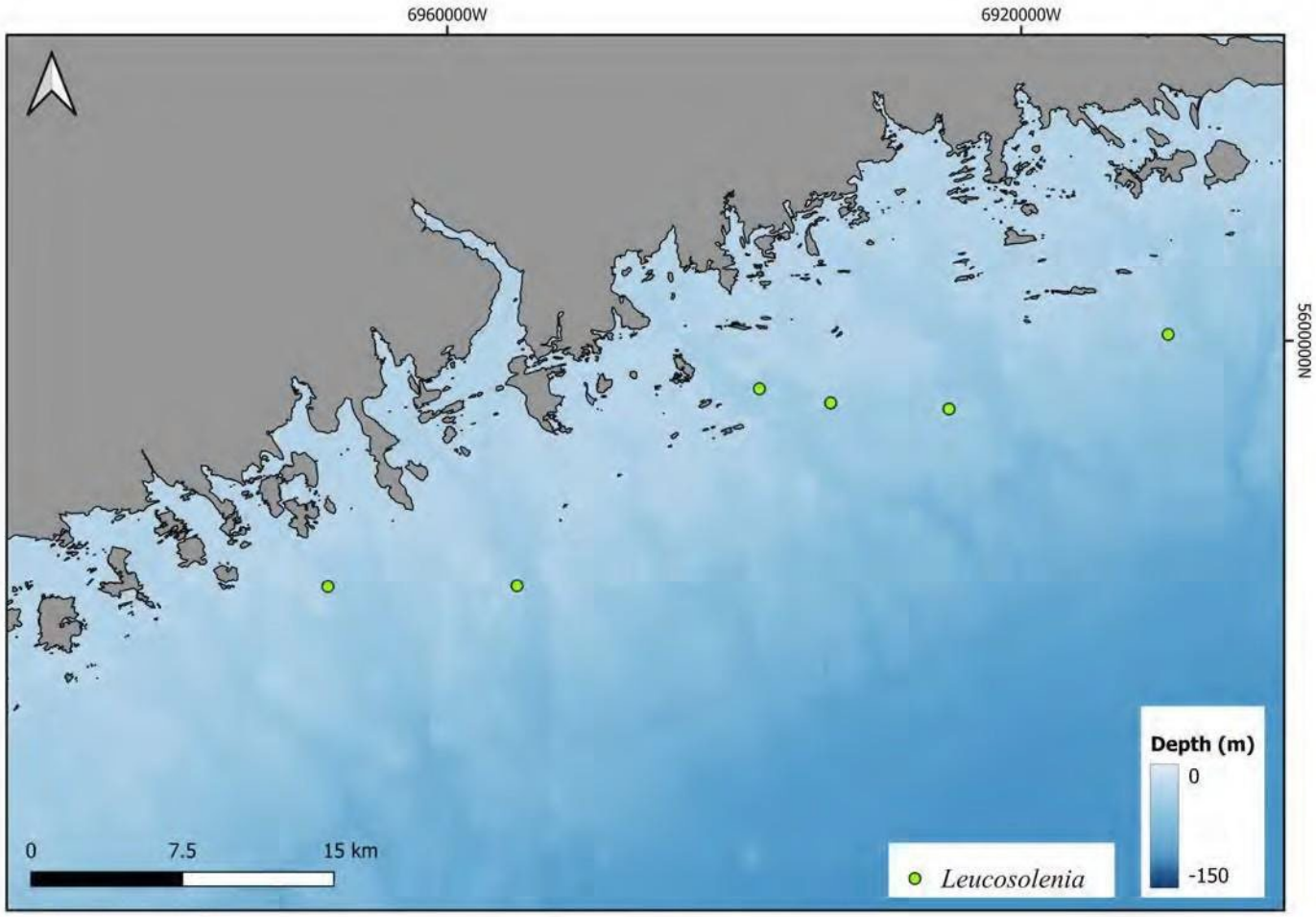


Figure 8. Records of *Leucosolenia* from this survey.

5.2 THINLY ENCRUSTING

Halisarca Johnston, 1842

APHIA ID: 131822 CLASS: Demospongiae ORDER: Chondrillida; FAMILY: Halisarcidae

External appearance (Fig. 9): Thinly encrusting beige sponge with raised oscula.

Skeleton: This genus of sponges has no spicule or spongin skeleton.

Distribution: Only sampled during the SCUBA surveys on the Eastern Shore (Fig. 10). May be present in deeper water, but unlikely to be sampled by trawling.

Remarks: This sponge does not have spicules. Identification to genus level was confirmed through genetic sequences (C01 for all three specimens, 28S was successful for ARC 82020). This does not seem to be a match for any known species in the barcode databases. Further taxonomic investigation is required to determine if it is a species new to science. There are currently 22 species of *Halisarca* regarded as valid. *Halisarca dujardini* Johnston, 1842 was described from the North Sea.



Figure 9. *Halisarca In situ* appearance ARC 82013 (top) and ARC 82016 (bottom).

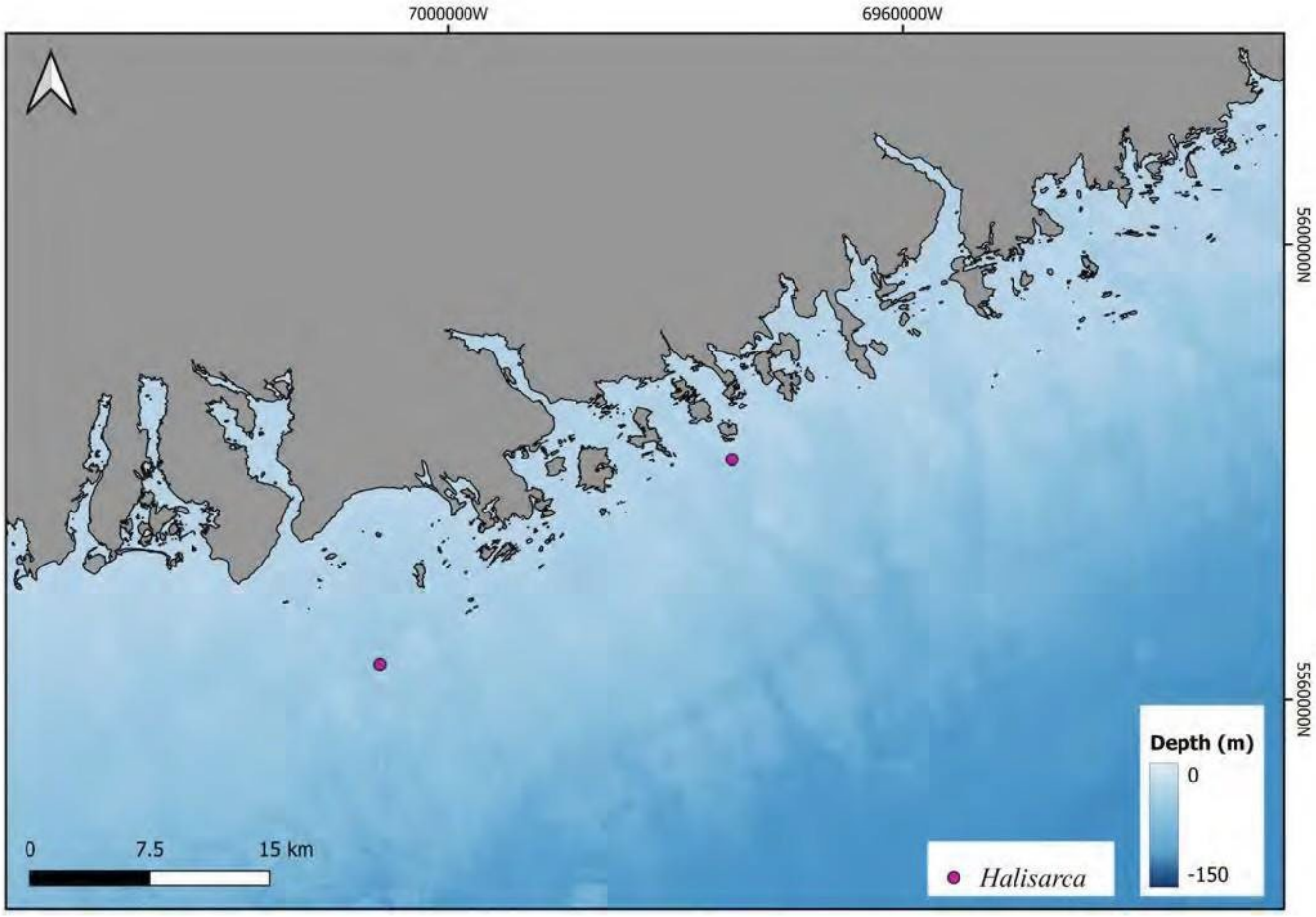


Figure 10. Records of *Halisarca* from this survey.

Aplysilla sulfurea Schulze, 1878

APHIA ID: CLASS: Demospongiae ORDER: Dendroceratida ; FAMILY: Darwinellidae

External appearance (Fig. 11): Bright yellow, thinly encrusting sponge with many conules.

Skeleton: Spongin fibres project, causing the surface conules.

Spicules: This sponge does not have spicules.

Distribution: Only one specimen was collected from the SCUBA surveys (Fig. 12), but there are many photographic records from deeper waters at the Eastern Shore Islands (Paulin et. al. 2025). The type locality of this species is the Adriatic Sea. It is widespread in North-western Europe. Given the lack of skeletal characters we plan to attempt to genetically sequence this specimen. *Aplysilla* cf. *sulfurea* has been recorded from the Gulf of St Lawrence where it was noted as common on rocks and boulders (Dinn 2020).

Remarks: The Latin species name comes from *sulfurea* meaning yellow.

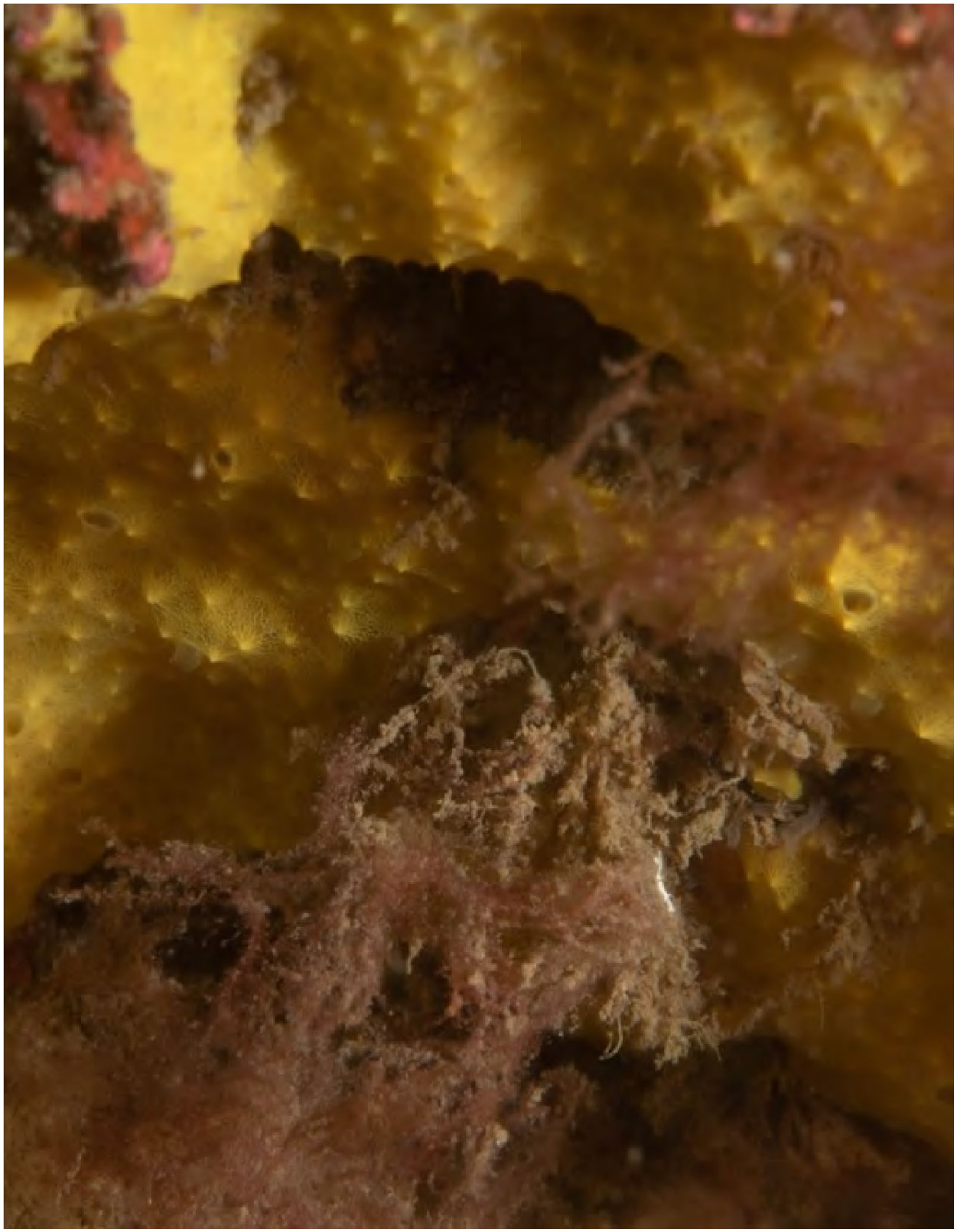


Figure 11. *Aplysilla sulfurea* Schulze, 1878. *In situ* appearance ARC 82228.

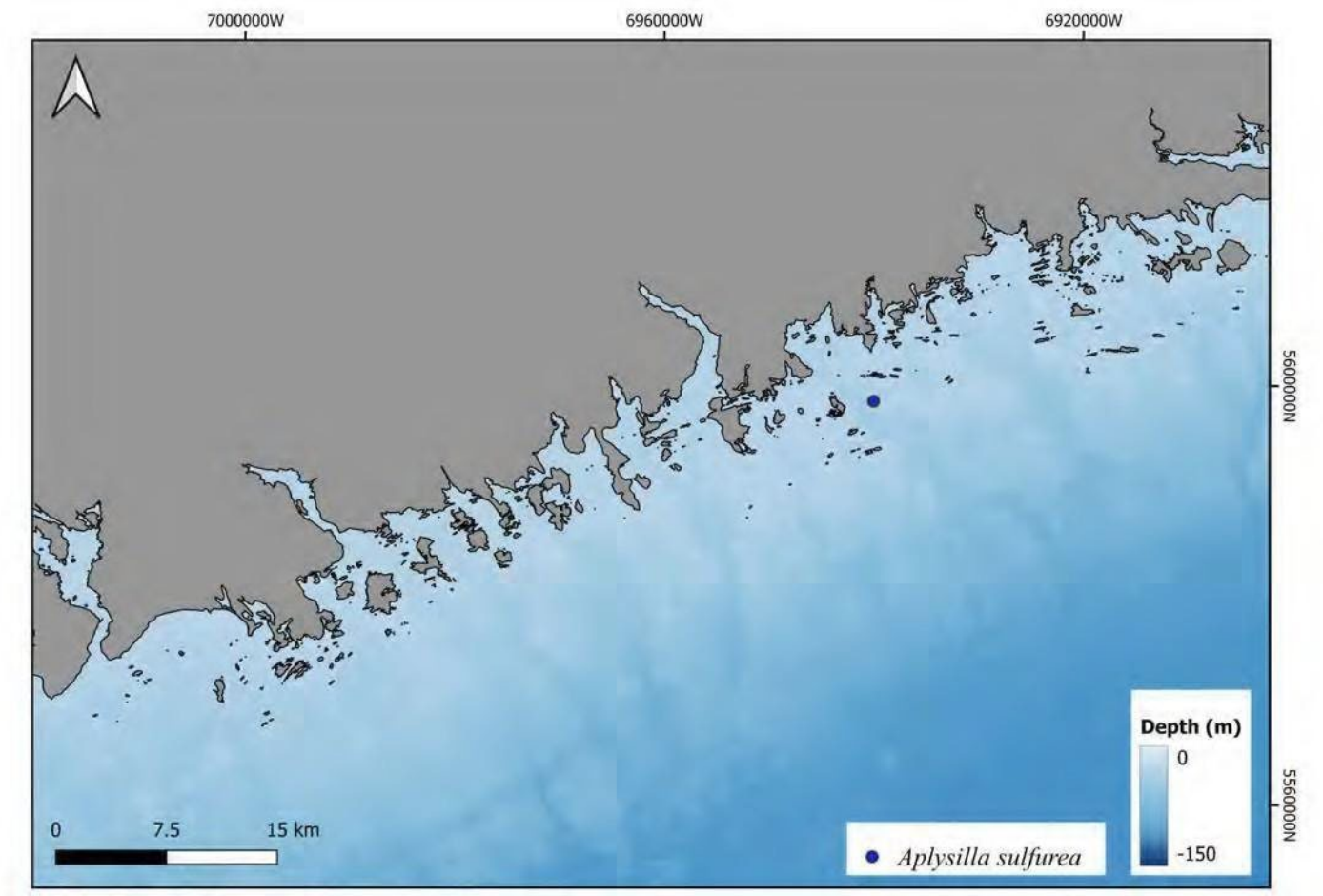


Figure 12. Records of *Aplysilla sulfurea* from this survey.

5.3 FINGER-SHAPED

Haliclona (Haliclona) oculata (Linnaeus, 1759)

APHIA ID: 132833 CLASS: Demospongiae ORDER: Haplosclerida ; FAMILY: Chalinidae

External appearance (Fig. 13A): This is a beige to yellow or brown branching sponge that can be very variable in form. It is attached to the substrate with a stalk, and a few to many branches arise from this. Specimens can reach over 30 cm in height. One specimen (ARC 82033) had numerous thin branches whereas the other collected (ARC 82149) had fewer branches which were flattened and much broader in comparison. The regular distribution of oscula can be distinctive – these are often found along the edge of branches. Many other specimens were photographed but not sampled.

Skeleton (Fig. 13B): Regular reticulate skeleton with ascending columns of 2-3 oxea joined by a single oxea. There is no specialised ectosomal skeleton, but the ends of the choanosomal columns support the sponge surface.

Spicules (Fig. 13C)**:** Short, fat oxea with short points: ARC 82149: 113(123)136 by 7(9)12 µm.

Distribution: Recorded at four locations during this survey (Fig. 14), it is found throughout the North Atlantic and up into the Arctic. On the eastern coast of North America distributed from the Gulf of St. Lawrence down to North Carolina. In the eastern Atlantic from Norway to Portugal. Present from the infralittoral to around 100 m (van Soest *et al.* 2000). Recent Canadian records from the Bay of Fundy (Goodwin 2017). It has been recorded from debris on the shores of the northern Gulf of St. Lawrence but was not found in offshore captures (Nozères *et al.*, 2020). However, it has been recorded from trawl surveys in the southern Gulf of St Lawrence (Dinn 2020).

The sponge *Cladocroce spatula* may be confused with broadly branched specimens of *Haliclona oculata*, and specimens from the northern Gulf of St. Lawrence had previously been mis-identified as *H. oculata* (Dinn *et al.* 2020). We did not find *C. spatula* in shallow waters (SCUBA collection) but it was present in deeper water on the Scotian Shelf (Goodwin *et al.* In prep).

Remarks: The Latin name refers to the eyelike oscula. *Oculata* = eyes.

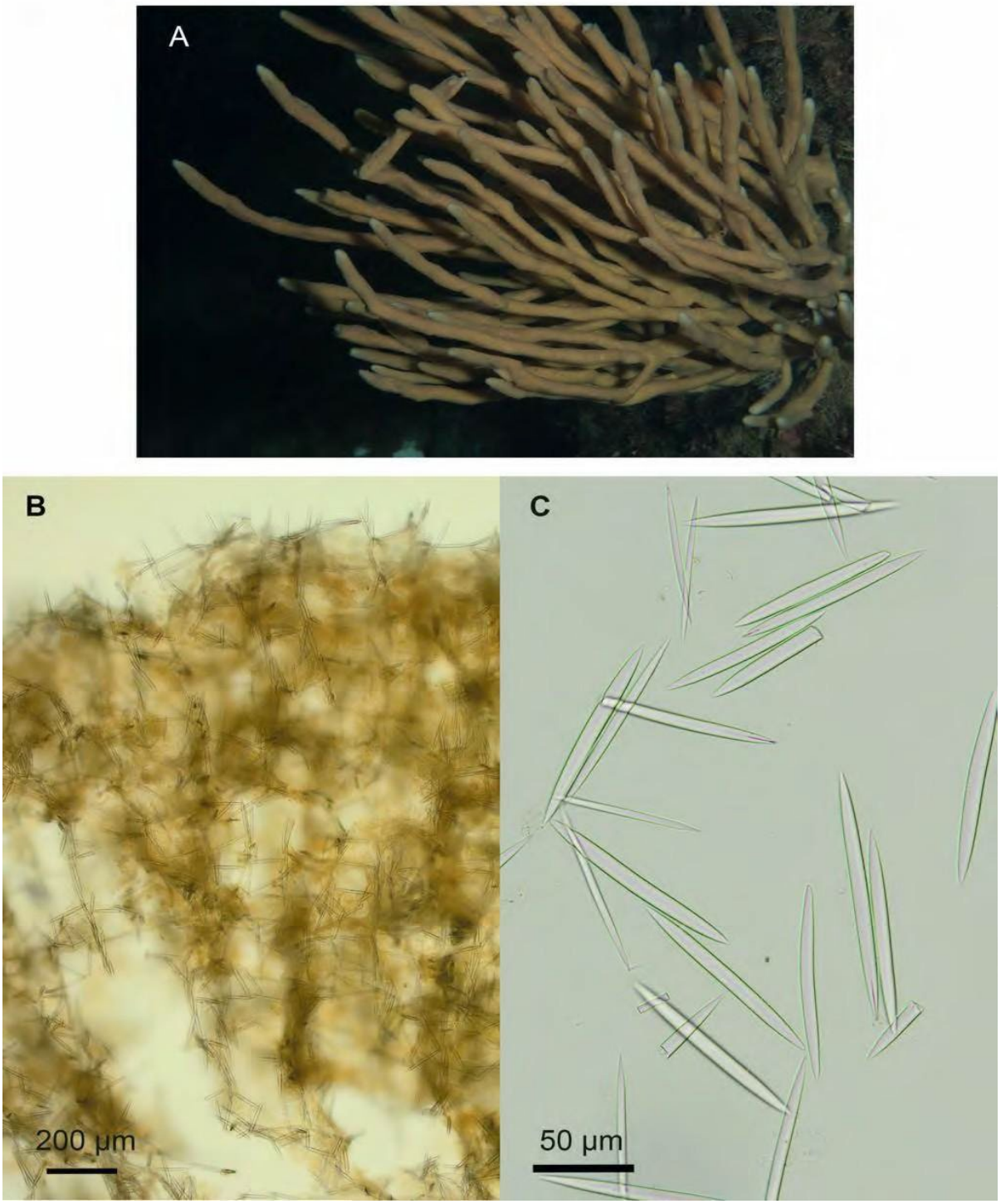


Figure 13. *Haliclona oculata* A. *In situ* appearance, specimen ARC 82033; B. Choanosomal skeleton; C. spicules, both specimen ARC 82149.

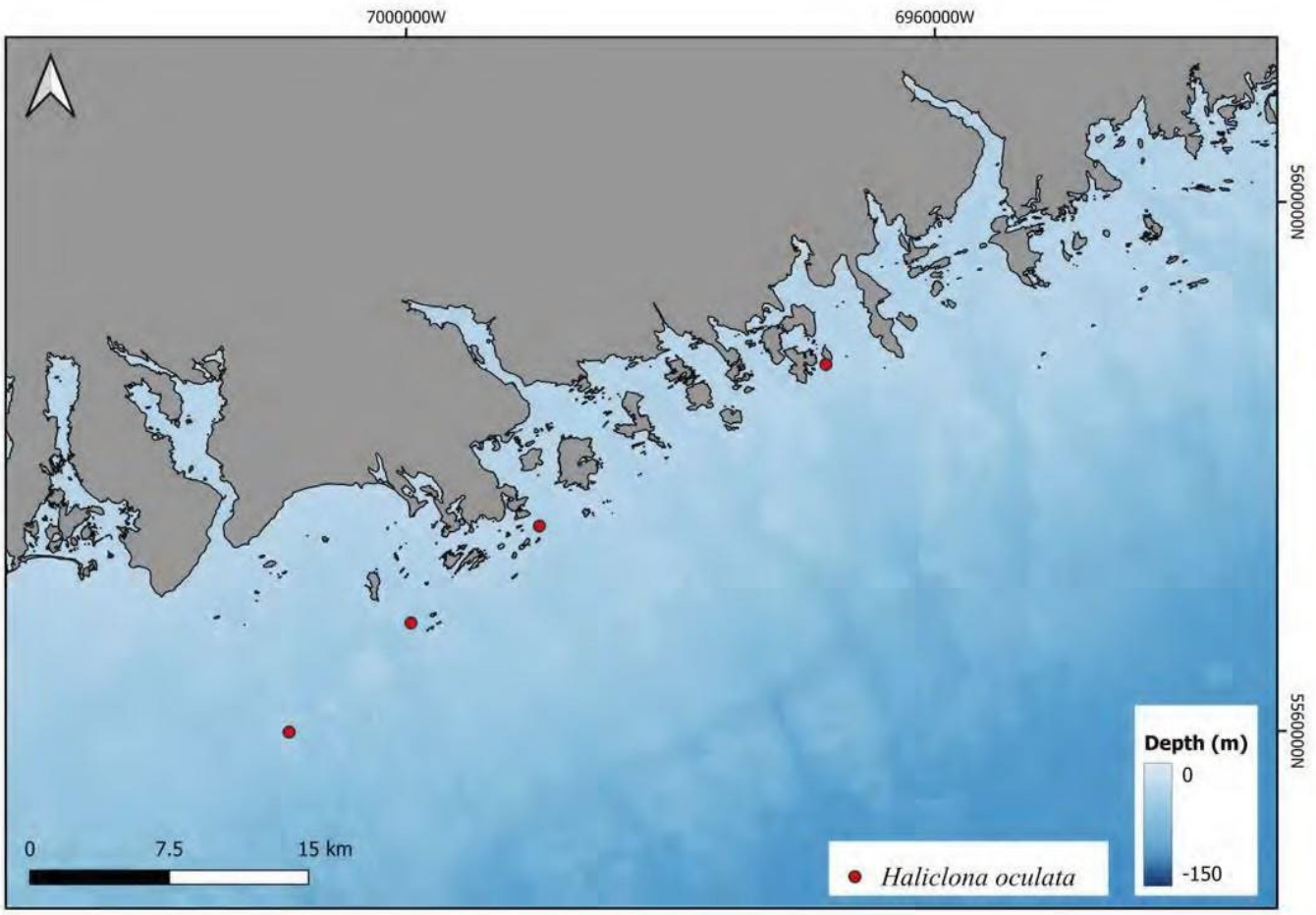


Figure 14. *Haliclona oculata* records from this survey.

5.4 THICKLY ENCRUSTING/MASSIVE

Iophon sp 1. Gray, 1867

APHIA ID: 131863 CLASS: Demospongiae ORDER: Poecilosclerida ; FAMILY: Acarnidae

External appearance (Fig. 15A)**:** Yellow crust on brachiopod. Channels, oscula and ostia visible on the surface of the sponge.

Skeleton (Fig. 15B): Choanosomal skeleton is a triangular meshed reticulation with ascending fibres of up to four acanthostyles connected by bundles of 2-4 acanthostyles. The ectosomal skeleton is formed of a palisade of tylotes lying tangentially to the sponge surface.

Spicules: Measurements from ARC 82148. Acanthostyles (Fig. 15C): 167(201)335 by 4(8)10 µm spined with small, sparse spines; Tylotes (Fig. 15D,E): 124(159)192 by 5(9)12 µm, ends oval and spined; Bipocilla (Fig. 15F): 8(9)10 µm with very small alae and teeth; Chelae (Fig. 15G) rare, around 10 µm.

Remarks: Recorded at three locations during this survey (Fig. 16), the *Iophon* species of the eastern coast of Canada require a complete taxonomic revision. There are possibly species new to science which require description from the Labrador Sea, Scotian Shelf (Claire Goodwin, unpublished data) and Bay of Fundy (Goodwin 2017). Confirming these requires revisiting the type material of all described species.

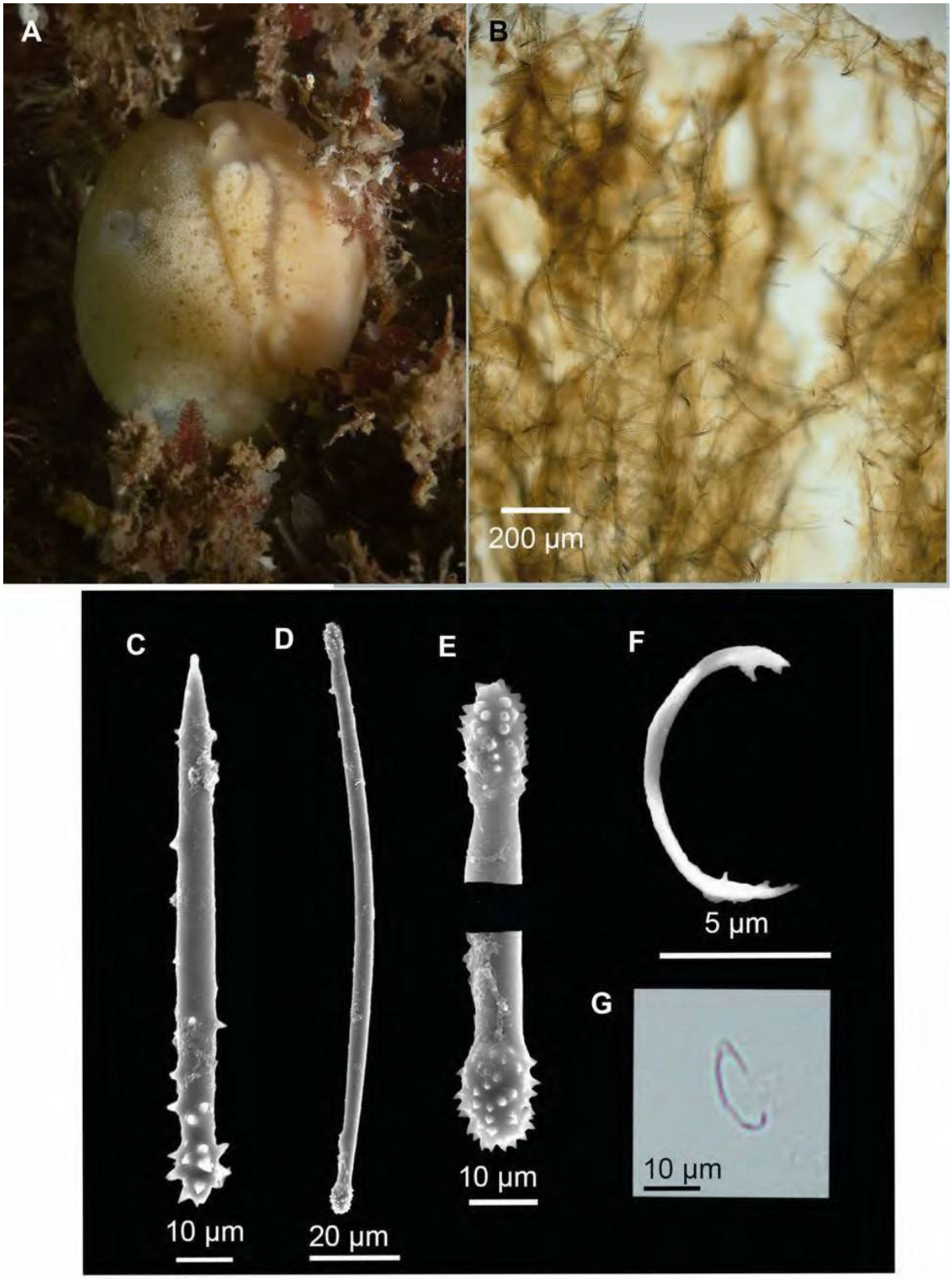


Figure 15. *Iophon* sp. 1. ARC 82148. A. *In situ* appearance (specimen growing on brachiopod shell); B. Skeleton; C. Acanthostyle; D. Tylote; E. Tylote ends; F. Bipocillum; G. Chela.

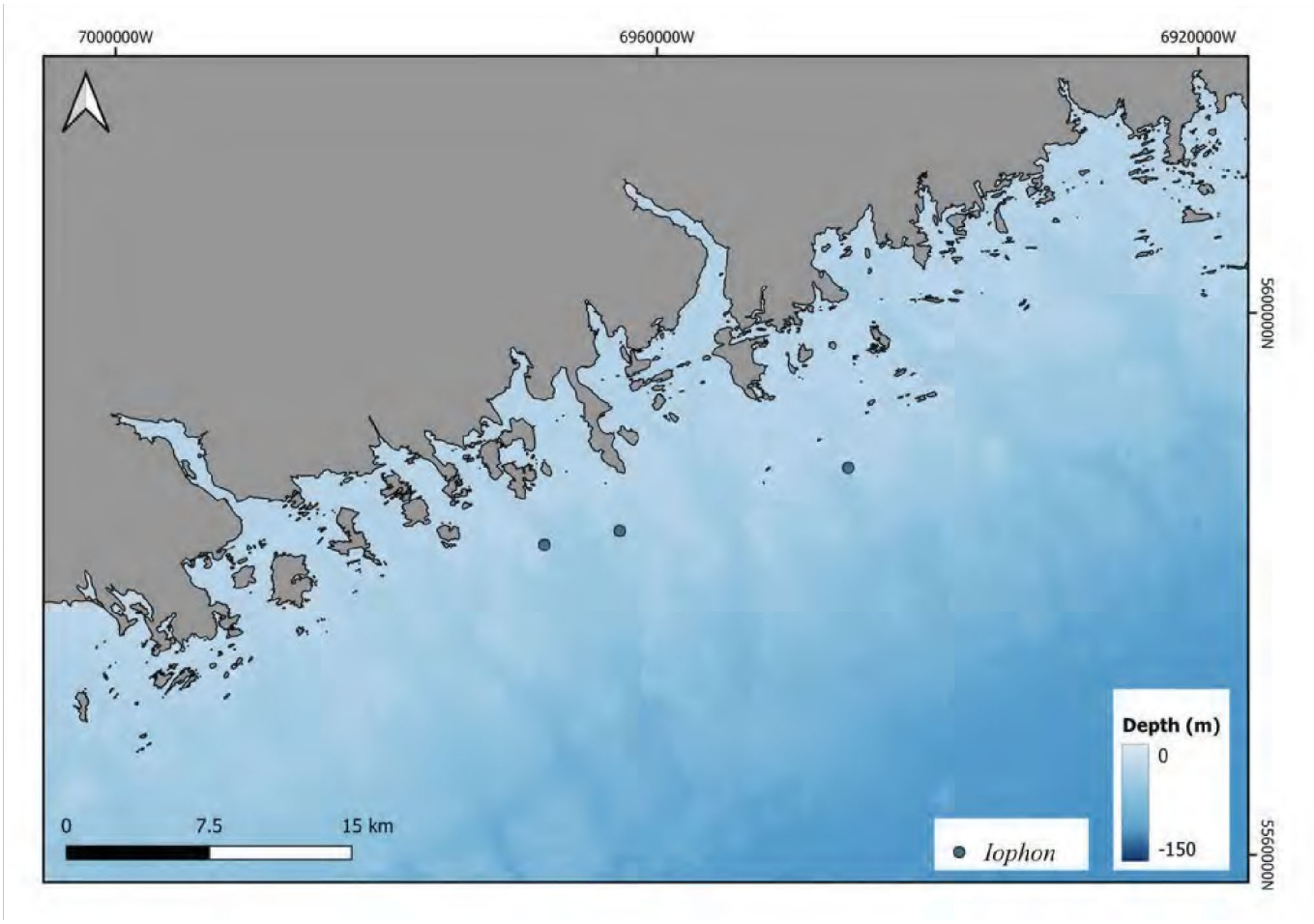


Figure 16. Records of *Iophon* sp from this survey.

Iophon sp 2. Gray, 1867

APHIA ID: 131863 CLASS: Demospongiae ORDER: Poecilosclerida; FAMILY: Acarnidae

External appearance (Fig. 17A): Yellow crust on brachiopod. Channels, oscula and ostia visible on the surface of the sponge.

Skeleton (Fig. 17B): The chonosomal skeleton is a triangular meshed reticulation. With ascending fibres of up to four acanthostyles connected by bundles of 2-4 acanthostyles. The ectosomal skeleton is formed of a palisade of tylotes lying tangentially to the sponge surface.

Spicules: Measurements from ARC 82179. Acanthostyles (Fig. 17C): 161(227)251 by 6(8)12 µm sparsely spined for their whole length; Tylotes (Fig. 17D, E): 129(184)217 by 4(6)8 µm slightly swollen ends, some oval, others more rounded, spined with small spines; Bipocilla (Fig. 17F) 6(9) 11 µm one larger and one smaller alae, both with large teeth; Palmate anisochelae (Fig. 17G): 11 (17)27 µm.

Remarks: Recorded at three locations during this survey (Fig. 16), the *Iophon* species of the eastern coast of Canada require a complete taxonomic revision. There are possibly species new to science which require description from the Labrador Sea, Scotian Shelf (Claire Goodwin, unpublished data) and Bay of Fundy (Goodwin, 2017). Confirming these requires revisiting the type material of all described species and would be aided by molecular sequencing, unfortunately this family is hard to sequence. The form of the bipocilla in these specimens was similar to *I.* cf*. koltuni* recorded in deeper water, however all spicule categories were smaller and only one category of chelae was present in *Iophon* sp. 2.



Figure 17. *Iophon* sp. 2. ARC 82179. A. *In situ* appearance (specimen growing on brachiopod shell); B. Skeleton; C. Acanthostyle; D. Tylote; E. Bipocilla; F. Bipocillum.

5.5 THINLY ENCRUSTING

Crellomima mehqisinpekonuta Goodwin, Dinn, Nefedova, Nijhof, Murillo & Nozères, 2021
APHIA ID: 1531932 CLASS: Demospongiae ORDER: Poecilosclerida; FAMILY: Crellidae

External appearance (Fig.18 A,B,C): Gold to bright orange, thinly encrusting sponge. Irregularly spaced oscula are surrounded by stellate channels. Between these, the entire surface is covered with small punctate pore sieves (<0.5 mm in diameter).

Skeleton (Fig. 18D): A layer of erect basal acanthostyles, heads down, echinate the substrate. Ascending columns of 15–20 tornotes fan out towards the surface, supporting a dense ectosomal crust of tangential acanthostyles. Chelae are scattered very sparsely throughout the tissue.

Spicules: ARC 82125: Basal acanthostyles (Fig. 18E): 136(164)208 by 8(9)11 µm. Heads not tylote. Spined with large spines, the smaller individuals are entirely spined, but the larger may be smooth or more sparsely spined at the tip; Ectosomal acanthostyles (Fig. 18H): 102(129)163 by 4(5)7 µm. Thin acanthostyles with an abrupt point. Entirely spined with large spines; Tornotes (Fig. 18F, G): 195(218)246 by 4(5)7 µm. Fusiform tornotes with uneven ends; Chelae (Fig. 18I) (rare) 19-25 µm. with 5–8 alae, the alae continue down the shaft, diminishing in size. The spicules correspond well to those found in the type specimen: Basal acanthostyles 152(166)192 µm by 8(14)18 µm; Ectosomal acanthostyles 120(138)188 by 5(5)6 µm; Tornotes 185(204)218 by 4(6)7 µm; Chelae 18(22)25 µm.

Distribution: The type location is Deer Island in the Bay of Fundy. There are other records from Brier Island in Nova Scotia (Goodwin *et al.* 2021). Records from the 2021 and 2022 SCUBA dive surveys of the ESI AOI (Fig. 19) extend its known distribution out of the Bay of Fundy onto the Scotian Shelf.

Remarks: Specimens from the Bay of Fundy, the type location, were all bright orange but some of the specimens from the Eastern Shore Islands were gold in colour. Spicule form and other characteristics were identical so we believe them to be conspecific.

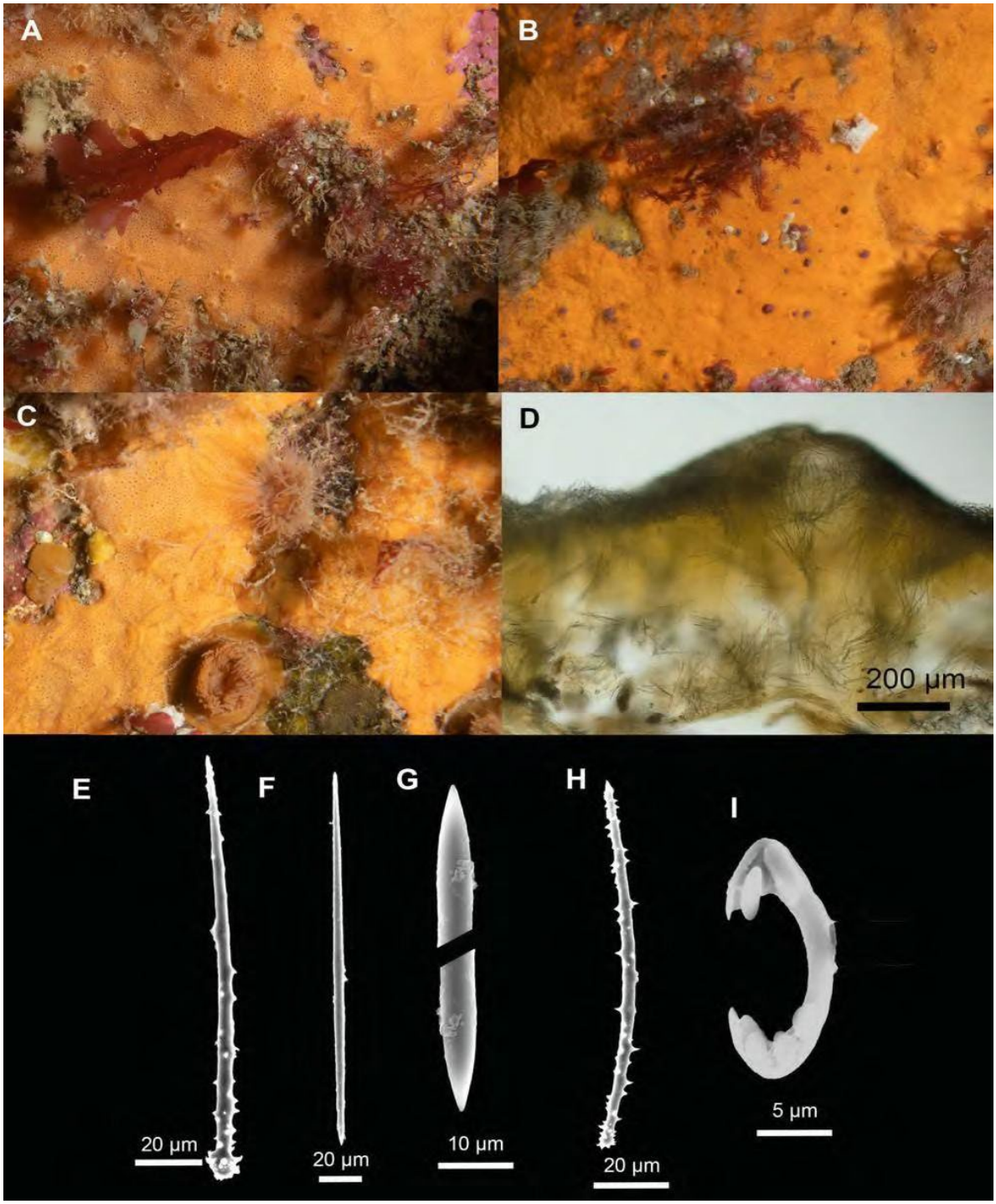


Figure 18. *Crellomima mehqisinpekonuta*: A. *In situ* appearance, specimen ARC 82075; B. *In situ* appearance, specimen ARC 82125; C. *In situ* appearance, specimen ARC 82047; D. Skeleton, specimen ARC 82125; Spicules all from ARC 82125, apart from ectosomal tornote, E. Basal acanthostyle; F. Tornote; G. Tornote ends; H. Ectosomal acanthostyle; I. Chela.

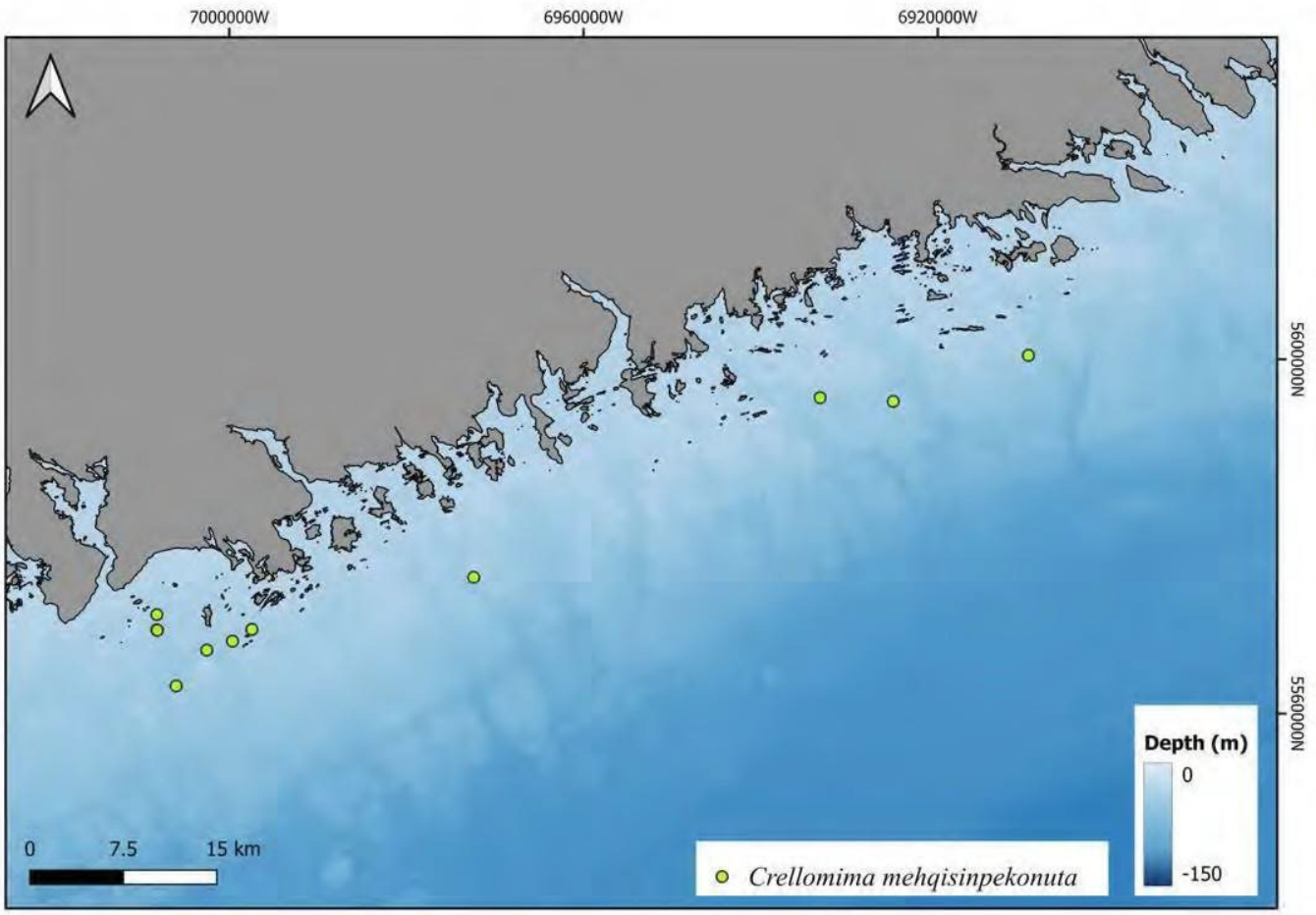


Figure 19. Records of *Crellomima mehqisinpekonuta* from this survey.

5.6 ENCRUSTING WITH PAPILLAE/THINLY ENCRUSTING

Amphilectus ovulum (Schmidt, 1870)

APHIA ID: 1424119 CLASS: Demospongiae ORDER: Poecilosclerida; FAMILY: Esperiopsidae

External appearance (Fig. 20A, B, C, D)**:** White to yellow encrusting sponge. Forms low lobes or small patches on bedrock. Typically 0.5-1 cm thick. There are prominent oscula scattered over the surface, often on low mounds and projections. The sponge surface in between these is punctate.
Skeleton (Fig. 20E): Plumo-reticulate. Ascending columns of 4-5 spicules joined by shorter bundles or individual spicules.
Spicules (Fig. 20F): Measurements from ARC 82076: Styles 150(164)179 by 19(21)2 µm; Palmate anisochelae 19(21)26 µm. Measurements from ARC 82154: Styles 151(173)206 by 6(6)8 µm; chelae 16(22)34 µm. These spicule dimensions from our specimens correspond well to those given in van Soest *et al.* (2000): Styles 145(190)230 µm (up to 310 µm in some specimens), widths of 2-4 and 7-10 µm (even 11 µm sometimes); Anisochelae 15-23 µm.
Distribution: The type locality of this species is in North Greenland. Found throughout the Russian Arctic and Okhotsk Sea (Koltun 1959), Faroe Plateau (Lundbeck 1905), Barents Sea, Northern Norway and Finnmark (Hentschel 1929), White Sea (Merejkowsky 1879) Southern Europe (Solórzano, 1990, van Soest *et al.* 2020). In Britain it is common on western coasts, particularly in the mouths of loughs and in estuaries (Ackers *et al.* 2007). In Canada there are records from the Bay of Fundy (Linkletter 1977) and the Gulf of St. Lawrence (Brunel *et al.* 1998; Nozères *et al.* 2020).
Remarks: *Amphilectus lobatus* (Montagu, 1814) is now regarded as a synonym. (van Soest *et al.* 2000) note that this species is typically found on weeds, hydroids, and erect bryozoans. Recorded at nine locations during this survey (Fig. 21), our specimens were usually encrusting bedrock.

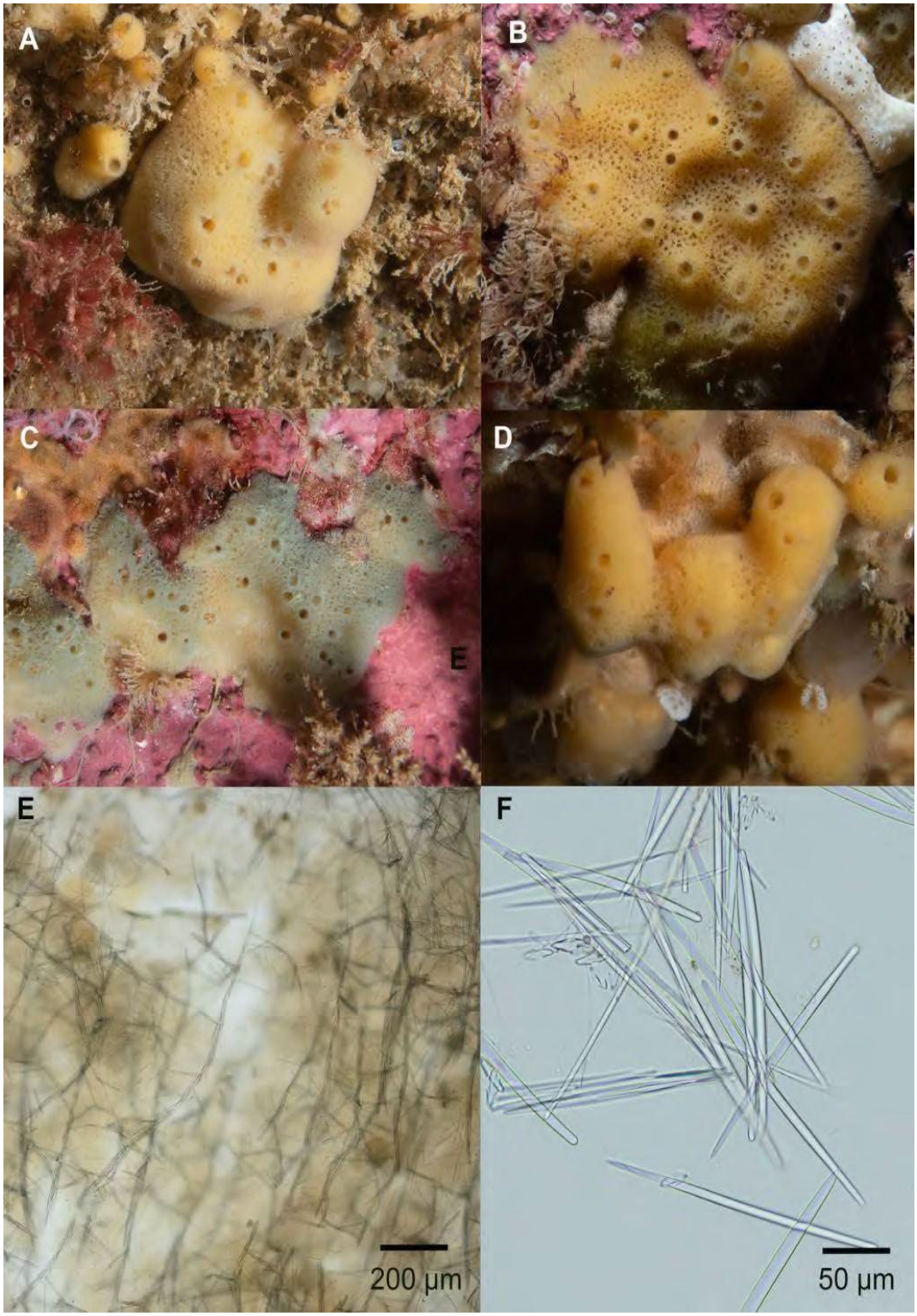


Figure 20. *Amphilectus ovulum*. *In situ* appearance. A. ARC 82076, B. ARC 82017, C. ARC 82154, D. ARC 82015; E. Choanosomal skeleton ARC 82076; F. Spicules ARC 82076.

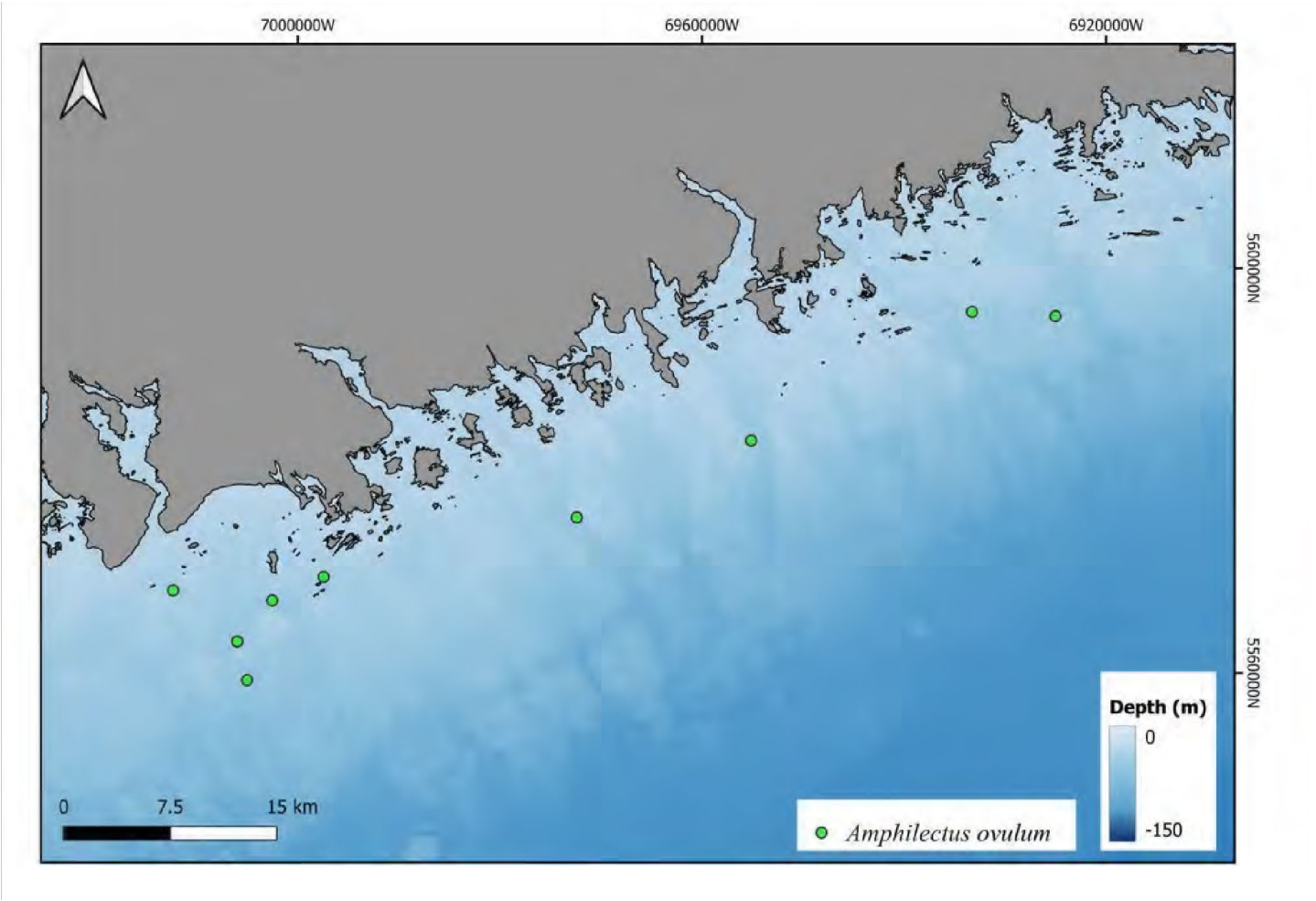


Figure 21. Records of *Amphilectus ovulum* from this survey.

Hymedesmia (Hymedesmia) jecusculum (Bowerbank, 1866)

APHIA ID: 133587 CLASS: Demospongiae ORDER: Poecilosclerida; FAMILY: Hymedesmiidae

External appearance (Fig. 22A, B): Bright red, thinly encrusting sponge that can form patches > 20 cm in diameter. Prominent pore sieves cover its surface.

Skeleton (Fig. 22C): Basal layer of large and small acanthostyles. Ascending columns of up to 15 ectosomal styles. Chelae scattered throughout the skeleton.

Spicules: Measurements from ARC 82039. Primary acanthostyles (Fig. 22E): 247(301)429 by 6 (7)9 µm. Spined with small spines. Head not tylote. Spines are more abundant at the head, but the tip is still lightly spined; Secondary acanthostyles (Fig. 22F): 95(120)159 by 8(8)10 µm, entirely spined, head tylote; Ectosomal styles (Fig. 22G): 210(250)306 by 3(4)6 µm. The majority of the ectosomal spicules are styles but there are some where the ends are more symmetrical (tylotes/ tornotes); Chelae (Fig. 22D): 19(24)28 µm, arcuate chelae. Some seem to have reduced alae.
Spicule size ranges are similar to those given by Ackers *et al.* (2007); van Soest *et al.* (2000) for European specimens: Primary acanthostyles 360 by 7.5 µm sparsely spined on their tip; Secondary acanthostyles: 120 by 5 µm; Ectosomal tornotes: 285 by 3.5 µm; Chelae: ca. 20 µm. However, they state that the ectosomal spicules are tornotes ‘symmetrical and pointed at both ends’.

Distribution: Recorded at 14 locations during this survey (Fig. 23), this is the most common *Hymedesmia* species on the west coast of Ireland and Scotland where it is frequently reported from bedrock and boulders, usually in waters deeper than 25 m (Ackers *et al.* 2007).

Remarks: *Hymedesmia canadensis* Ginn, Logan, Thomas and van Soest, 1988 is very similar in appearance to this species and is the most common *Hymedesmia* in the Bay of Fundy (Goodwin, 2017). However, it has larger spicules, the primary acanthostyles are only partially spined and has two forms of chelae, one with reduced alae (Measurements from the type specimen: Primary acanthostyles 340-440 by 7.5 µm spined mostly on head; Secondary acanthostyles 125-180 by 6µm; Tornotes: 260-370 by 5µm; and chelae: 25-37 µm).

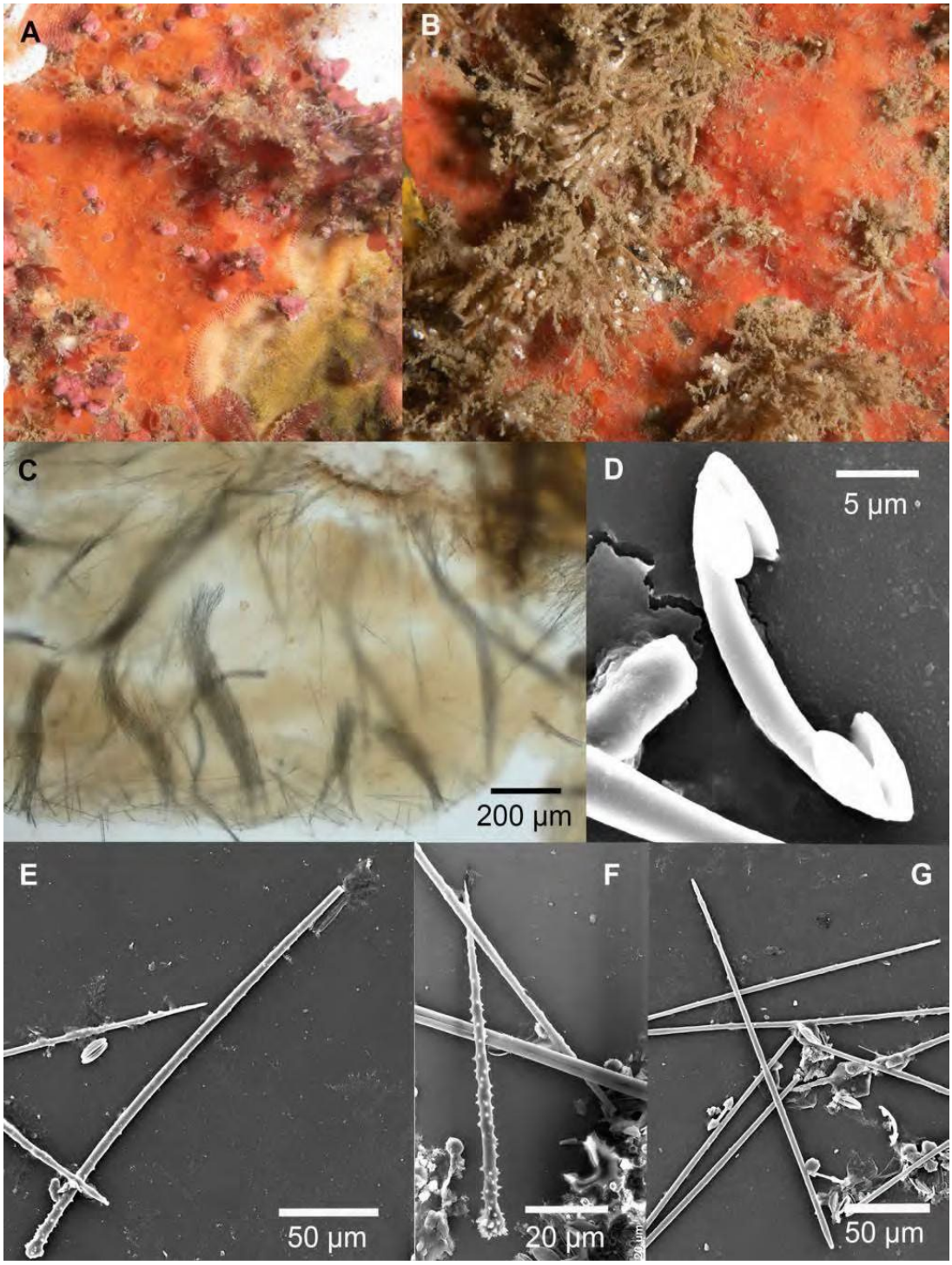


Figure 22. *Hymedesmia jecusculum* A. *In situ* appearance, specimen ARC 82039; B. *In situ* appearance, specimen ARC 82058; C. Skeleton, specimen ARC 82039; D. Chela; E. Primary acanthostyle; F. Secondary acanthostyle; G. Ectosomal style – all ARC 82058.

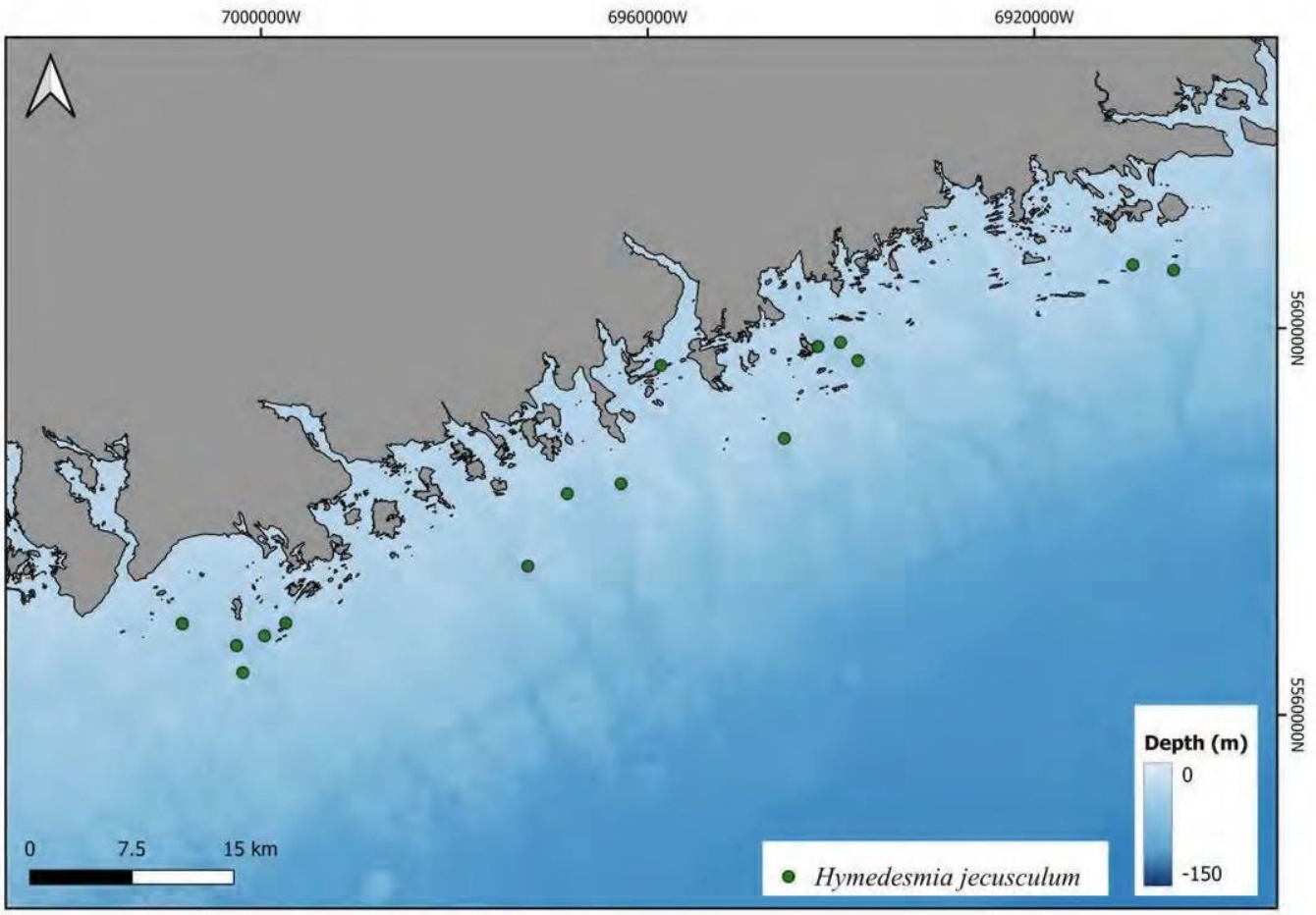


Figure 23. Records of *Hymedesmia jecusculum* from this survey.

Hymedesmia (Hymedesmia) sp. 1 Bowerbank, 1864

APHIA ID: 131950; CLASS: Demospongiae ORDER: Poecilosclerida; FAMILY: Hymedesmiidae

External appearance (Fig. 24A): Thinly encrusting, lemon yellow sponge. Patch around 10 cm in diameter. Pore sieves scattered over surface. Some sub-surface channels visible.

Skeleton: Hymedesmoid with a basal layer of acanthostyles and ascending columns of ectosomal styles 10-20 spicules wide, which fan out towards the surface.

Spicules: Measurements from ARC 82174. Primary acanthostyles (Fig. 24C): 228(291)364 by 4(5) 6 µm. Head not tylote but marked with larger spines. The spicules are entirely spined but the spines in the upper half are much finer and less numerous so it may appear on a first glance that they are smooth; Secondary acanthostyles (Fig. 24B): 117(144)167 by 3(5)7 µm. Head not tylote but marked with larger spines. Entirely spined but spines larger and more numerous on head and lower half of spicule; Ectosomal styles (Fig. 24D, E): 275(339)406 by 4(5)7 µm these are the majority of the ectosomal spicules. They have a subtylote head and either a sharply pointed or mucronate end. Some spicules are polytylote. Some shorter strongyles are present (194(225)258 by 5(7)9 µm), but less common, presumably modifications of the styles; Chelae (Fig. 24F): 22(30)33 µm gently curved shaft and relatively small alae.

Distribution: Only one specimen collected during this survey (Fig. 25).

Remarks: This appears to be distinct from described species of *Hymedesmia* and may be new to science.

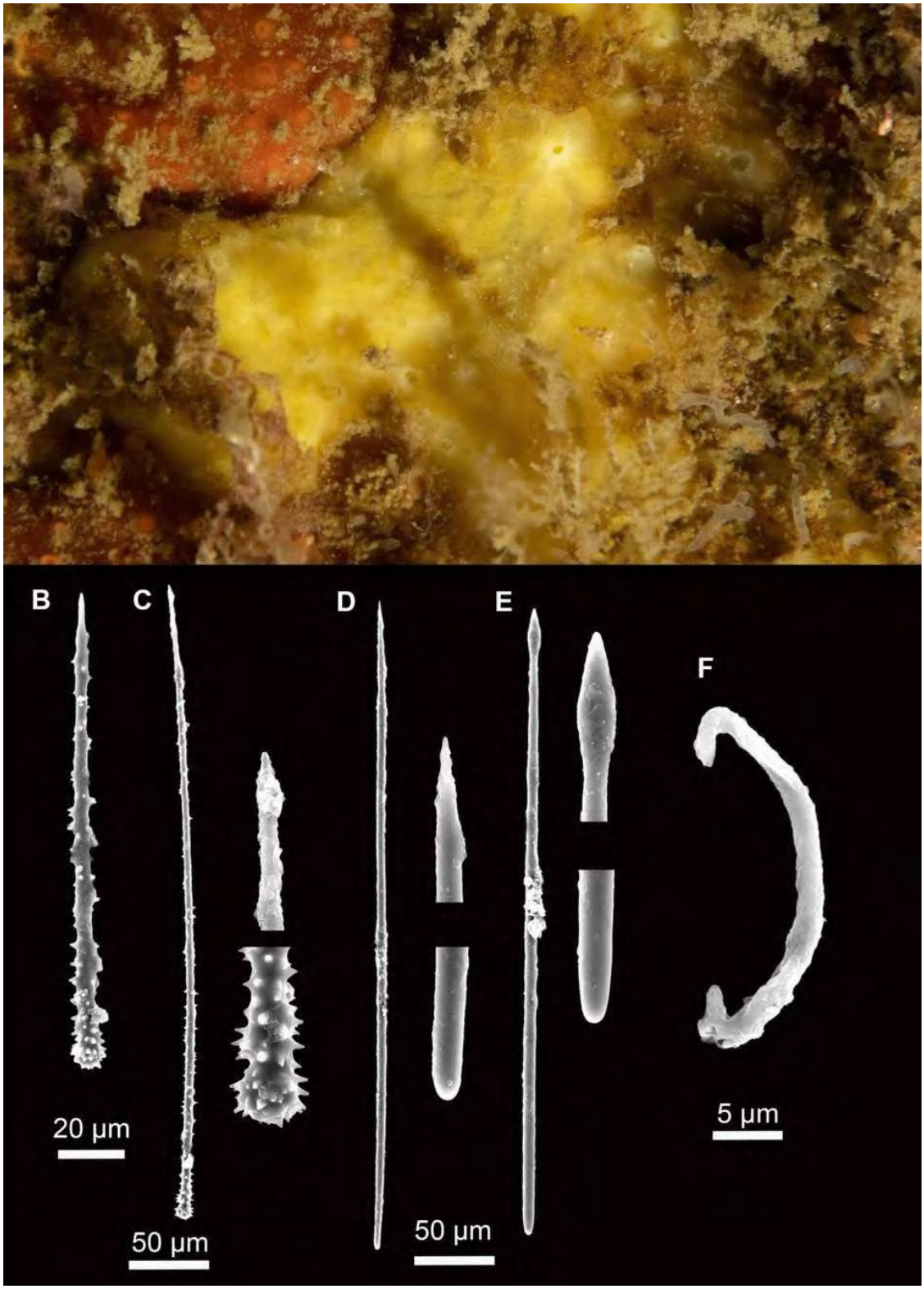


Figure 24. *Hymedesmia* sp 1. A. *In situ* appearance, specimen ARC 82174; B. Secondary acanthostyle; C. Primary acanthostyle; D, E. Ectosomal style; F. Chelae, all ARC 82174.

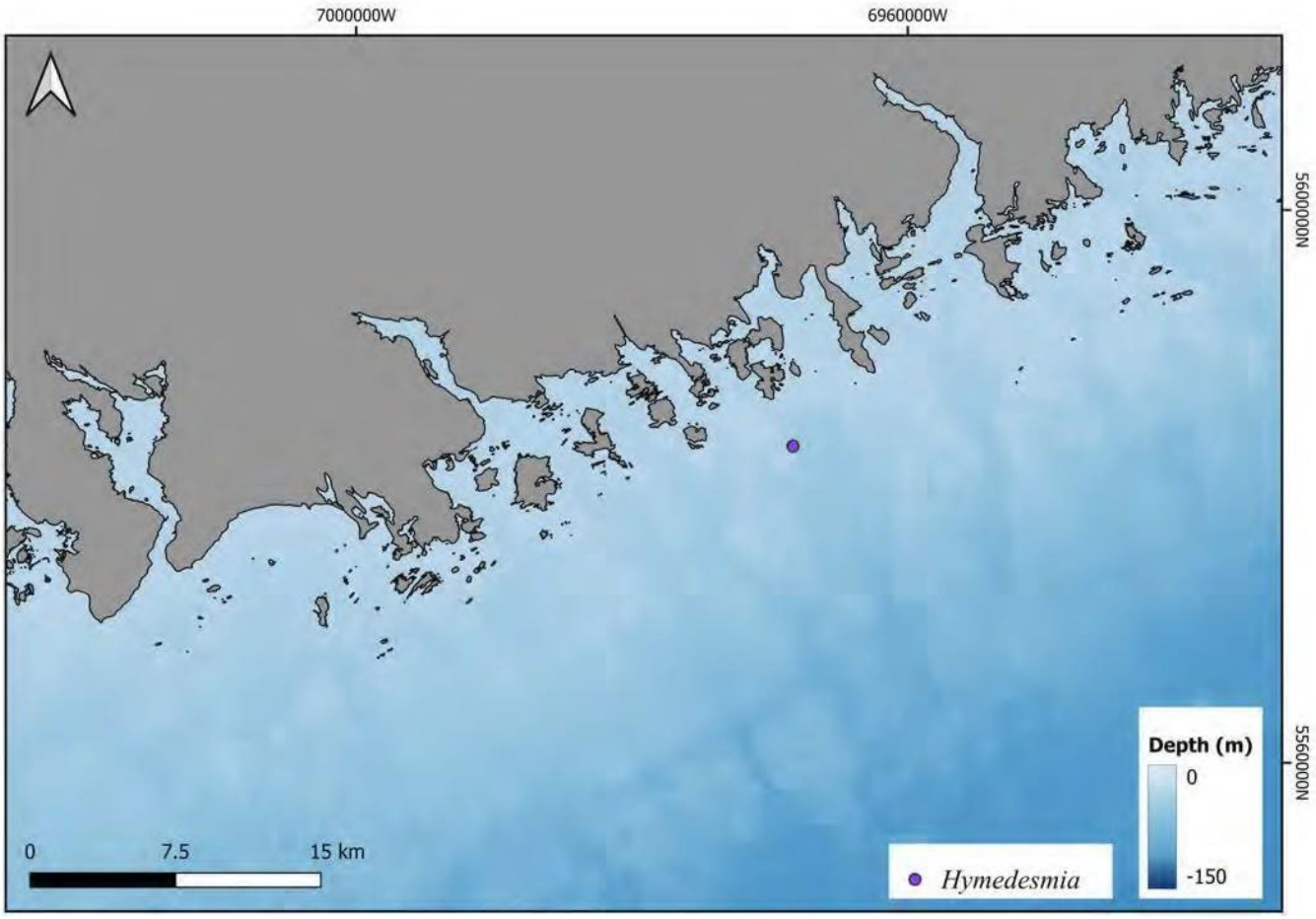


Figure 25. Records of Hymedesmia sp. 1 from this survey.

Hymedesmia (Hymedesmia) stellifera Goodwin & Picton, 2009

APHIA ID: 133587 CLASS: Demospongiae ORDER: Poecilosclerida; FAMILY: Hymedesmiidae

External appearance (Fig. 26A,B,C): Bright yellow/orange sponge forming large patches (over 20 cm in diameter), which are very conspicuous because of their bright colour and oscule form. Prominent oscula are surrounded by numerous (10–20) oscular channels, some of which are branched. The oscula are regularly spread over the sponge surface and are arranged in diamonds. The ends of the oscular channels touch those of neighbouring oscula, giving the surface a regular star-type pattern.

Skeleton (Fig. 26D): Basal layer of large and small acanthostyles, from which ectosomal spicules arise in columns that are 10–15 spicules thick. The smaller acanthostyles are more abundant. Sigmas are very abundant throughout the tissue. Chelae are present in certain regions of the sponge but may not be apparent in some specimens. Where present, they are reasonably common and form a layer at the surface.

Spicules: Measurements from ARC 82130. Large acanthostyles (Fig. 26E) 237(321)419 by 7(8)12 µm. Fusiform acanthostyles with a tylote head. The shaft is smooth, and the head is sparsely spined with small, rounded spines; Small acanthostyles (Fig. 26F): 89(105)127 by 6(8)11 µm. Taper evenly to a sharp point, with no development of the head. The majority of the shaft is spined with large spines, but the last eighth to one-quarter, towards the tip, is smooth, and there are smooth areas on the shaft above the head; Ectosomal styles (Fig. 26G, H): 210(237)252 by 13(15)17 µm. Fusiform, one end is rounded and tylote, and the other end is pointed; some are mucronate at the tip; Chelae (Fig. 26I): 16(18)21 µm, small chelae, with leaf-like alae, only joined to the shaft by a short section at the top. The alae have a claw-like appearance when viewed under the light microscope; Sigmata: 13(15)17 µm. The dimensions and form of spicules correspond well to the holotype – large acanthostyles 265(358)440 by 8-12 µm; Small acanthostyles 65(79)95 by 8-10 µm; Ectosomal styles: 210(247)290 by 8-10 µm; Chelae: 15-18 µm. Sigmata 10-12 µm.

Distribution: The type location for this species is Rathlin Island, Northern Ireland (UK), with paratypes from the Maidens, Northern Ireland, and the Firth of Lorne in western Scotland. It hasn't been recorded elsewhere since its description. The records from the Eastern Shore Islands (Fig. 27) extend its range across the north Atlantic to Canada. It was very common in the Eastern Shore Islands.

Remarks: This species was very common in the Eastern Shore Islands. It is rare in the UK, from where it was initially described (Goodwin and Picton 2009). It may be an Arctic species, and on the southern end of its range in the United Kingdom. This pattern would be similar to the distribution of

other Arctic-boreal sponge species. There has been little work done on encrusting sponges in eastern Canada, so, despite being very common, it is not surprising it wasn't previously recorded. Encrusting sponges are challenging to collect by remote methods such as dredging and trawling. SCUBA surveys often reveal additional species (e.g. Ginn *et al.* 1998; Picton and Goodwin 2007; Vacelet and Perez 1998).

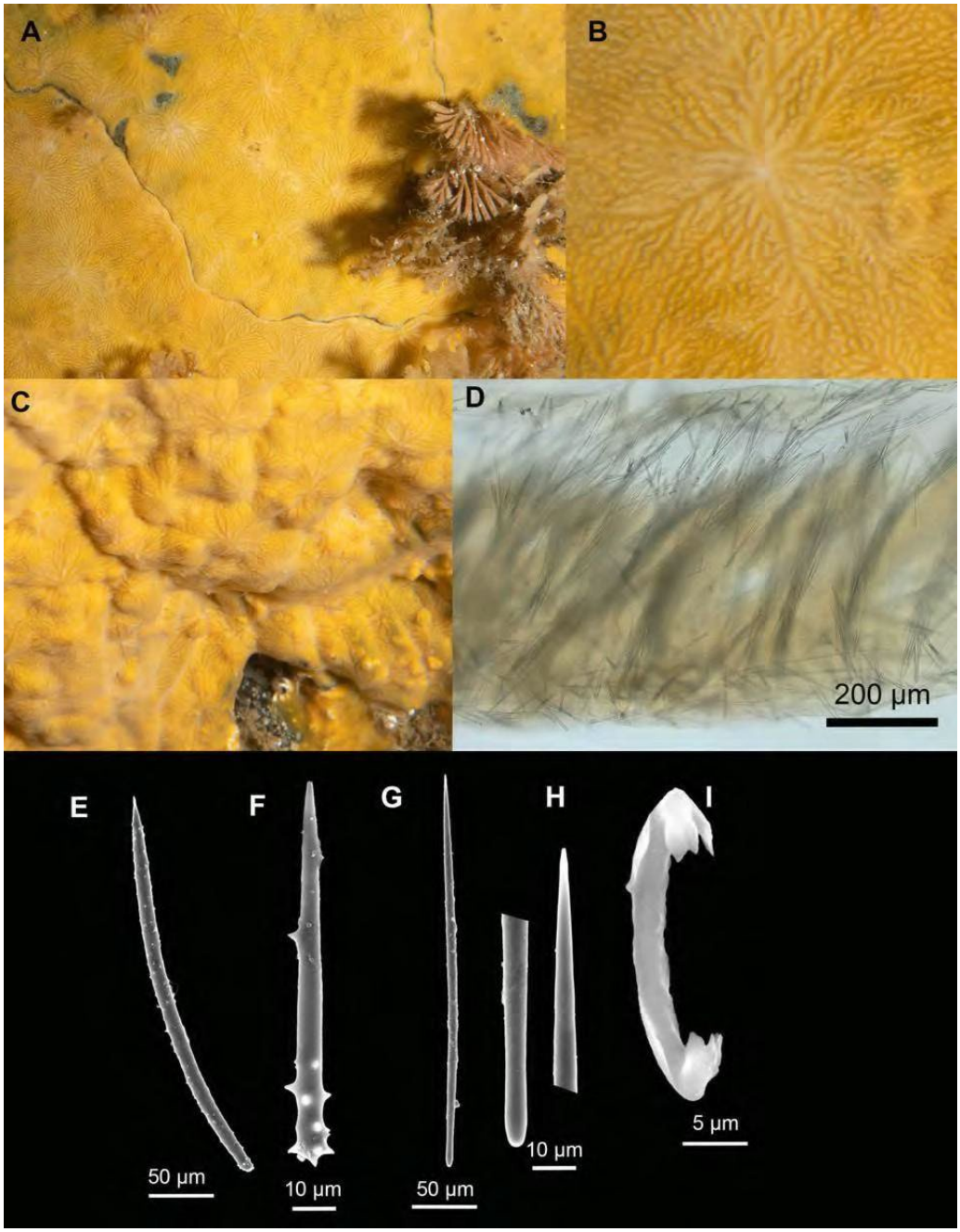


Figure 26. *Hymedesmia stellifera* A. *In situ* appearance, specimen ARC 82143; B. *In situ* appearance, close up of stellate channels around oscule specimen ARC 82143; C. *In situ* appearance, specimen ARC 82057; D. Skeleton, specimen ARC 82143, Spicules all from ARC 82143; E. Primary acanthostyle; F. Secondary acanthostyle; G. Ectosomal style; H. Ectosomal style ends; I. Chelae. Note sigma not pictured.

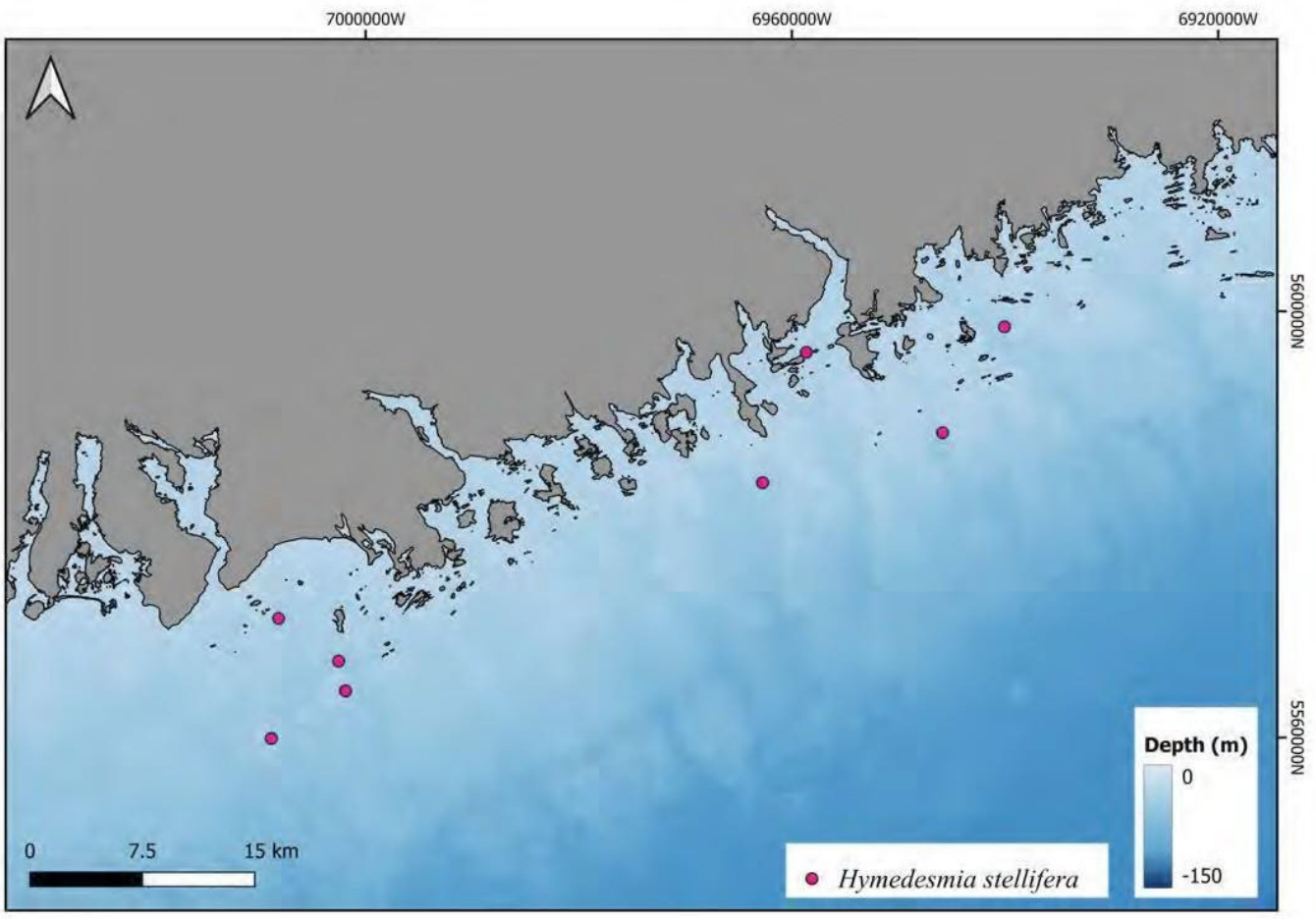


Figure 27. Records of *Hymedesmia stellifera* from this survey.

5.7 THICKLY ENCRUSTING/FINGER-SHAPED

Isodictya deichmannae (de Laubenfels, 1949)

APHIA ID: ; CLASS: Demospongiae; ORDER: Poecilosclerida; FAMILY: Isodictyidae

External appearance (Fig. 28A,B,D): Bright orange sponge. Form varied from thickly encrusting sheet to finger-like projections and rounded lobes. All specimens had irregularly scattered large oscula and the tissue in between these was punctate. The surface of the sponge is slightly hispid. The type description states this species can be massive to lamellate with digitate projections.

Skeleton (Fig. 28C): The skeleton is a fairly neat reticulation of ascending spicule columns joined by shorter columns of the same or thinner width. There is no specialised ectosomal skeleton but the ends of the ascending fibres project, causing the hispid surface. There are some free spicules in between the columns, particularly further away from the sponge surface.

Spicules: Measurements from ARC 82115. Styles (Fig. 28E): 145(175)205 by 5(9)11 µm; Palmate isochelae (Fig. 28F): 19(22)24 µm. Measurements in the type description are given as styles 150 by 6 µm and chelae 21 µm.

Distribution: Recorded at five locations during this survey (Fig. 29), this species was originally described from specimens found near Woods Hole, MA. Distributed over the east coast of North America from New England to the Gulf of Saint Lawrence (Forster *et al.* 2004).

Remarks: This species may be conspecific with the European species *Isodictya palmata* (Ellis and Solander, 1786, van Soest *et al.* 2000). *I. palmata* has styles 130-265 by 4-17 µm as the main megascleres and chelae 17-35 µm. Van Soest *et al.* (2000) suggested this on the basis that specimens bearing styles and oxea occur sympatrically and the habit and chelae are identical. Our specimens of *I. palmata* found in deeper water all had oxea, which were larger than the styles found in our specimens of *I. deichmannae* and significantly larger chelae (2638 µm). They also appeared to be beige in colour rather than the bright orange typical of *I. deichmannae.* Although the two may occur sympatrically, in our opinion these are good distinguishing characters. However, we plan to obtain molecular sequences to confirm this.

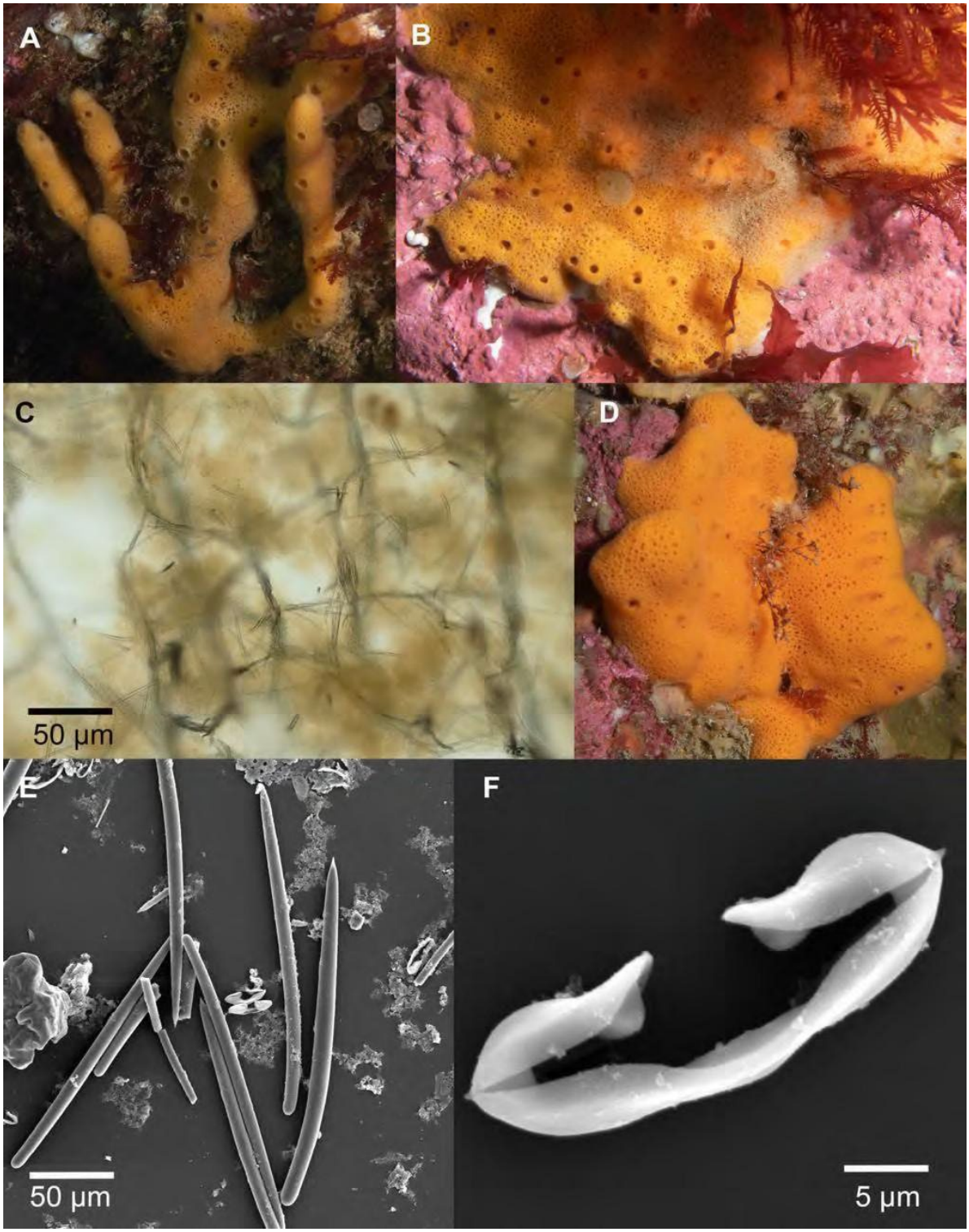


Figure 28. *Isodictya deichmannae* A. *In situ* appearance, specimen ARC 82115; B. *In situ* appearance, specimen ARC 82116; C. Skeleton, specimen ARC 82115; D. *In situ* appearance, specimen ARC 82082; E. Spicules, Specimen ARC 82115; F. Chela.

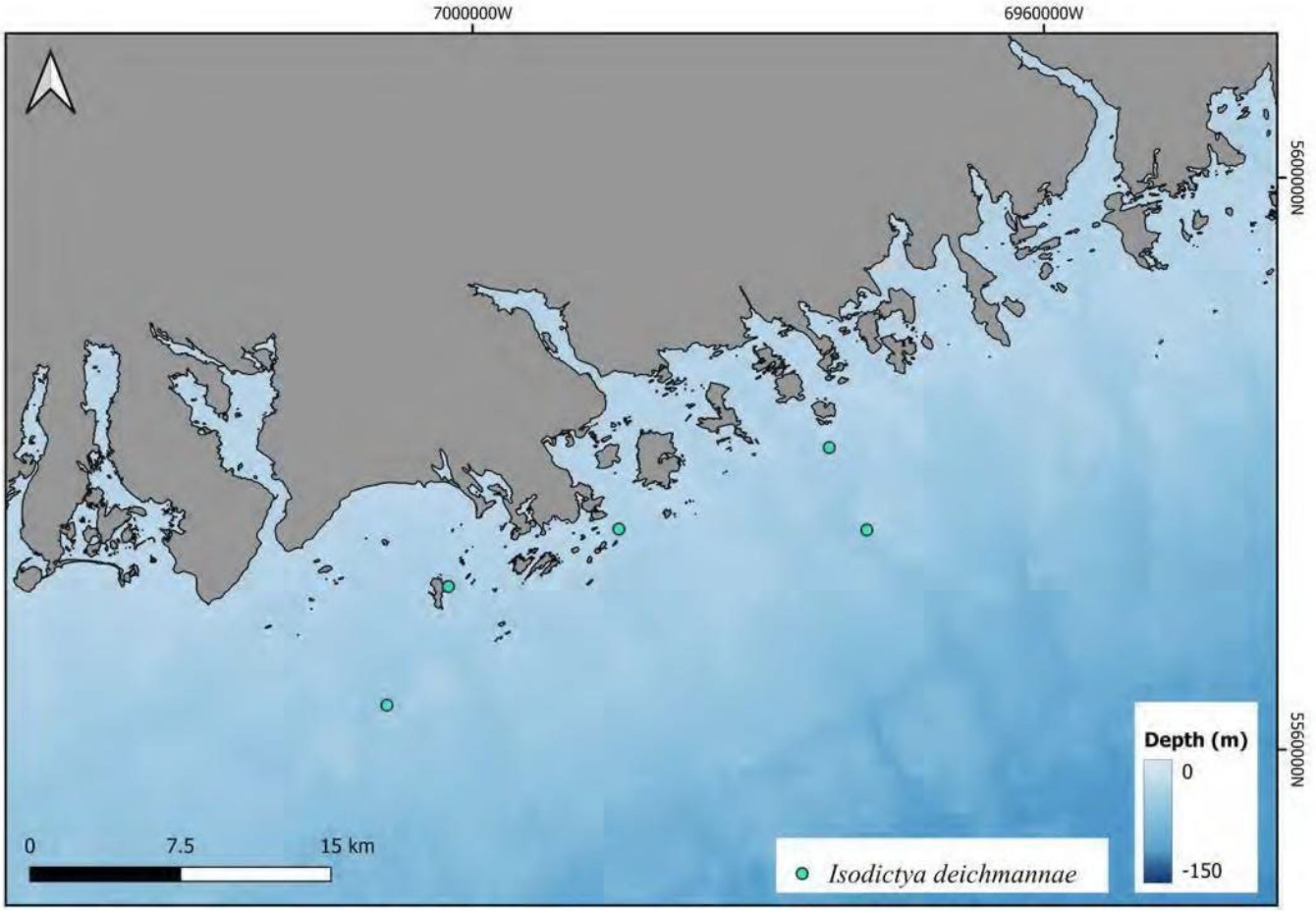


Figure 29. Records of *Isodictya deichmannae* from this survey.

5.8 THICKLY ENCRUSTING/MASSIVE

Myxilla fimbriata (Bowerbank, 1866)

APHIA ID: 169461; CLASS: Demospongiae; ORDER: Poecilosclerida; FAMILY: Myxillidae

External appearance (Fig. 30A, D): Bright orange sponge forming low, thick cushions or mounds. Large oscula (up to 10 mm in diameter) are sparsely scattered across the surface and sub-surface spaces and are visible through the ectosomal membrane, giving the sponge a punctate appearance. When preserved in alcohol the tissue turns a dark chocolate brown and shipboard specimens are also a dark brown colour (Fig. 30B).

Skeleton (Fig. 30C): The choanosomal skeleton is a regular reticulation of acanthostyles. The ectosomal skeleton is formed of a tangential layer of tornotes.

Spicules (Fig. 30E): Measurements from ARC 82167. Acanthostyles: 189(253)329 by 7(9)13 µm sparsely spined; Tornotes: 173(209)252 by 6(7)9 µm. Abruptly pointed ends, often mucronate; Chelae (Fig. 30F): 21(24)27 µm spatuliferous anchorate chelae. These have the fimbriae which are distinctive for the species. A second category of larger chelae 60-70 µm in length was found in some specimens. These were rare and not found in other specimens; Sigmata: Not recorded. The spicule form and sizes recorded are a good match for that given by Van Soest *et al.* (2000): Acanthostyles: 265-300-350 µm; Tornotes: 265-300-350 µm; Chelae: 27 and 60 µm (two size classes). The tornotes are smaller in our specimens, as reported from the Bay of Fundy (Goodwin, 2017).

Distribution: Very common on the Scotian Shelf and Eastern Shore and recorded at 23 locations during this survey (Fig. 31). Elsewhere in eastern Canada it is also common in the Quoddy Region of the Bay of Fundy (Ginn 1997; Goodwin 2017) and has been recorded from Cobscook Bay, Maine (Trott 2004), Mount Desert, Maine (Procter 1933). However, it was not recorded during surveys of the Gulf of St. Lawrence (Dinn 2020; Dinn and Leys 2018; Nozères *et al.* 2020). This species is present in the Atlantic and Arctic (Baker *et al.* 2018a, 2018b), and has been found in the Faroes, Norway, Sweden, Northern France and the British Isles in north-eastern Europe (Van Soest *et al.* 2000). There are also records from Greenland and Iceland (Lundbeck 1905) and Baffin Bay to the Davis Strait (Fristedt 1887).

Remarks: The Latin species name refers to the visible fimbriae of the large anchorate chelae.

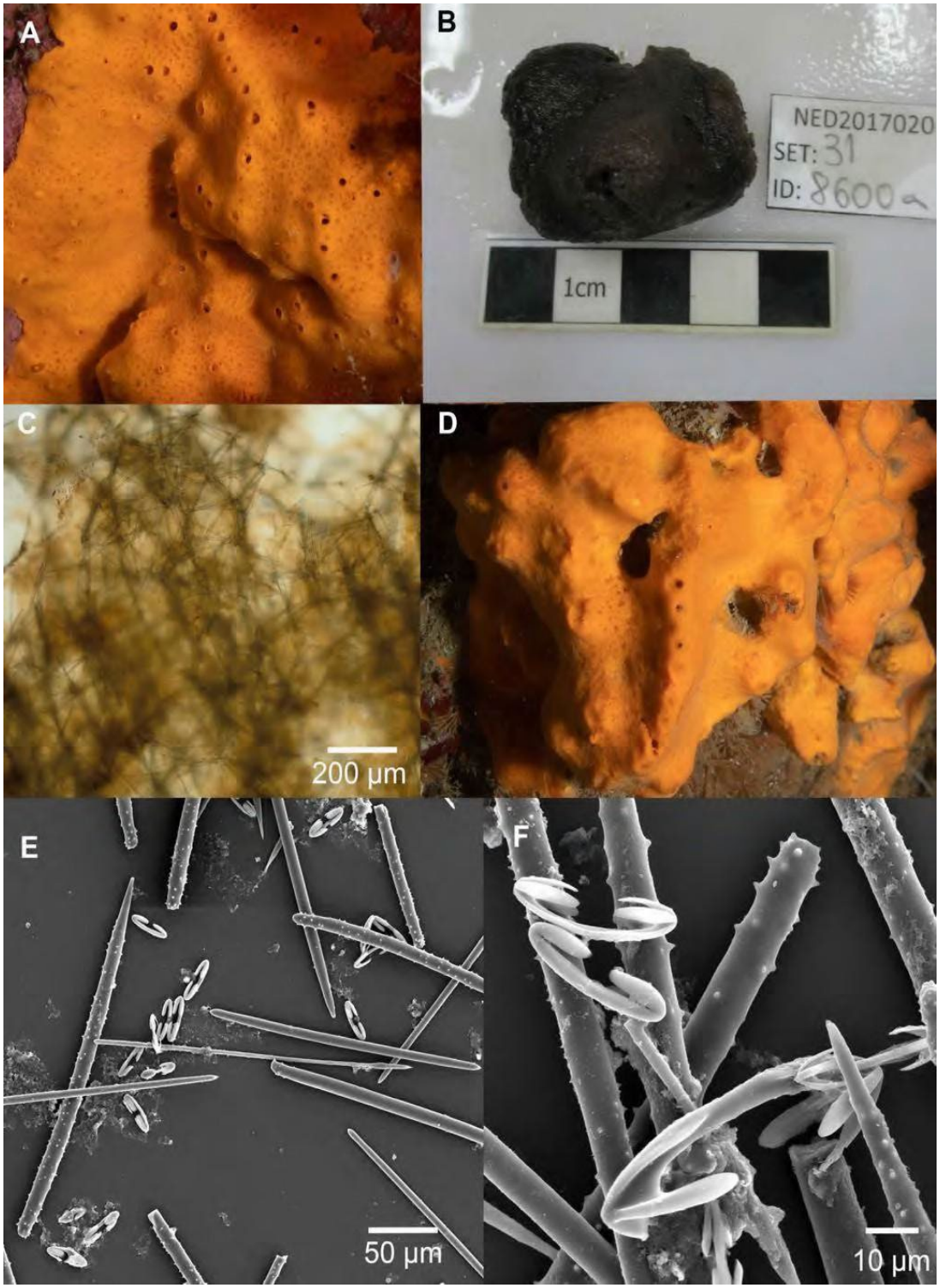


Figure 30. *Myxilla fimbriata* A. *In situ* appearance, specimen ARC 82111; B. Preserved appearance, specimen ARC 82167; C. Skeleton, specimen ARC 82141; D. *In situ* appearance, E. Spicules, specimen ARC 82107; F. Close up of chelae, specimen ARC 82107.

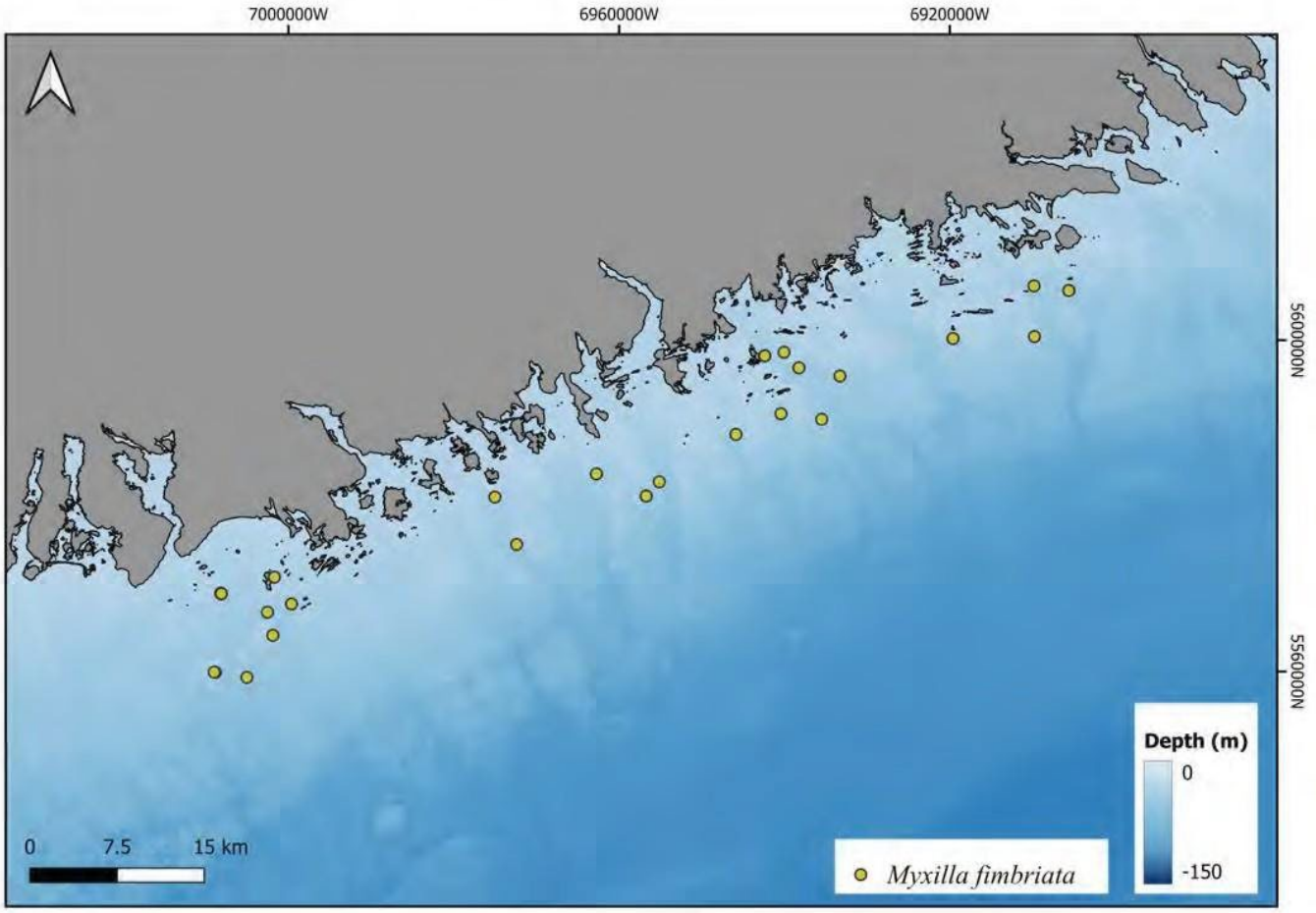


Figure 31. Records of *Myxilla fimbriata* from this survey.

5.9 THINLY ENCRUSTING

Plocamiancora arndti Alander, 1942

APHIA ID: 133902; CLASS: Demospongiae; ORDER: Poecilosclerida; FAMILY: Myxillidae

External appearance (Fig. 32A): Bright orange, thinly encrusting sponge forming a patch around 15 cm maximum diameter.

Skeleton: Basal skeleton consists of a layer of acanthostrongyles on which the upright acanthostyles of the main skeleton rest with their head on the acanthostrongyles. A dermal skeleton is formed of bundles of tornotes which ascend to the ectosome.

Spicules: Primary acanthostyles (Fig. 32B): 263(393)524 by 4(6)9 µm – spined at head only; Secondary acanthostyles (Fig. 32C): 139(190)236 by 5(7)8 µm – entirely spined; Basal acanthostrongyles (Fig. 32D): 102(134)155 by 4(6)8 µm; Ectosomal tornotes (Fig. 32E, F): 234(297) 338 by 3(4)5 µm – mucronate ends; Chelae (Fig. 32G): 43(50)59 µm - large isochelae.

Good match for the type specimen which has basal acanthostrongyles 135-165 by 7-8 µm; Acanthostyles 160-450 by 8-11 µm (larger ones are smooth at apex); Ectosomal tornotes 160-300 by 4-6 µm; and large tridentate isochelae 50-60 µm.

Distribution: Recorded at one location during this survey (Fig. 33), the type locality of this species is in the North Sea, off Jomfruland, Sweden (Alander 1942). It has also been recorded from the Maidens in North Channel in the UK (Goodwin *et al.* 2011).



Figure 32. ARC 82204 *Plocamiancora arndti.* A. *In situ* appearance; B. Large acanthostyle; C. Small acanthostyle; D. Acanthostrongyle; E. Ectosomal tornote; F. Ectosomal tornote ends; G. Chela.

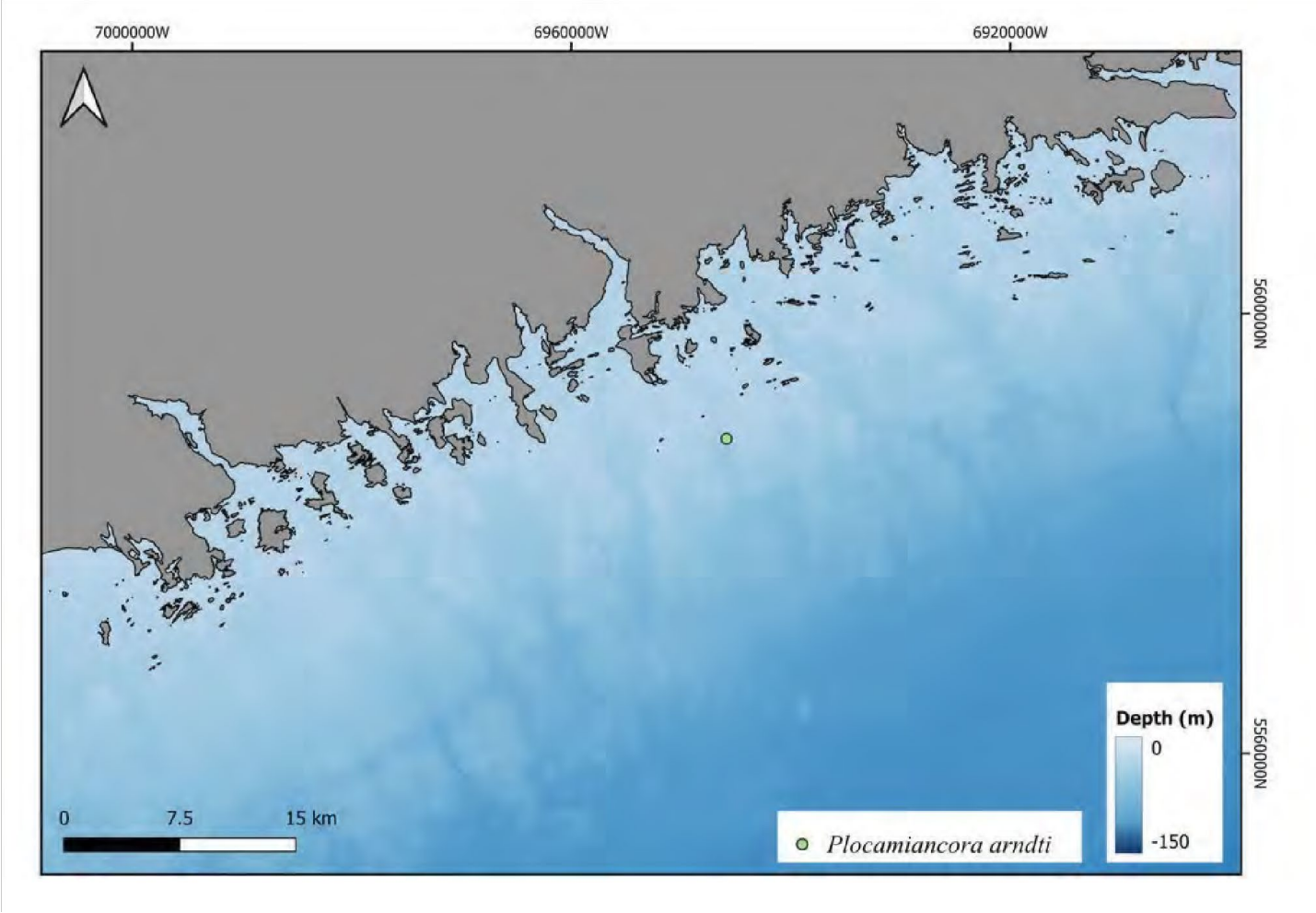


Figure 33. Records of *Plocamiancora arndti* from this survey.

5.10 ENCRUSTING WITH PAPILLAE/CUSHION WITH PROJECTIONS

Polymastia uberrima (Schmidt, 1870)

APHIA ID: 134214; CLASS: Demospongiae; ORDER: Polymastiida; FAMILY: Polymastiidae

External appearance (Fig. 34A): Smooth (apart from marginal collar), custard yellow, cushion with many conical papillae. There is a brown, hispid, margin collar around the edge of the sponge.

Skeleton (Fig. 34B): Choanosomal skeleton with thick ascending tracts of largest tylostyles. The auxiliary choanosomal skeleton is composed of bundles of the intermediate tylostyles, the cortex consists of a palisade of the smallest tylostyles.

Spicules (Fig. 34C): Measurements from ARC 82146. Tylostyles in three size categories: Large tylostyles: 884(1088)1297 by 13(21)30 µm; Intermediate tylostyles: 365(455)546 by 7(11)14 µm; Small tylostyles (ectosomal): 166(204)245 by 6(8)13 µm. These sizes are a good match for those reported by (Plotkin *et al.* 2018) for this species: Large styles: 715 (1409)1889 by 11(23)30 µm, Intermediate styles: 381 (550) 706 by 7(12) 17 µm, Small styles: 153(218)327 by 3(6)9 µm.

Distribution: The holotype location is Iceland. Leucotype designated by (Plotkin *et al.* 2018) from south-east of Halifax, described as *Polymastia infrapilosa* Topsent, 1927. Recorded at one location during this survey (Fig. 35), this species has been recorded from Nova Scotia, Labrador, SW Greenland/Davis Strait, Iceland, north-east Atlantic, Norwegian Sea, Barents Sea, Norway, Svalbard, Finland, Russia, and offshore Arctic Ocean (Plotkin *et al.* 2018). There are other recent Canadian records from the Gulf of St. Lawrence (Dinn 2020), and eastern Arctic (Dinn and Leys 2018).

Remarks: This species is similar to *Polymastia thielei* Koltun, 1964 but can be distinguished by the presence of a marginal hispid collar, which is lacking in *P. thielei*. This collar is sometimes lost in dredged specimens, making identification difficult, but there are also differences in skeletal architecture and genetic sequences (Plotkin *et al.* 2018). Plotkin notes depth ranges of 31-700 m, so our dive collected specimen extends this into slightly shallower water.

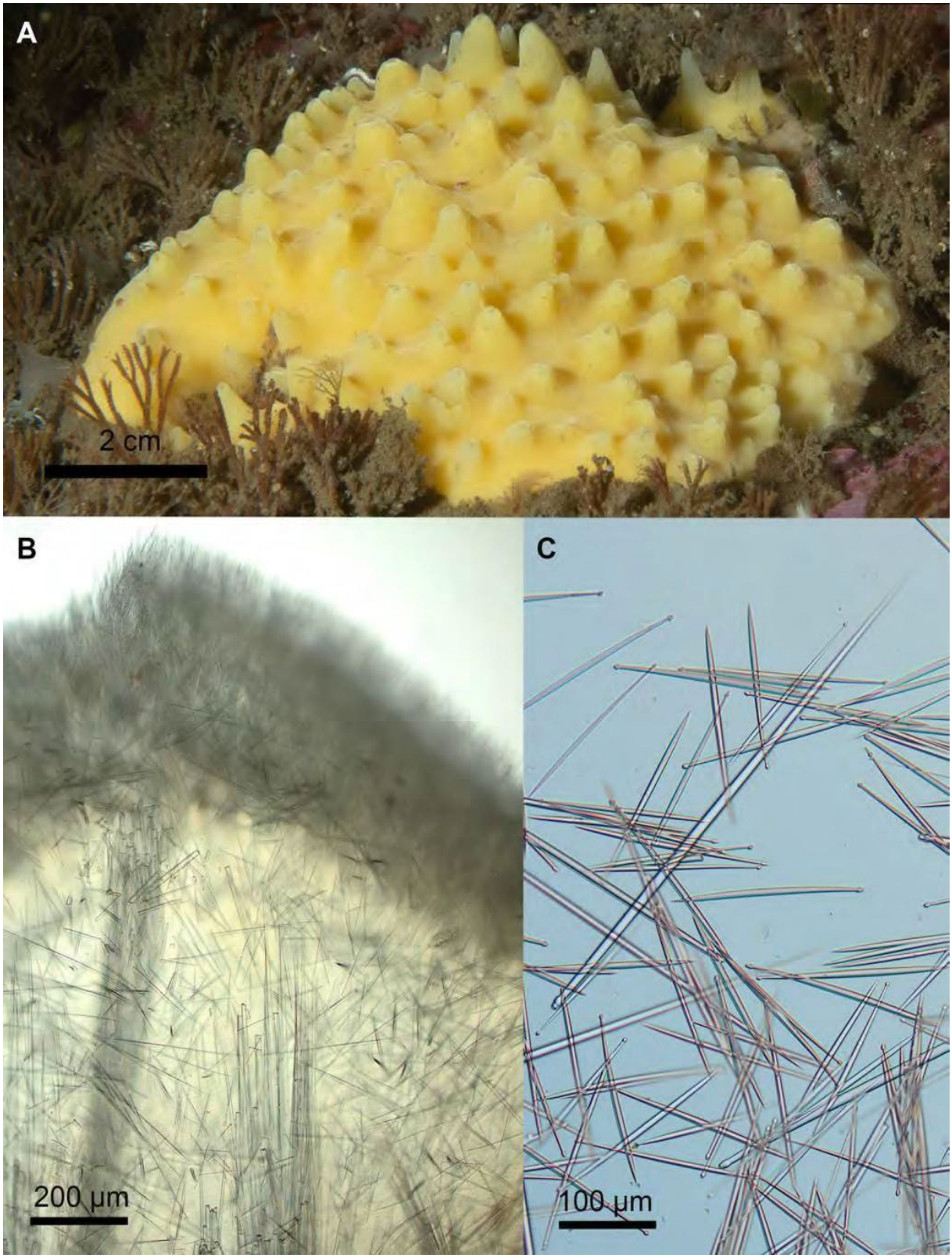


Figure 34. *Polymastia uberrima,* specimen ARC 82146. A. *In situ* appearance; B. Skeleton, ectosome to top; C. Spicules.

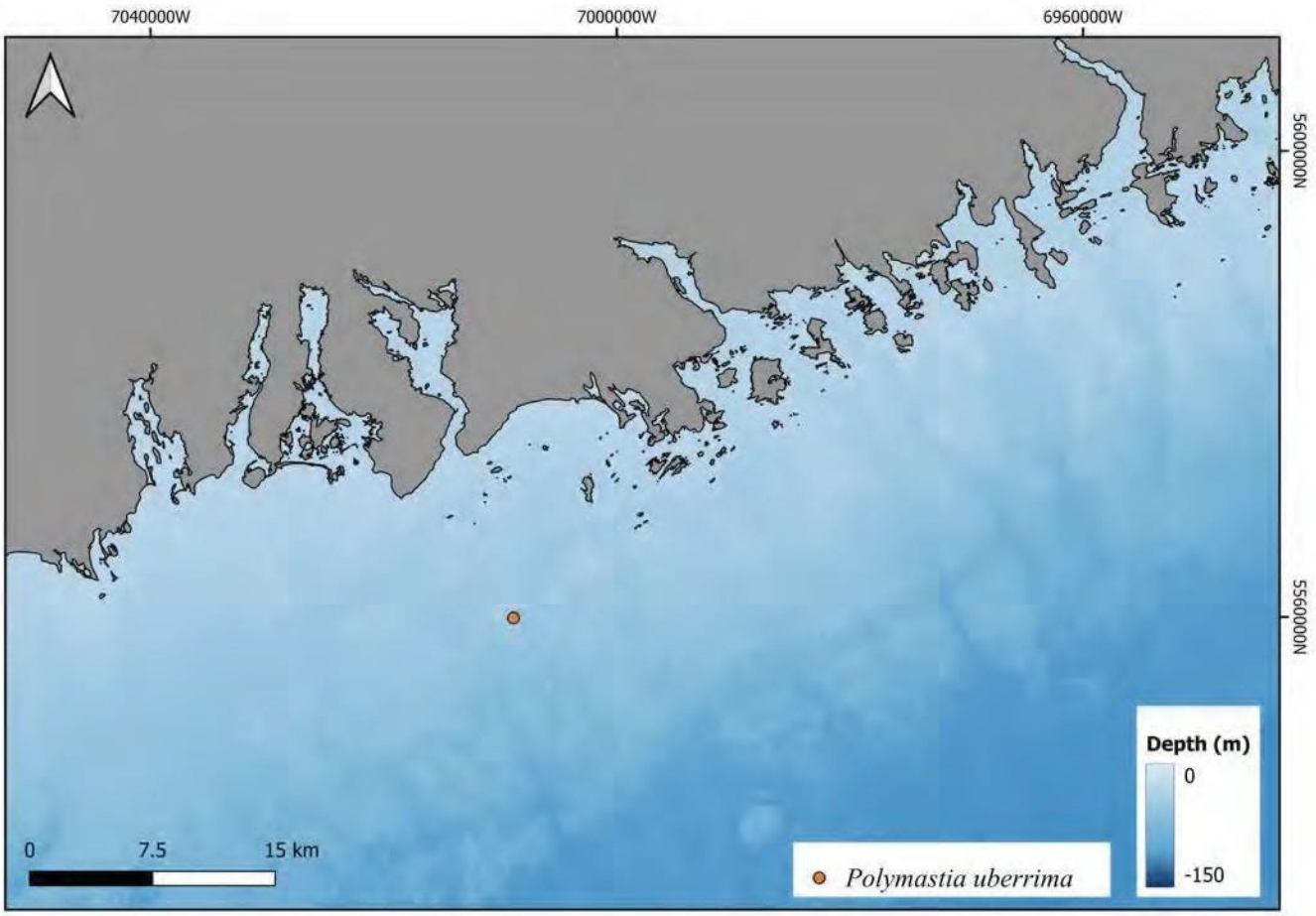


Figure 35. Records of *Polymastia uberrima* from this survey.

Sphaerotylus sp. 1 Topsent, 1898

APHIA ID: 132051; CLASS: Demospongiae; ORDER: Polymastiida; FAMILY: Polymastiidae

External appearance (Fig. 36A, B): Yellow sponge encrusting bedrock. Much of surface covered in silt. Many conical yellow papillae.

Skeleton (Fig. 36C): Ascending columns of primary tylostyles. The auxiliary choanosomal skeleton is composed of bundles of the intermediate tylostyles, the cortex consists of a palisade of the smallest tylostyles. Exotyles protrude through the cortex, creating a hispid surface.

Spicules (Fig. 36E): ARC 82280 Primary tylostyles: 740(1065)1812 by 6(9)12 µm; Intermediate tylostyles: 287(460)701 by 4(6)8 µm; Small tylostyles: 86(110)142 by 2(2)4 µm. ARC 82281 Long subtylostyles: 577(675)787 by 9(11)14 µm; Medium subtylostyles: 265(349)413 by 3(6)8 µm; Small Tylostyles: 81(114)159 by 2(3)4 µm. It was not possible to get a length of the exotyles (Fig. 36F) as the majority were broken.

Distribution: Recorded at only one location during this survey (Fig. 37), the distribution is not known.

Remarks: CO1 genetic sequences were obtained from specimens. These show that the specimens are genetically similar to *Sphaerotylus capitatus* (Vosmaer, 1885) which is known from eastern Canada. But CO1 is not very variable in sponges and 28S or other markers are often needed to discriminate between species. Our specimens lack the pronounced ectosomal layer of exotyles which are present in *S. capitatus.* The appearance also differs from *S. capitatus*, in our specimens some of the surface is clear, whereas *S. capitatus* has a uniformly velvety surface. After correspondence with the expert on this genus (Dr Alexander Plotkin) we believe these could conform to *Sphaerotylus tjalfei* Plotkin, Morrow, Gerasimova & Rapp, 2017, which was described from specimens from West Greenland, or be a species new to science. We need to obtain 28S sequences and do further morphological analysis to refine identifications in this group.

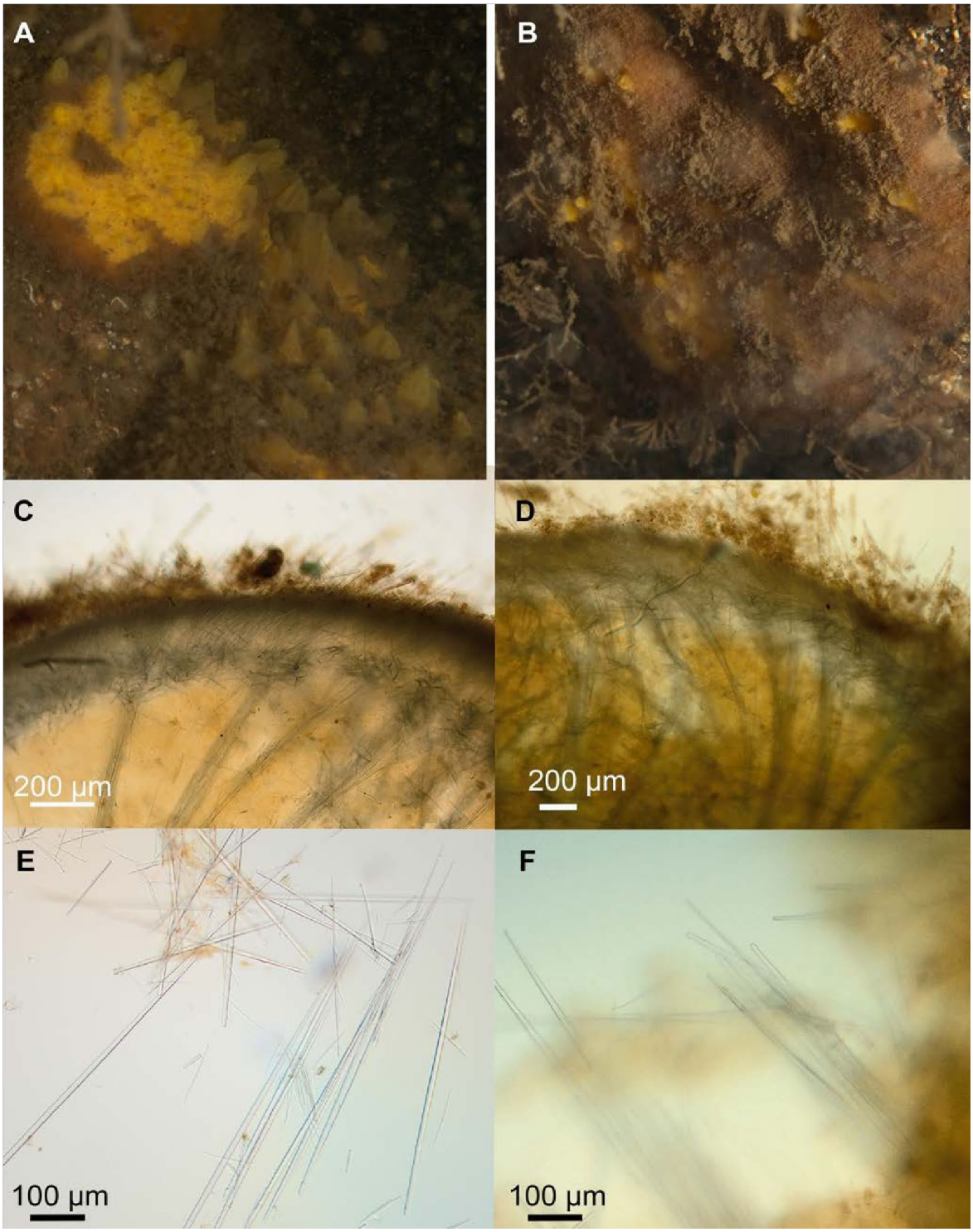


Figure 36. *Sphaerotylus* sp 1. A. *In situ* appearance, specimen ARC 82281; B. *In situ* appearance, specimen ARC 82280; C. Skeleton, specimen ARC 82281; D. Skeleton, specimen ARC 82280; E. Spicules ARC 82280; F. Exotyles, ARC 82280.

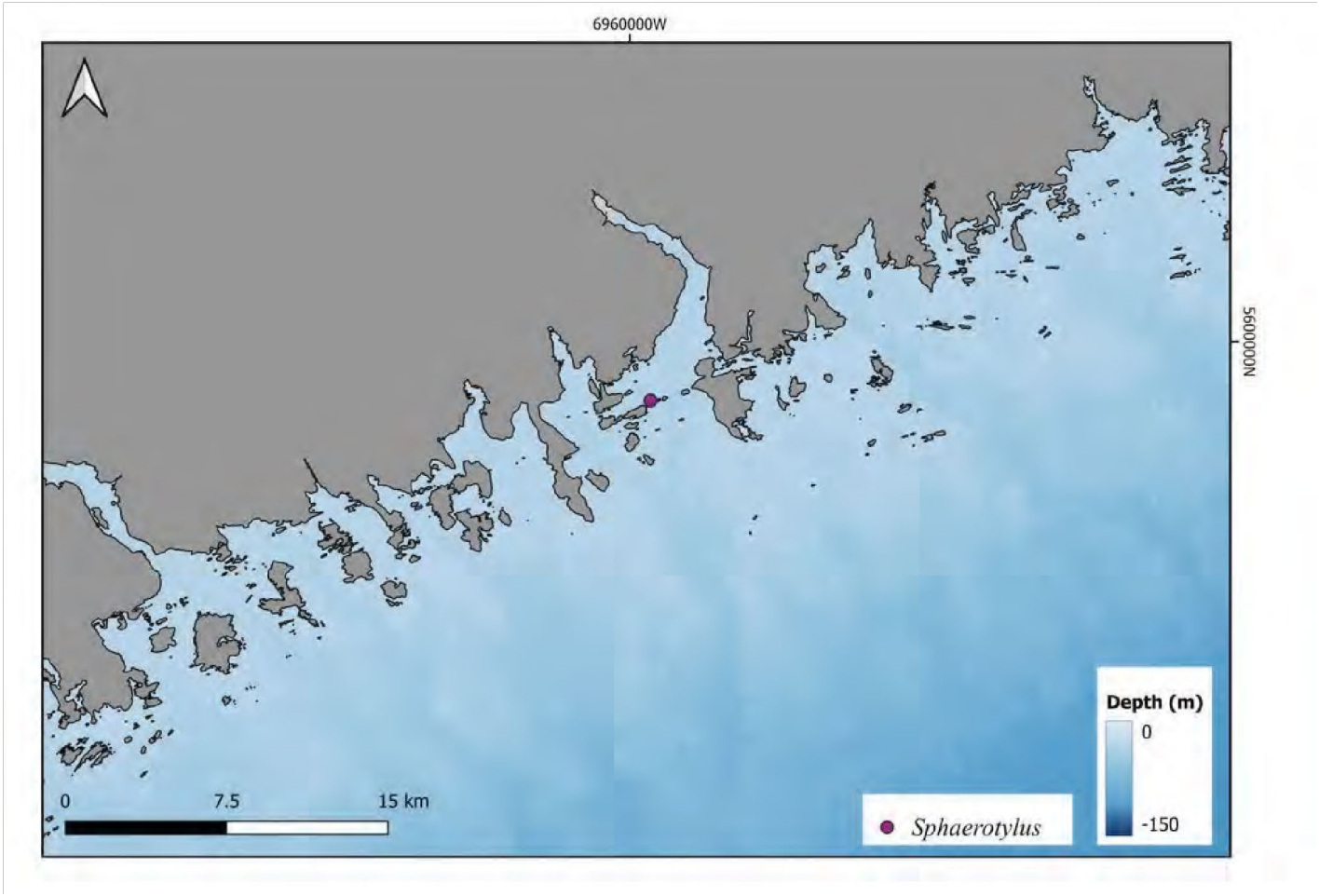


Figure 37. Records of *Sphaerotylus* sp. 1 from this survey.

5.11 THICKLY ENCRUSTING/MASSIVE

Halichondria (Eumastia) sitiens (Schmidt, 1870)

APHIA ID: 165789 CLASS: Demospongiae; ORDER: Suberitida; FAMILY: Halichondriidae

External appearance (Fig. 38A,B,C,D): Yellow massively encrusting sponge with irregular fistules. Surface often translucent with internal skeleton visible through it.

Skeleton (Fig. 38F): The choanosomal skeleton consists of ascending columns of oxea joined by individual spicules. The ectosomal skeleton consists of a felted layer of oxea, with no particular arrangement, which is supported by the ends of the choanosomal spicule tracts.

Spicules (Fig. 38E): Long oxea, evenly taping to sharp points. Oxea are often bent in the middle.

Size range of oxea in specimens from this area was 224-833 by 6-19 from SCUBA specimens and 514(752)1089 by 11(15)20 µm from ARC 81473 which was from 154 m. Van Soest *et al.* (2000) note the size range of oxea in this species are 360-1020 by 7-20 µm, this is similar to that found in our specimens, although the deeper water specimen had larger spicules.

Distribution: Recorded at four locations during this survey (Fig. 39), the type location for this species is on the west Greenland Shelf. It is found from the Arctic (Koltun 1959; Dinn and Leys 2018), through Gulf of St. Lawrence (Dinn 2020; Nozères *et al.* 2020) and the Scotian Shelf (this report) down to Maine (Trott 2004). It is also found in Iceland (Montety *et al.* 2021). In the eastern Atlantic there are records from Northern Ireland (Picton and Morrow 2016) and Norway (van Soest *et al.* 2000).

Remarks: Specimens from the Bay of Fundy typically form very large patches (some over 2 m in diameter), the Eastern Shore Islands specimens were smaller but also have more prominent papillae as noted in the original description (Schmidt 1870) and photographed in Northern Ireland (Picton and Morrow 2016). Our Eastern Shore specimens are a genetic match with those from other regions (Turner *et al.* 2025). The papillae on the shallow water Eastern Shore Islands specimens do seem to be shorter and less numerous than reported elsewhere, but the deeper water specimen was similar. This might be related to their habitat, on quite exposed, relatively shallow, bedrock. However, the skeleton with it's detachable ectosomal membrane and subdermal spaces is unlike other *Halichondria* species found in the area.

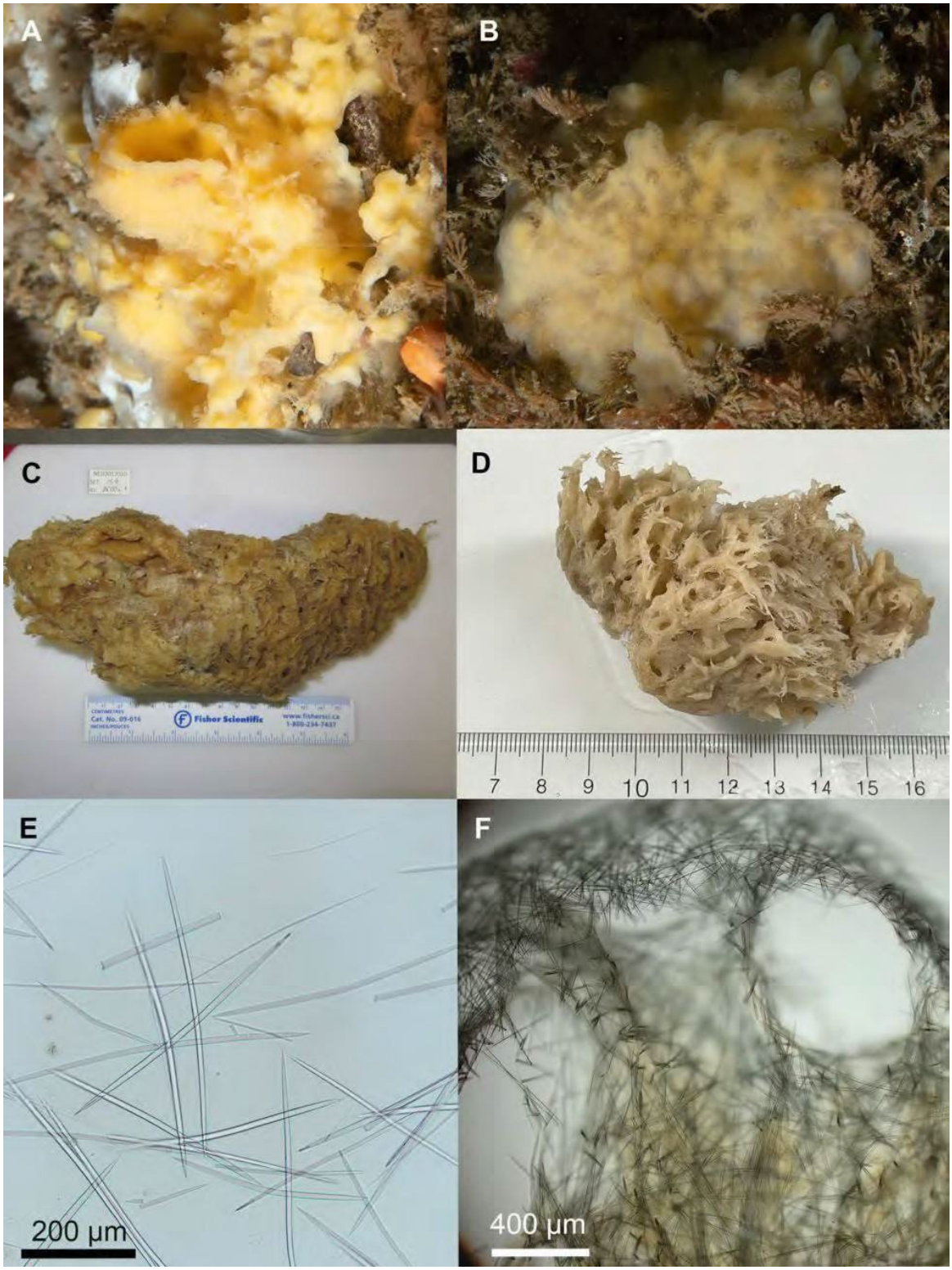


Figure 38. *Halichondria (Eumastia) sitiens. In situ* appearance: A. ARC 82165; B. ARC 82144; C. Freshly collected trawl specimen ARC 81473; D. Preserved specimen ARC 81473; E. Spicules, ARC 82165; F. Skeleton, ARC 82165, ectosome to right.

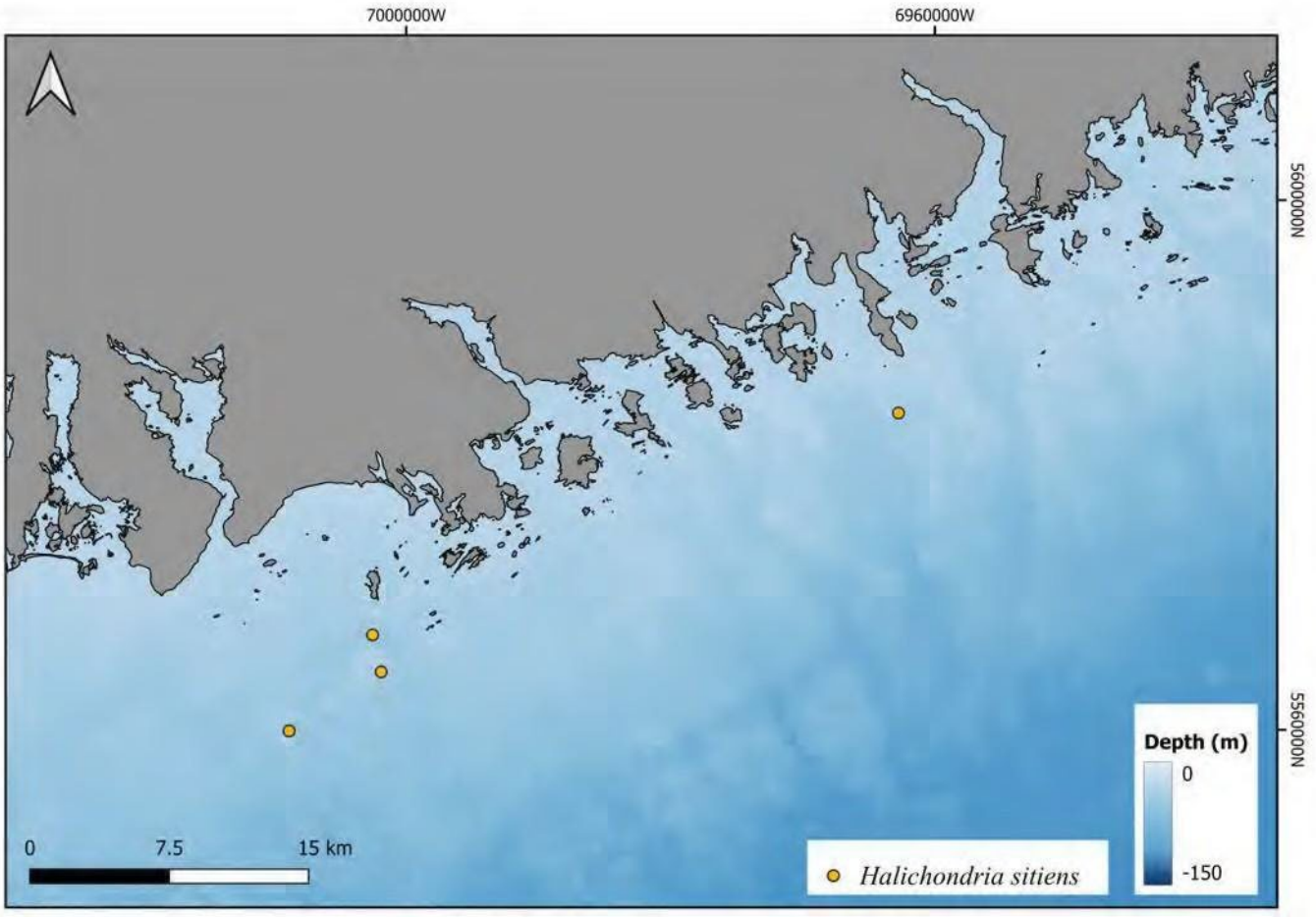


Figure 39. Records of *Halichondria sitiens* from this survey.

Halichondria (Halichondria) akesa Turner, Morrow, Picton, Goodwin & Thacker, 2025

APHIA ID: 1846802 CLASS: Demospongiae; ORDER: Suberitida; FAMILY: Halichondriidae

External appearance (Fig. 40A): Thickly encrusting yellow sponge with prominent oscula.

Skeleton (Fig. 40B): Tangential ectosomal skeleton which varies from being a dense mat in some areas to a network of tracts and single spicules surrounding oval shaped mesh apertures in others. Supported by large spicule tracts that arise from the choanosome. Choanosmal skeleton with some tracts but confused in the interior.

Spicules (Fig. 40C): Oxea. Often bent in the middle. Ends taper to sharp points. Ectosomal oxea 110(256)438 by 4(6)10 µm, choanosomal oxea 98(281)459 by 2(6)9 µm. Spicules slightly smaller than *Halichondria panicea* but might not be possible to distinguish solely on morphology.

Distribution: Recorded at one location during this survey (Fig. 41), it is currently known from three samples, all from the far North Atlantic / Arctic: Eastern Shore Islands, Nova Scotia, Canada; Skútan, Northern Iceland; and Svalbard, Norway. Habitat preferences are likely similar to *H. panicea* – though all three samples were collected from the subtidal by divers, so it is possible this species does not occur in the intertidal.

Remarks: Name inspired by the Greek goddess Akeso, sister of Panakeia. This species was described based on specimens collected during this survey of the Eastern Shore Islands. Distinguished from *H. panicea* on the basis of genetic characters (average pairwise differences (Dxy) between the two *Halichondria akesa* mitochondria and 9 sequenced *Halichondria panicea* mitochondria is 0.8%, leading to an Fst of 0.745 across the mitochondrial genome between species.

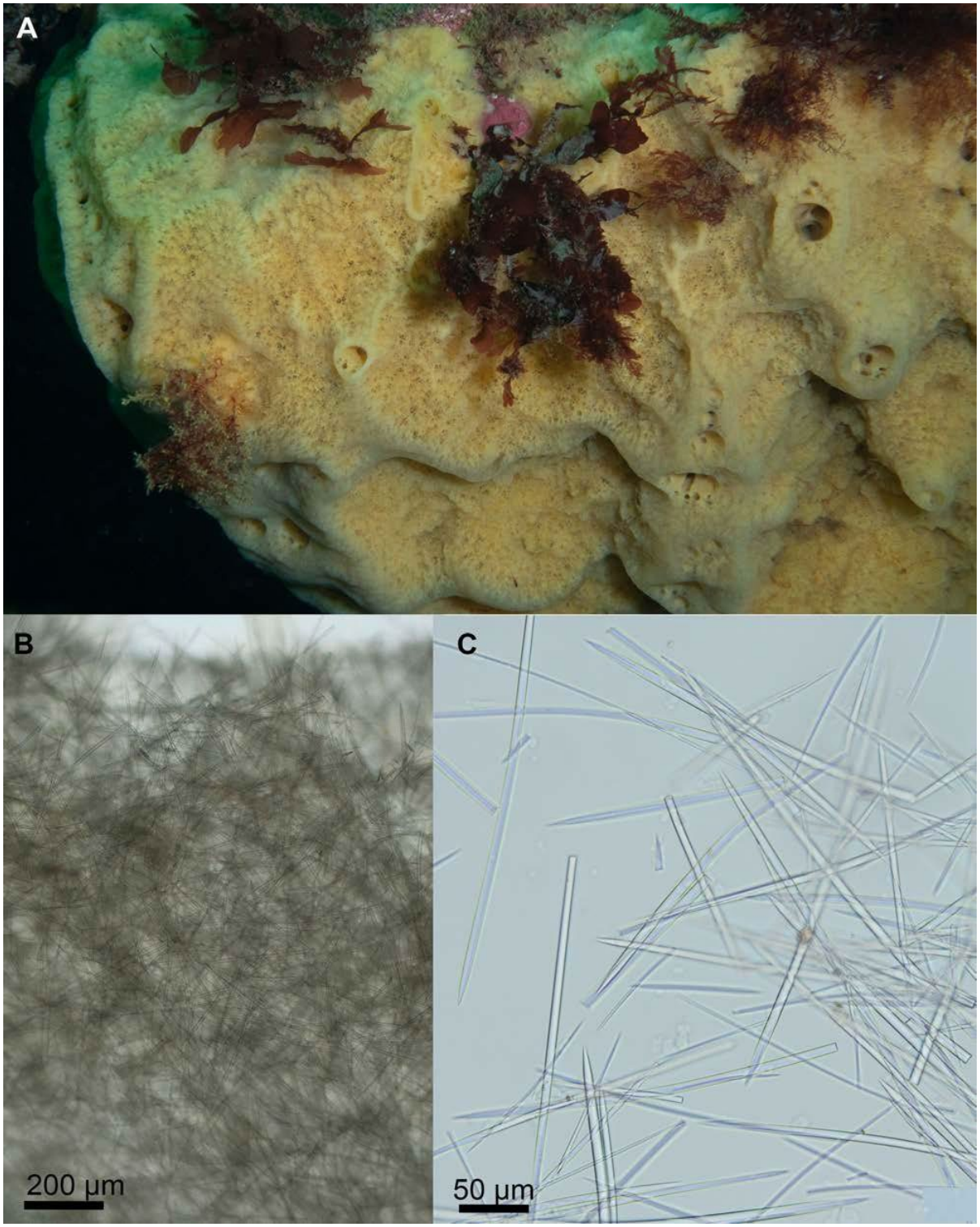


Figure 40. *Halichondria akesa.* A. *In situ* appearance ARC 82019; B. Skeleton, ARC 82019; C. Spicules, ARC 82019.

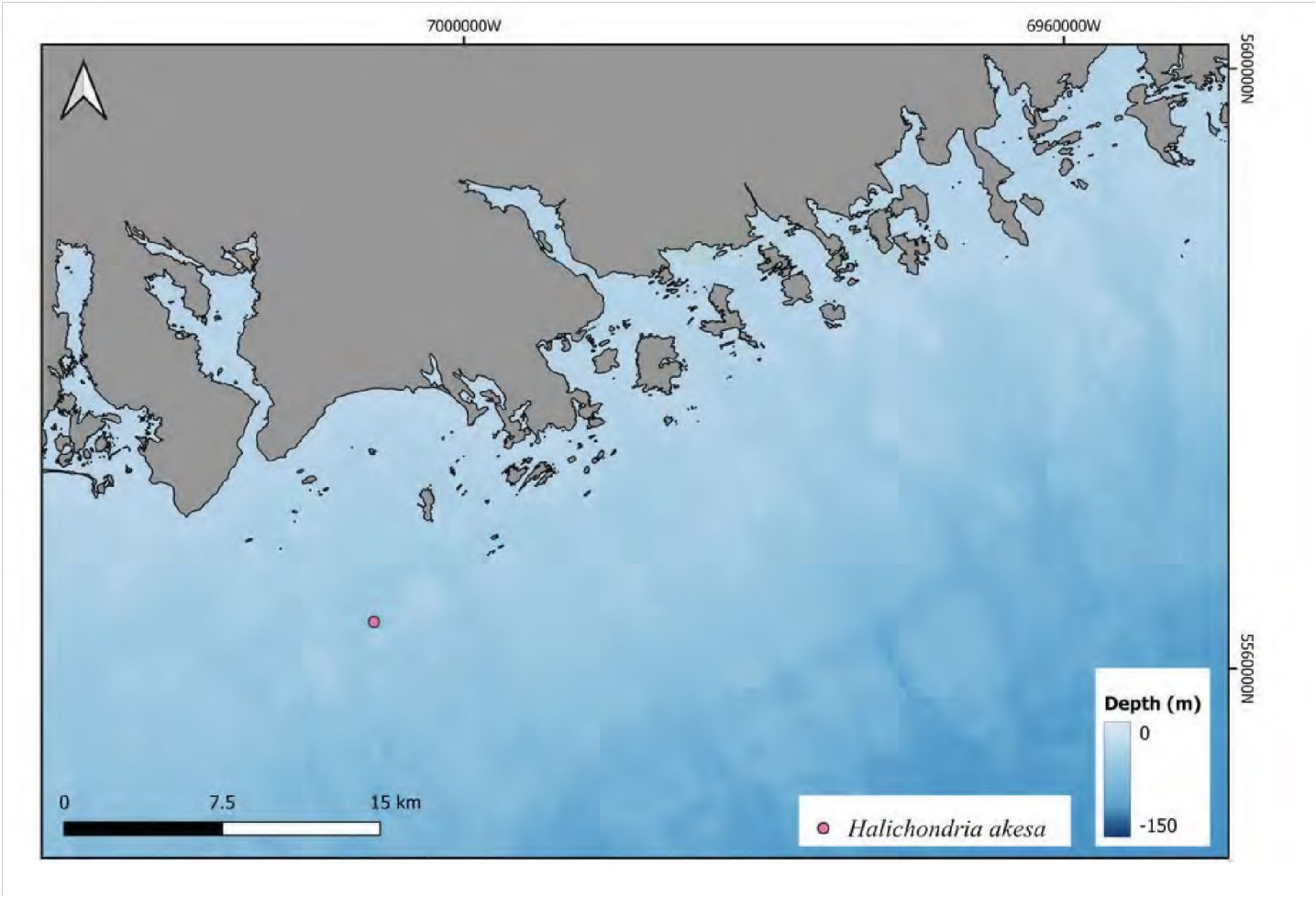


Figure 41. Records of *Halichondria akesa* from this survey.

Halichondria (Halichondria) panicea (Pallas, 1766)

APHIA ID: 165853 CLASS: Demospongiae; ORDER: Suberitida; FAMILY: Halichondriidae

External appearance: Form varies from thick crust to massive with lobes (Fig. 42A, B, C). Massive specimens have low lobes or ridges, which usually bear terminal oscula. Encrusting specimens have large oscula irregularly scattered over their surface. The colour in life is dull yellow to green, the green tinge is from symbiotic algae.

Skeleton: Choanosomal skeleton is confused with some ascending tracts (Fig. 42D). Ectosomal skeleton is a more regular reticulation formed of bundles of 10-15 oxea.

Spicules: Oxea. Often bent in the middle. Ends taper to sharp points (Fig. 42E). Oxea are 177-360 by 4-14 µm in our SCUBA specimens. This size range is similar to that reported for European specimens. This can be 124-482 by 2-15 µm (Hooper and Van Soest 2002), but is more typically 200(265)320 µm (Ackers *et al.*, 2007).

Distribution: Recorded at 10 locations during this survey (Fig. 43), it was common in shallow waters < 30 m depth in the ESI AOI. This species is usually found in the intertidal and shallow subtidal but recorded down to 500 m. It is particularly common on boulders in the intertidal and on the holdfasts of kelp (van Soest *et al.* 2000). It has a wide distribution. Its type locality is the UK, but it is found throughout the North Atlantic, both on European and American coasts. It is reported from the Mediterranean and New England to Norway, Iceland, and Northern Canada (van Soest *et al.* 2000). While there are records from the Pacific coasts of North America, these may be a sister species (Erpenbeck *et al.* 2004). In Canada, it has been recorded from the Bay of Fundy (Hartman 1958; Goodwin 2017), Southern Grand Banks (Topsent 1892), Gulf of St Lawrence (Dinn 2020; Lambe 1896), and Northern Labrador (Dinn and Leys, 2018).

Remarks: The Latin name *paniceus* (Latin) = of bread, refers to the bread-like texture of dried specimens. It is often known as the breadcrumb sponge or crumb-of-bread sponge (van Soest *et al.*, 2000).

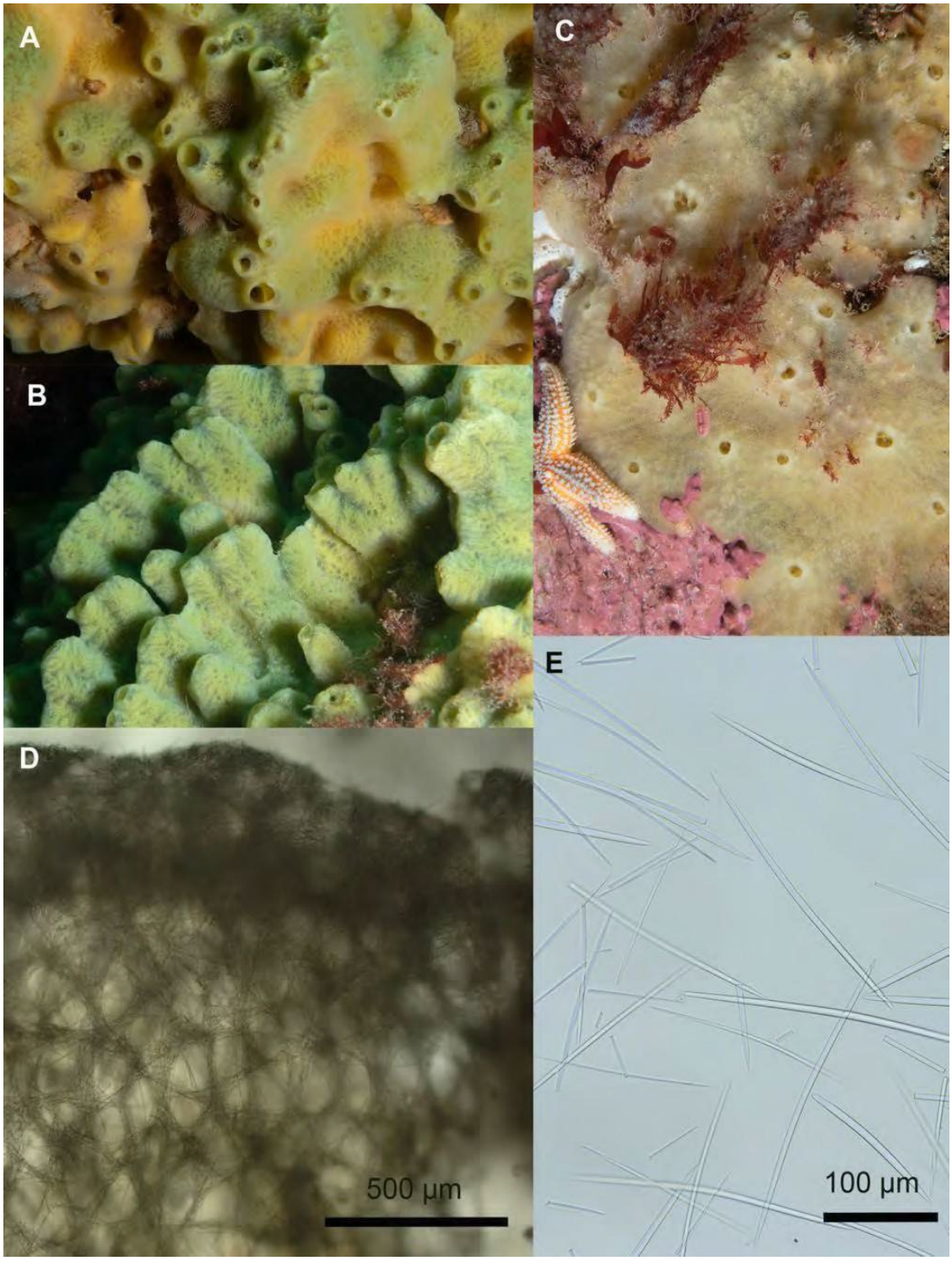


Figure 42. *Halichondria panicea. In situ* appearance: A. ARC 82023; B. ARC 82030; C. ARC 82086; D. Skeleton, ARC 82023; F. Spicules, ARC 82023.

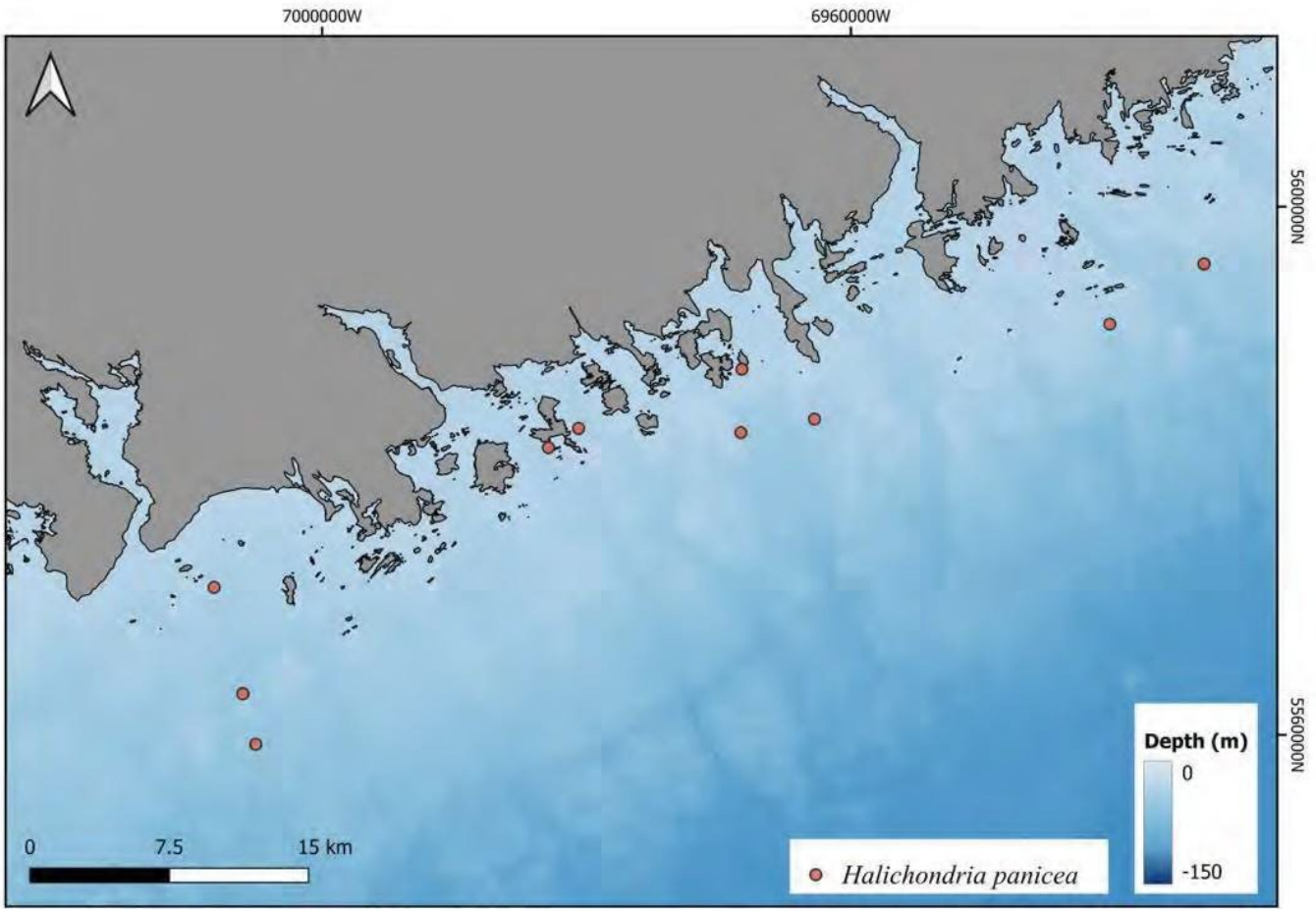


Figure 43. Records of *Halichondria panicea* from this survey.

Hymeniacidon sp. (Bowerbank, 1858)

APHIA ID: 13108 ; CLASS: Demospongiae; ORDER: Suberitida; FAMILY: Halichondriidae

External appearance (Fig. 44A): Bright custard yellow encrusting sponge with its surface covered in ridges and short finger like projections.

Skeleton (Fig. 44B): Reticulate skeleton formed from ascending columns of styles joined by bundles of styles and individual spicules. In the ectosome, bundles of styles fan out and piece the surface.

Spicules (Fig. 44C): Styles/subtylostyles ARC 82258 203(237)260 by 5(6)9 µm. ARC 82273: 107 (190)268 by 3(5)7 µm.

Distribution: As well as records from the Scotian Shelf and Eastern Shore Islands (Fig. 45), this species has been recorded from the Quoddy region of the Bay of Fundy and Grand Manan (Goodwin 2017, and unpublished data).

Remarks: Given the paucity of spicule characters, we need to obtain genetic sequences to investigate the identity of these specimens. Spicule size ranges are similar to *Hymeniacidon perlevis* . A shore and sublittoral form of this species has been noted, the shore form with styles 230 (255)280 µm and sublittoral form with styles 300(375)475 µm. The sublittoral form turns brown in alcohol. However, the external appearance of our specimens is different to *H. perlevis* and the majority of validated records for this species are from European waters (de Voogd *et al.* 2025). *Hymeniacidon heliophila* (Wilson, 1911) was recorded from the Quoddy Region of the Bay of Fundy by Ginn *et al.* (1998). The type locality of this species is in Beaufort Harbour, North Carolina where it is one of the most abundant species. It possesses styles 120-350 by 4-8 µm. This is an orange encrusting sponge which often has surface lobes. However, this species seems to have a warmer water distribution, with records from the Caribbean and Brazil.

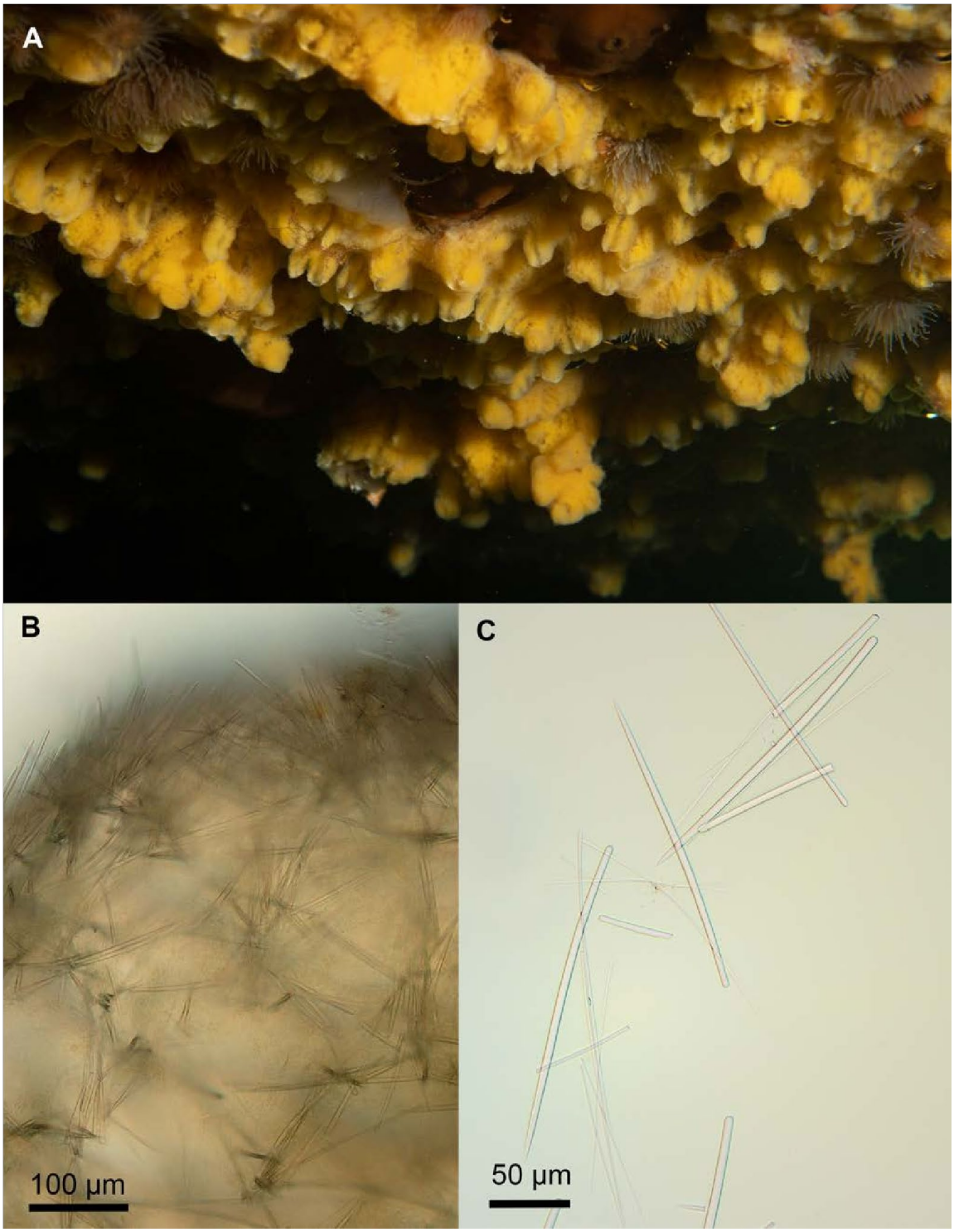


Figure 44. *Hymeniacidon* sp. ARC 82258 *Hymeniacidon* sp. A. *In situ* appearance; B. Skeleton; C. Spicules.

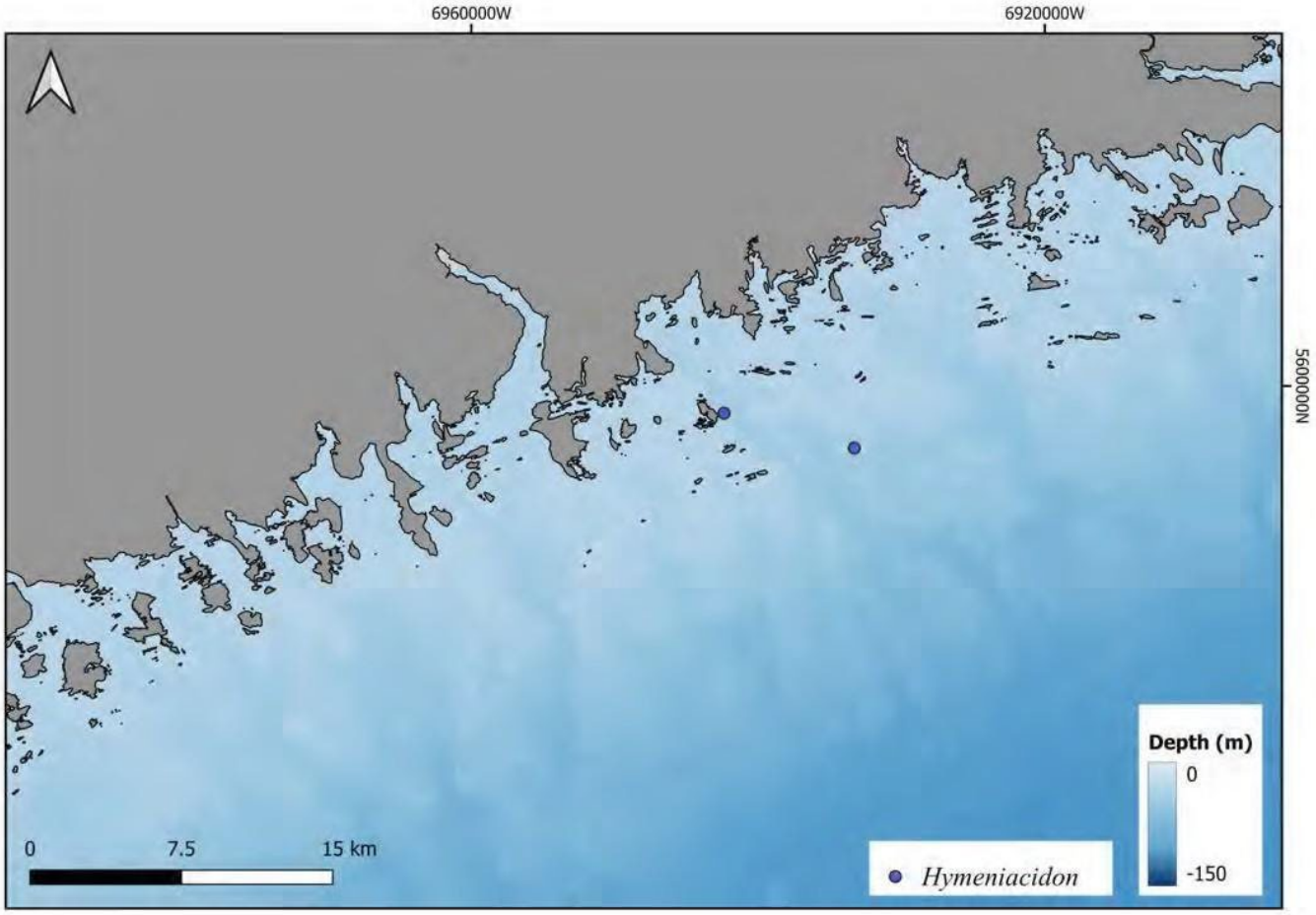


Figure 45. Records of *Hymeniacidon* sp. from this survey.

5.12 THINLY ENCRUSTING

Protosuberites sp. 1 Swartschewsky, 1905

APHIA ID: 170779; CLASS: Demospongiae; ORDER: Suberitida; FAMILY: Suberitidae

External appearance (Fig. 46A,C,D): Thin, bright yellow, encrusting sponge. Either forming patches on bedrock or encrusting shells, typically brachiopod shells. Surface on larger specimens with gelatinous raised oscula and many ostia visible.

Skeleton (Fig. 46E)**:** The choanosomal skeleton is composed of ascending columns of tylostyles (around 10-15 spicules wide). Ectosomal skeleton formed of the projecting ends of these columns.

Spicules (Fig. 46B): Tylostyles with a neat, pin-like head. ARC 82045: 159(350)545 by 3(5)6 µm. ARC 82104: 147(307)506 by 4(5)7 µm. ARC 82124: 118(267)493 by 3(7)11 µm ARC 82153: 142 (288)488 by 4(5)8 µm. The spicule size ranges are a good match with those reported by van Soest *et al.* (2000) for *Protosuberites dehartogi* specimens from Europe. They give ranges of 110(145)180 by 4 µm to 220 (300)350 by 7 µm in a given specimen. However, they state that lengths to ca. 600 µm and widths to ca. 11 µm may occur in some specimens.

Distribution: *P. dehartogi* is known from the North Sea coasts, south and west coasts of Britain, and west coast of France (van Soest *et al.* 2000). It is typically found in shallow water, down to around 12 m in depth. Recorded at 16 locations during this survery (Fig 47), similar specimens were reported from the Bay of Fundy (Goodwin 2017) and there are other northwest Atlantic records (as *P. epiphytum*) from the Bay of Fundy (Ginn *et al.* 1998). There are some differences in the molecular sequences obtained from our specimens and *P. denhartogi*. Analysis is ongoing to determine if our specimens are distinct and if this species is new to science.

Remarks: *P. denhartogi* was designated as a new name for European specimens previously assigned to *P. epiphytum* (Lamarck, 1814). The type locality for *P. epiphytum* is in Australia and it differs from NE Atlantic specimens as it always grows on the thallus of algae, where European specimens grow on substrates including rock and shells. There are also differences in spicule size and form (van Soest and Kluijver 2003).

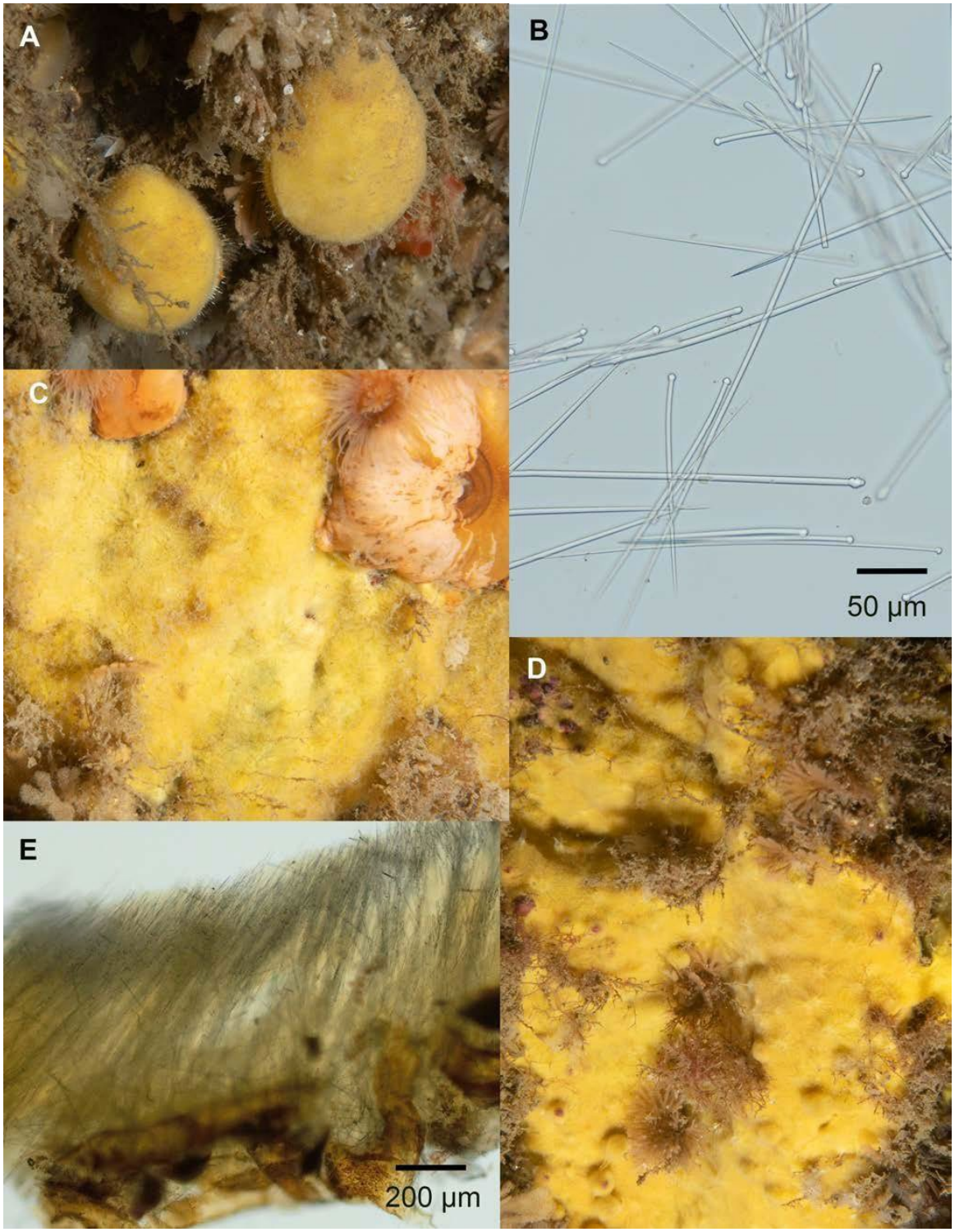


Figure 46. *Protosuberites* sp. 1. A. *In situ* appearance, specimen ARC 82104; B. Spicules, Specimen ARC 82045; C. *In situ* appearance, specimen ARC 82045; D. *In situ* appearance, specimen ARC 82153; E. Skeleton, Specimen ARC 82153.

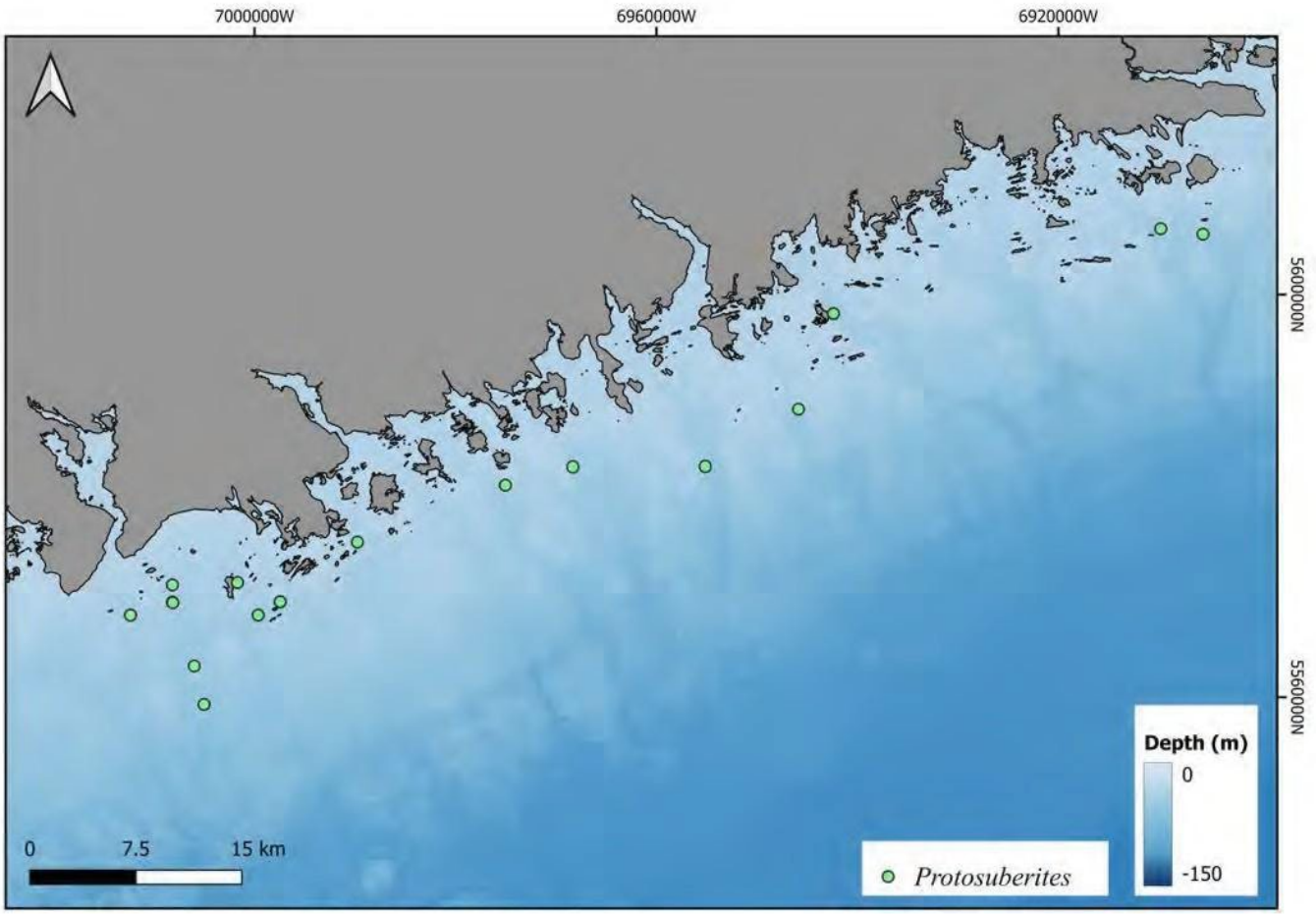


Figure 47. Records of *Protosuberites* sp 1. from this survey.

6. DISCUSSION

Our knowledge of Porifera in Eastern Canada has rapidly improved in recent years thanks to several targeted studies (Baker *et al.* 2018a, 2018b; Bouchard-Marmen *et al.* 2019, 2021; Dinn 2020; Goodwin 2017; Nozères *et al.* 2020; Odenthal *et al.* 2023; Tompkins *et al.* 2017). These have revealed many new records for the region and even species new to science (Goodwin *et al.* 2021). However, additional studies incorporating laboratory identification are needed to fully understand the diversity of Porifera present in the north-west Atlantic coasts of Canada.

Most of the species recorded and collected during the 2021-2022 SCUBA surveys of the ESI AOI were encrusting. In general, encrusting sponges are challenging to collect by remote methods such as dredging and trawling and there has been little work done in eastern Canada. Diver-based surveys are an effective method to observe and collect encrusting sponges and often reveal additional species (e.g. Ginn *et al.* 1998; Picton and Goodwin 2007; Vacelet and Pérez 1998). So, despite that in some cases these species were commonly observed in the dive survey, it is not surprising that they contribute new records for the region. This survey did provide important new knowledge on species present including three new records for Canada (*Hymedesmia jecusculum, H. stellifera, Plocamiancora arndti*) and a range extension for a species new to science (*Crellomima mehqisinpekonuta*) which was recently described from the Bay of Fundy (Goodwin *et al.* 2021). Studies such as this where *In situ* imagery is related to physical samples which confirm specimen identification can be useful for remote video and still camera survey work. They can help refine imagery catalogues used the identify organisms present, such as Paulin *et al.* (2025) which was recently created for the Eastern Shore Islands. Only by confirming identification with sampling can be determine the range or morphology within species and untangle the *In situ* morphological differences between similar species such as *Myxilla fimbriata* and *Isodictya deichmannae*. Once this ground-truthing work has been done it is possible to identify from imagery with more certainty. For a full discussion of the sponge and other invertebrate biodiversity of this region see Goodwin *et al.* (2025a).

One species new to science has recently been described from a specimen from this survey: *Halichondria akesa* (Turner *et al.* 2025). There may also be three additional species new to science (*Hymedesmia* sp., *Sphaerotylus* sp., and *Protosuberites* sp.); additional taxonomic work (morphological and molecular) and comparison with type material is currently being undertaken to confirm this and describe these new species. There are also other taxa which require further investigation such as *Halisarca* sp.,the three Calcarea taxa, and the Iophon.

7. ACKNOWLEDGEMENTS

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8. AUTHOR CONTRIBUTION STATEMENT

Conceptualization: CEG, JAC, PL; Data curation: CEG, JAC, PL. Formal analysis: CEG, MC; Funding acquisition: CEG, JAC, PL; Investigation: CEG, JAC, PL, TB, MC; Methodology: CEG; Project administration: CEG, JAC, PL; Writing—original draft: CEG; Writing: review and editing: CEG, JAC, PL, MC.

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APPENDIX 1. SCUBA SURVEY QUICK REFERENCE GUIDE FOR SPONGES OBSERVED IN THE EASTERN SHORE ISLANDS AREA OF INTEREST.

SCUBA survey quick reference guide

Cushion with projections



Polymastia uberrima
Low projections, hispid collar



Sphaerotylus sp.
Pointed projections, silty surface



Halichondria sitiens
Irregular projections,
which are sometimes branched

Thickly encrusting/massive



Myxilla fimbriata
Bright orange.
Oscules on tops of mounds and ridges.



Halichondria panicea/akesa
Yellow often with green tinge.
Mounds with terminal oscules.



Iophon
Pale yellow.
Often growing on brachiopods.



Hymeniacidon
Yellow often with ridges and projections.

SCUBA survey quick reference guide

Finger-shaped



Isodictya deichmannae
Thick orange fingers. May also be thickly encrusting.



Haliclona oculata
Thin branches with oscules along sides

Calcareous tubes



Clathrina
Lacy mesh of thin tubes



Leucosolenia
Tubes with terminal oscule arise from base.



Grantia sp.
Small tube with terminal oscule, spicule fringe around oscule

SCUBA survey quick reference guide

Thinly encrusting



Halisarca
Beige, slimy



Amphilectus ovulum
Cream or pale yellow, many oscules



Hymedesmia sp.



Aplysilla sulfurea
Bright yellow, spiky



Hymedsemia stellifera
Bright yellow, star-shaped channels



Protosuberites



Crellomima mehquisinpekonuta
Bright orange, pores and veins



Plocamianocora arndti



Hymedesmia jecusculum
Bright red, pore sieves