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Notable Crustacea (Mysida, Amphipoda and Decapoda) from England's deepest and most remote Marine Conservation Zone

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Abstract

A recent survey of The Canyons Marine Conservation Zone provided noteworthy records of several crustacean species, which are presented here. The geographic or bathymetric ranges of several species are considerably extended, while the genus *Rhachotropis*, which has not previously been reported from British waters, is represented by two species. Other species that were previously only known in British waters from very few, often historical, records are also reported.

Introduction

The marine fauna of the British Isles and Ireland is usually considered well known. Due to the monograph on British Gammaridean Amphipoda by Lincoln (1979) this group may be regarded as particularly well studied. Whilst it is true that the shallow-water, coastal species are reasonably well documented compared with some other geographic regions, the wealth of publications that have appeared since Lincoln (1979) reporting new records or describing new species from British and Irish waters attests to the fact that the amphipod fauna is still not completely known. British mysids were comprehensively reviewed by Tattersall & Tattersall (1951) with coastal species further reported by Makings (1977) but have received very little attention since. Likewise, the decapod fauna may be thought to be well studied but, even for conspicuous, shallow-water species, basic information on distribution is often incomplete or compiled from a small number of historic records (Ashelby, 2006). When sampling in deeper waters (>100 m) or further from the shore, nearer the limits for UK territorial waters, this information is even more fragmentary and a number of species may be found that have either not been formally reported or are rarely recorded from these waters.

The Canyons Marine Conservation Zone (MCZ) is England's most remote and deepest MCZ with a central point at approximately 48°20′23″N 009°40′59″W (coordinates of the bounding box: 48°30′0″N 009°48′0″W, 48°30′0″N 009°36′0″W, 48°30′0″N 009°33′33″W, 48°10′0″N 009°33′37″W, 48°10′0″N 009°48′0″W, 48°20′0″N 009°48′0″W, back to origin). The depth at the site ranges from around 100 m to over 2000 m below chart datum. The site was designated by Defra, as part of the first tranche of England's MCZ programme, under the Marine and Coastal Access Act 2009 (designation order available at http://www.legislation.gov.uk/ukmo/2013/4/pdfs/ukmo_20130004_en.pdf; accessed 3 August 2018). This unique MCZ encompasses the steep part of the shelf break, covering areas of diverse seafloor habitat within the 'deep sea' broad-scale habitat, including sub-marine canyons and deep-sea coral habitats. The northern, north-western and southern boundary sections of the site align with the U.K. Continental Shelf Limit (as defined under the Continental Shelf Act, 1964; available at http://www.legislation.gov.uk/ukpga/1964/29/contents; accessed 2 January 2018) whilst the western and eastern boundary sections form straight north–south lines (Figure 1). Within the site, there are two large canyons that give the site its name and indent the shelf break, adding to the topographic complexity of the seafloor: the Dangaard Canyon to the north and the Explorer Canyon below. There is a patch of live deep-water coral reef (*Lophelia pertusa* (Linnaeus, 1758) and *Madrepora oculata* Linnaeus, 1758), located on the northernmost wall of the Dangaard Canyon. This is a protected feature of the MCZ and the only known example of living deep-water coral reef recorded within England's seas, with other patches occurring along the continental shelf break off Scotland and Ireland, but making it unique within English waters.

Materials and method

As part of a routine monitoring survey of The Canyons MCZ conducted by the Joint Nature Conservation Committee (JNCC) and the Centre for Environment, Fisheries & Aquaculture Science (Cefas) between 28 May and 3 June 2017 thirty-seven 0.1 m^2 NIOZ core samples were collected in the shallower regions of the MCZ. NIOZ core sampling was chosen over other sampling methods as it reduces wash-out during sample retrieval; wash-out may result

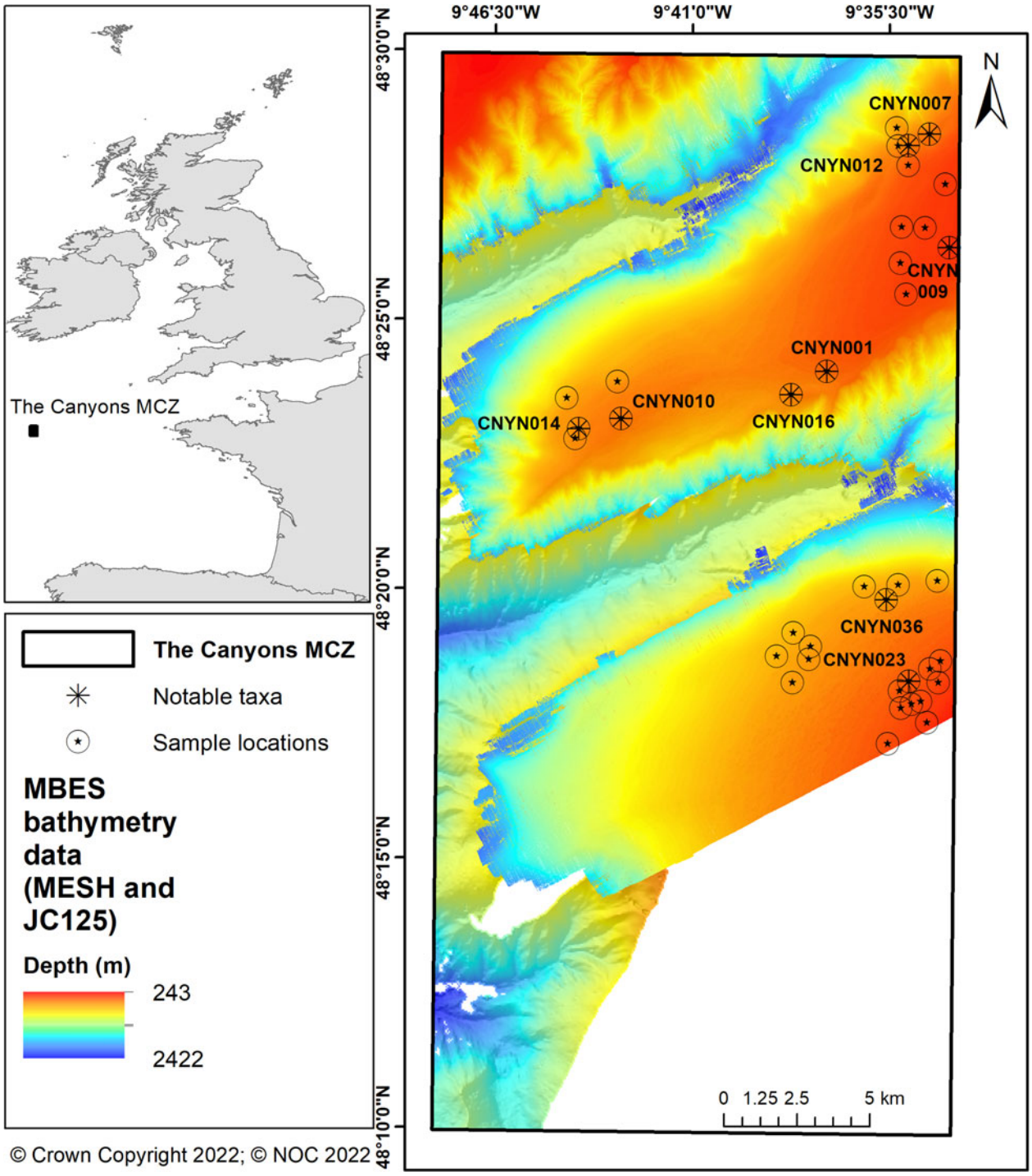

Fig. 1. Location of samples within The Canyons MCZ; stations with notable Crustacea are labelled using the station codes.

in the loss of fine sediment and smaller organisms. The samples were collected from water depths between 210–400 m and the sediments were mostly fine, including muds, sands and clays. The macrobenthic samples were processed over a 1.0 mm sieve mesh following NMBAQC Scheme guidelines (Worsfold *et al.*, 2010) whilst particle size samples were analysed following Mason (2016) using a combination of half-phi sieves (>1.0 mm) and a Beckman Coulter LS 13 320 particle size analyser (sub-sample of <1.0 mm material) with data mathematically merged using the GRADISTAT software (Blott & Pye, 2001) to determine the percentage weight distribution of each grain size and standardized descriptions (Folk, 1954). Macrobenthic samples were processed by APEM Ltd and were subject to independent analytical quality assurance by Fugro Ltd. All material is retained either at Cefas or APEM Ltd.

Results

A total of 307 macrobenthic taxa were recorded from the samples, of which 58 (~19%) were crustaceans (Table 1). Many of the taxa were typical of deep waters and are rarely recorded; some of the more noteworthy crustacean records are discussed in further detail below. Sediment samples collected from within the MCZ ranged from sandy mud to slightly gravelly muddy sand. The

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Table 1. Crustacean taxa recorded from NIOZ core samples taken from The Canyons MCZ in 2017

Taxon	Number of samples	Total number
Verruca stroemia (O.F. Müller, 1776)	1	1
Copepoda H. Milne Edwards, 1840	12	18
Hypererythrops serriventer Holt & Tattersall, 1905	1	1
Erythrops elegans (G.O. Sars, 1863)	2	2
Rhachotropis northriana d'Udekem d'Acoz, Vader & Legezinska, 2007	1	1
Rhachotropis cf. *gracilis* Bonnier, 1896	1	1
Deflexilodes subnudus (Norman, 1889)	1	1
Pontocrates arcticus Sars, 1895	1	1
Westwoodilla caecula (Spence Bate, 1857)	2	2
Amphilochoides boecki G.O. Sars, 1892	1	1
Stenothoe marina (Spence Bate, 1856)	1	1
Urothoe elegans (Spence Bate, 1857)	9	10
Harpinia antennaria Meinert, 1890	10	14
Harpinia crenulata (Boeck, 1871)	2	2
Acidostoma obesum (Spence Bate, 1862)	3	3
Hippomedon denticulatus (Spence Bate, 1857)	5	5
Tryphosa nana (Krøyer, 1846)	1	2
Perrierella audouiniana (Spence Bate, 1857)	1	1
Tryphosites longipes (Spence Bate & Westwood, 1861)	1	1
Syrrhoe affinis Chevreux, 1908	1	1
Nototropis vedlomensis (Spence Bate & Westwood, 1862)	1	1
Dexamine thea Boeck, 1861	1	1
Ampelisca sorbei Dauvin & Bellan-Santini, 1996	2	2
Ampelisca dalmatina Karaman, 1975	1	1
Ampelisca gibba G.O. Sars, 1883	1	1
Byblis ? *erythrops* G.O. Sars, 1883	4	9
Bathyporeia gracilis G.O. Sars, 1891	2	2
Melphidippella macra (Norman, 1869)	1	2
Abludomelita aculeata (Chevreux, 1911)	1	1
Eriopisa elongata (Bruzelius, 1859)	1	1
Jassa Leach, 1814; juvenile specimen	1	1
Centraloecetes striatus (Myers & McGrath, 1979)	1	1
Caprella Lamarck, 1801; juvenile specimen	1	1
Pariambus typicus (Krøyer, 1844)	1	1
Phtisica marina Slabber, 1769	4	4
Themisto Guérin, 1825	4	5
Gnathiidae Leach, 1814; female specimen	1	1
Gnathia oxyuraea (Lilljeborg, 1855)	2	2
Natatolana borealis (Lilljeborg, 1851)	3	3
Eurydice truncata (Norman, 1868)	8	10
Munna Krøyer, 1839	1	1
Iphinoe serrata Norman, 1867	4	5
Campylaspis ? *affinis* G.O. Sars, 1870	1	1
Mesolamprops denticulatus Ledoyer, 1983	1	1
Mesolamprops hartleyi Shalla & Bishop, 2007	1	1
Hemilamprops roseus (Norman, 1863)	2	2
Makrokylindrus (*Adiastylis*) *longipes* (G.O. Sars, 1871)	2	1
Diastyloides biplicatus (G.O. Sars, 1865)	7	8
Solenocera membranacea (Risso, 1816)	2	1
Philocheras echinulatus (M. Sars, 1862)	1	1
Callianassa subterranea (Montagu, 1808)	1	1
Paguridae Latreille, 1802; juvenile specimens	4	4
Pagurus alatus Fabricius, 1775	1	1
Pagurus prideaux Leach, 1815	1	1
Munida Leach, 1820; juvenile specimens	2	2
Ebalia nux A. Milne-Edwards, 1883	2	3
Liocarcinus Stimpson, 1871; juvenile specimen	1	1
Monodaeus couchii (Couch, 1851)	1	1

full macrobenthic data set is available online at https://doi.org/10.14466/CefasDataHub.55.

Systematic Account

MYSIDA Boas, 1883

Mysidae Haworth, 1825

Hypererythrops serriventer Holt & Tattersall, 1905

Material: 1 specimen; The Canyons MCZ, station CNYN007; 48° 28′30″N 009°34′23″W; water depth 307 m; slightly gravelly sand; leg. Cefas, 29 May 2017; det. C. Ashelby, 12 Dec. 2017.

Remarks: Although this species was described from the west of Ireland (Holt & Tattersall, 1905) it has only rarely been recorded around Irish coasts. According to Tattersall & Tattersall (1951) it has been recorded on 13 occasions off the west coast of Ireland in the early 1900s and no further formally published records from Britain or Ireland have emerged since. *Hypererythrops serriventer* is otherwise recorded in the Bay of Biscay (Nouvel & Lagardère, 1976; Mauchline & Murano, 1977; Elizalde *et al.*, 1991) where it is most common between 500 and 600 m (Elizalde *et al.*, 1991).

AMPHIPODA Latreille, 1816

Eusiridae Stebbing, 1888

Rhachotropis cf. *gracilis* Bonnier, 1896

Material: 1 specimen; The Canyons MCZ, station CNYN010; 48° 23′11″N 009°42′54″W; water depth 302 m; slightly gravelly muddy sand; leg. Cefas, 31 May 2017; det. C. Ashelby, 01 Dec. 2017.

Remarks: *Rhachotropis* species are fragile (d'Udekem d'Acoz *et al.*, 2007) and the single specimen reported here was unfortunately damaged and so a thorough morphological assessment could not be made. It fits best with the characters noted for *R. gracilis* but the telson is cleft slightly further than in typical *R. gracilis* (to ~15% of its length). As discussed by d'Udekem d'Acoz *et al.* (2007), *R. gracilis* is likely to represent a species complex and there are potential undescribed species occurring in European waters currently confounded under this name (Cartes

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& Sorbe, 1999). Given the condition of the material, the difference in the cleft of the telson, the comparatively shallow depth of this record and the taxonomic uncertainty surrounding this species the identification is regarded as tentative at this stage.

Rhachotropis northriana d'Udekem d'Acoz, Vader & Legezinska, 2007
Figure 2C

Material: 1 specimen; The Canyons MCZ, station CNYN001; 48° 24′05″N 009°37′11″W; water depth 284 m; slightly gravelly muddy sand; leg. Cefas, 30 May 2017; det. C. Ashelby, 08 Nov. 2017.

Remarks: d'Udekem d'Acoz *et al.* (2007) described *R. northriana* based on four specimens collected from the Statfjord oilfield in the North Sea, close to the boundary between Norwegian and UK waters. Lörz *et al.* (2018) reported a further five specimens from 169 m water depth, close to the type locality. No further records of the species have been reported to date. Although slightly damaged, the material reported here was in good agreement with the description and figures provided by d'Udekem d'Acoz *et al.* (2007) and this record extends the geographic distribution of the species southwards.

Synopiidae Dana, 1853
Syrrhoe affinis Chevreux, 1908

Material: 1 specimen; The Canyons MCZ, station CNYN036; 48° 19′51″N 009°35′29″W; water depth 351 m; slightly sandy gravelly mud; leg. Cefas, 04 Jun. 2017; det. C. Ashelby, 13 Nov. 2017.

Remarks: *Syrrhoe affinis* occupies a large geographic range in the North-east Atlantic and Mediterranean Sea (Karaman, 1993; Bachelet *et al.*, 2003; Fuchs *et al.*, 2019). Barnard (1961) followed by Lörz & Coleman (2013), with some hesitation, also attributed specimens from New Zealand to *S. affinis* (as *S.* ? *affinis* and *S.* cf. *affinis* respectively). Whilst both expressed doubts that a

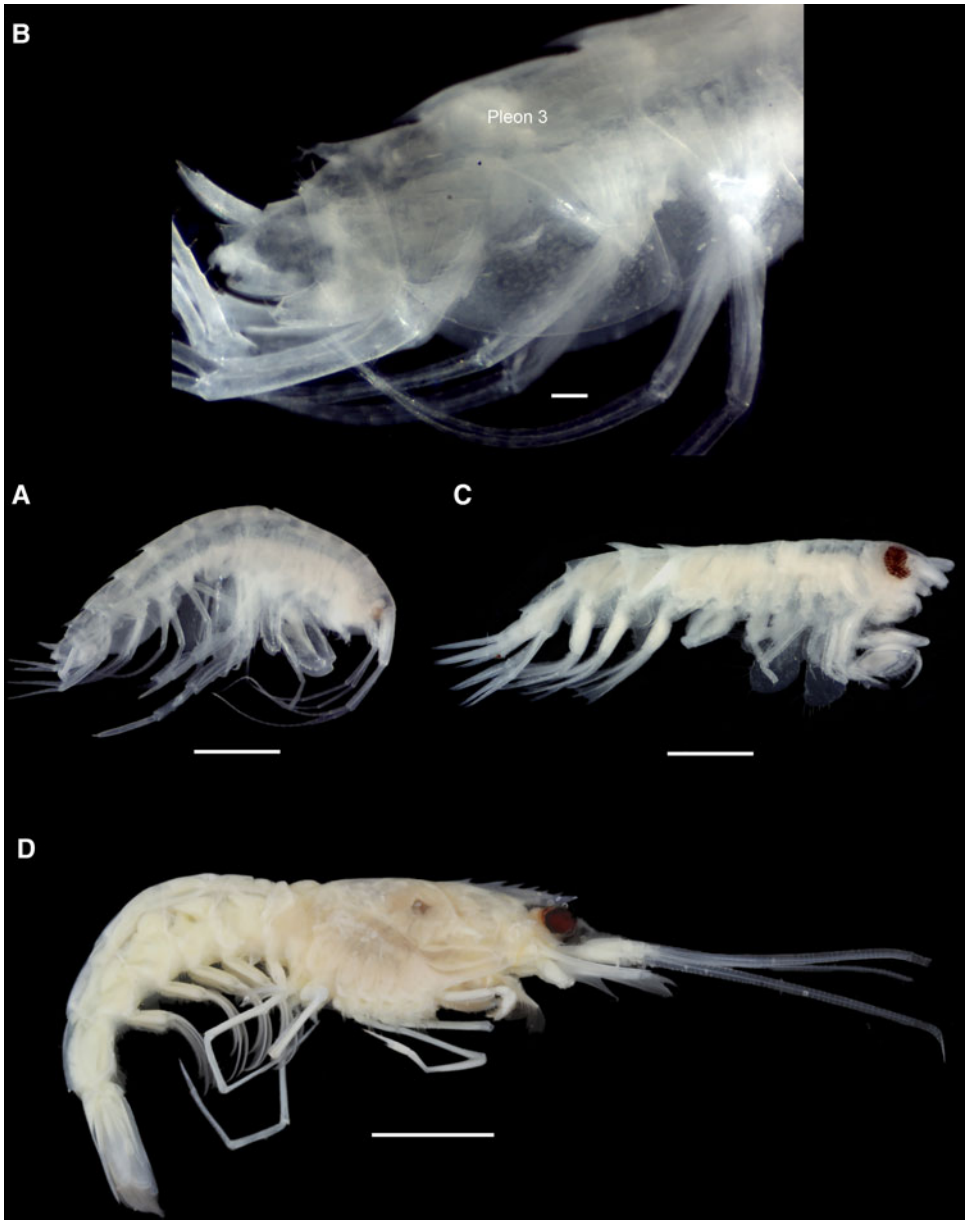

Fig. 2. (A) *Abludomelita aculeata* (Chevreux, 1911). (B) Same, detail of pleosome and third epimeral plate. (C) *Rhachotropis northriana* d'Udekem d'Acoz, Vader & Legezinska, 2007. (D) *Solenocera membranacea* (Risso, 1816). Scale bars = 1.0 mm (A, C), 0.1 mm (B), and 10 mm (D).

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species originally described from Morocco should occur in New Zealand waters, Lörz & Coleman (2013) could detect no morphological differences between their material from New Zealand and Atlantic material. Costello *et al.* (1989) stated that the only British or Irish record of *S. affinis* is from off the coast of Malahide, County Dublin based on identification of material collected in 1885 and held in the National Museum of Ireland. The species does not appear to have been formally reported in British or Irish waters since then. The present specimen, although damaged, fits well with the figures and descriptions provided by Sexton (1911), Barnard (1972), Karaman (1993) and Fuchs *et al.* (2019), and provides evidence of the species' recent occurrence in these waters.

Bathyporeiidae d'Udekem d'Acoz, 2011
Bathyporeia gracilis G.O. Sars, 1891

Material: 1 specimen; The Canyons MCZ, station CNYN007; 48° 28′30″N 009°34′23″W; water depth 307 m; slightly gravelly sand; leg. Cefas, 29 May 2017; det. C. Ashelby, 12 Dec. 2017. 1 specimen; The Canyons MCZ, station CNYN012; 48°28′17″N 009°34′58″W; water depth 307 m; slightly gravelly sand; leg. Cefas, 29 May 2017; det. C. Ashelby, 12 Dec. 2017.

Remarks: d'Udekem d'Acoz (2004) reported a maximum depth for *B. gracilis* of 106 m. The present specimens, both collected at 307 m, therefore considerably extend the bathymetric range of the species.

Melitidae Bousfield, 1973
Abludomelita aculeata (Chevreux, 1911)
Figure 2A–B

Material: 1 male; The Canyons MCZ, station CNYN016; 48°23′39″N 009°38′11″W; water depth 319 m; slightly gravelly muddy sand; leg. Cefas, 30 May 2017; det. C. Ashelby, 12 Dec. 2017.

Remarks: *Abludomelita aculeata* is easily distinguished from the two other members of the genus occurring in British waters, *A. gladiosa* (Spence Bate, 1862) and *A. obtusata* (Montagu, 1813), through having a single, strong dorsal tooth on pleon segment 1 (three strong teeth in *A. gladiosa*, unarmed in *A. obtusata*), by having a serrate posterior margin of the third epimeral plate (both posterior and ventral margins serrate in *A. gladiosa*, posterior and ventral margins smooth in *A. obtusata*), and its distinctly rectangular propodus and palm with a strong tooth of the second gnathopod in males.

Karaman (1982) believed *A. aculeata* to be endemic to the western part of the Mediterranean Sea. Recently, Bakir *et al.* (2010) reported its occurrence in Turkey, providing the first records from the eastern Mediterranean. Cunha *et al.* (1997) reported *A. aculeata* from off the coast of Portugal providing the first evidence of its occurrence in the north-east Atlantic. The new record presented here extends its distribution considerably northwards and demonstrates that it probably has a much larger range in the North-east Atlantic than previously thought.

DECAPODA Latreille, 1802
Solenoceridae Wood-Mason in Wood-Mason & Alcock, 1891
Solenocera membranacea (Risso, 1816)
Figure 2D

Material: 1 female; The Canyons MCZ, station CNYN009; 48°26′24″N 009°33′48″W; water depth 210 m; muddy sand; leg. Cefas, 29 May 2017; det. C. Ashelby, 30 Nov. 2017.

Remarks: Calman (1896) provided the first records of *S. membranacea* from British or Irish waters (as *S. siphonocerus* Philippi, 1840) reporting two specimens from the west coast of Ireland. Subsequently, Kemp (1910) reported records of a further seven specimens from trawl samples taken between 1904 and 1907 in deep waters off south-west Ireland. Stephensen (1923) reported the occurrence of larvae of *S. membranacea* from the west of the English Channel, midway between Devon and Brittany, but does not report any adult specimens from this region. Ó Céidigh (1963) mentions 16 specimens retrieved from fish stomachs off Co. Galway whilst O'Riordan (1969) cited a further 14 previously unreported specimens from Irish waters held in the collections of the National Museum of Ireland. More recently, Ellis *et al.* (2013) recorded nine specimens from trawl samples from the Jones Bank in the central Celtic Sea at a depth of 132 m. Further records of this species from the south-western Celtic Sea are reported on the Ocean Biogeographic Information System website (Intergovernmental Oceanographic Commission of UNESCO, https://obis.org/taxon/107120; accessed: 22 April 2020).

A single confirmed specimen of this species was obtained from The Canyons MCZ; however, a fragmented specimen from this survey that was only identifiable with certainty to suborder level (Dendrobranchiata) almost certainly also belonged to this species.

Leucosiidae Samouelle, 1819
Ebalia nux A. Milne-Edwards, 1883

Material: 1 female; The Canyons MCZ, station CNYN014; 48° 22′59″N 009°44′05″W; water depth 334 m; slightly gravelly muddy sand; leg. Cefas, 31 May 2017; det. C. Ashelby, 06 Nov. 2017. 1 female, 1 male; The Canyons MCZ, station CNYN032; 48°19′14″N 009°38′03″W; water depth 400 m; sandy mud; leg. Cefas, 02/06/2017; det. C. Ashelby, 12 Dec. 2017.

Remarks: Clark (1986) plotted the known distribution of *Ebalia nux* in British and Irish waters based on records from O'Riordan (1969) and Levell (1980), demonstrating its occurrence in deeper waters around the continental shelf limits to the south and west of Ireland and a single record off north-east Shetland. The present records fall within this previously reported distribution range. However, as noted by Clark (1986: 59) identification of North-east Atlantic *Ebalia* spp. is laborious and problematic and the records used to construct the distribution maps for *Ebalia* may be unreliable. Based on the potentially problematic identification, and since the record from off Shetland (Levell, 1980) represents the northernmost record of the species, is from a comparatively shallow depth, is from a region where several other *Ebalia* species are well known, and is reasonably remote from the next known records, it was desirable to confirm the identity of these specimens. The specimens reported by Levell (1980) were re-examined herein (2 ovigerous females, 4 males; Magnus Oilfield; 61°37.20′N 01°18.42′E; Leg. OPRU 06.1979; Det. OPRU; NMWZ 2011.022.0021) and are confirmed as belonging to *E. nux*. Additional northerly specimens from the Gullfaks Oilfield were also examined (2 juvenile males; Gullfaks Oilfields A and C; 62°20′N 02°20′E; 129–137 m; Leg. G Hobbs 05.1992; Det. D Levell 1992; NMWZ 2000.102.0003), which slightly extends the northern limit of the known range of *E. nux*. A further five British records of *E. nux* are posted on the NBN Atlas website (at https://species.nbnatlas.org/species/NHMSYS0021049620; accessed 2 January 2018) but are considered here as potentially erroneous based on the unusually shallow sampling depth for a typically deep-water species and the problematic identification of *Ebalia* species. Conversely, some deeper water records of *Ebalia tuberosa* (Pennant, 1777) reported by Clark (1986) are considered here to possibly belong to *E. nux*.

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Discussion

Records of eight crustaceans from a recent survey of The Canyons MCZ are discussed here. None of the species were abundant but all represent significant findings for a variety of reasons. *Bathyporeia gracilis* is widely distributed and reasonably common in shallower waters around the British Isles but has not previously recorded at such depths. The geographic range of *Abludomelita aculeata* is extended considerably northwards from previous Atlantic records off the coast of Portugal. The genus *Rhachotropis*, previously unrecorded for British waters, is represented by two species whilst new records of *Hypererythrops serriventer*, *Solenocera membranacea*, *Ebalia nux* and *Syrrhoe affinis*, all of which were known from British or Irish waters only from a small number of historical records, are presented.

The records demonstrate the value of routine monitoring programmes in providing current distributional data for species. Monitoring over several years can also provide data on temporal changes in species' distribution or populations. This is particularly important in light of the ever-growing and potentially cumulative pressures on the marine environment such as the introduction of non-native species, climate change, marine litter, removal of ecologically important taxa and the destruction of vulnerable marine ecosystems. Whilst the importance of routine monitoring applies to all marine habitats, it is especially true of deeper waters where sampling is less frequent, and the existing faunal composition is less well studied. Additionally, the records reported here are derived from a single sampling type, a NIOZ core, which is a good generalist sampling method for sampling small- and mid-sized organisms from soft sediments. However, use of alternative sampling methods such as baited traps, light traps, trawls and dredges would enable sampling of a wider range of sedimentary habitats and associated fauna, likely providing records of additional species not identified in the present samples. These records also demonstrate that, despite the perception that British waters are well known, there is still a great deal to learn about the crustacean fauna of the region, especially in deeper waters or amongst taxonomically problematic groups.

Chan *et al.* (2016) recently reported the little-known shrimp *Leontocaris lar* Kemp, 1906 from a deep-water location close to The Canyons MCZ. This species was previously known from just three specimens collected in deep waters off west and south-west Ireland in 1905 and 1907 and it seems probable that it will also occur in the deeper parts of The Canyons MCZ that harbour cold-water corals. It is almost certain that further sampling in remote areas or deeper waters, such as those found around The Canyons MCZ, will provide records of additional crustacea species that are currently poorly known or have not been previously reported from British waters, and thus add to the known biodiversity of the region.

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Author contributions. PM and AC were involved in the sample collection. Specimens were identified by CA. CA drafted the manuscript. AC and PM created Figure 1 and SP created Figure 2. All co-authors made substantial contributions to the content, design and revision of the manuscript and figures and approved the final version for publication.

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Conflict of interest. The authors declare that they have no competing interests.

Data availability statement. The full macrobenthic data set is available online at https://doi.org/10.14466/CefasDataHub.55. Material examined is held in the collections of either APEM or Cefas and may be made available upon reasonable request.

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