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New deep-water cnidarian sites in the southern Adriatic Sea

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Abstract

Recent ROV (Remotely Operated Vehicle) exploration and bottom sampling in the southern Adriatic Sea (Apulian and Montenegrin margins) resulted in the discovery of cnidarian-rich deep-sea habitats in the depth range of ca. 400-700 m. In particular, ROV inspection of Montenegrin canyons reveals the existence of megabenthic communities dominated by a variety of cnidarians, including scleractinians (*Madrepora oculata, Lophelia pertusa, Dendrophyllia cornigera*), antipatharians (*Leiopathes glaberrima*) and gorgonians (*Callogorgia verticillata*) as major habitat forming taxa, often in association with sponges and, subordinately, serpulids. All such cnidarians are new records for the south-eastern side of the Adriatic Sea. Our investigation indicates that an almost continuous belt of patchy cold water coral sites occurs along the entire south-western margin (Apulian), basically connecting the Adriatic populations with those inhabiting the Ionian margin (Santa Maria di Leuca coral province).

Keywords: Scleractinians, Antipatharians, Gorgonians, benthos, nekton, deep-sea, ROV, south Adriatic.

Introduction

Complex deep-water sessile megabenthic communities, best embodied by Cold Water Coral (CWC)-dominated systems such as for example *Lophelia*-reefs, are recorded to date at many sites in the Mediterranean Sea (Taviani *et al*., 2005, 2011a, b; Freiwald *et al.*, 2009; Gori *et al*., 2013, Fabri *et al*., 2013, with references therein). However, vast areas of this basin are still virtually unexplored in this respect.

A case in point is the Adriatic Sea, where lush live CWC sites have been discovered in the last few years by using Remotely Operated Vehicles (ROV). Best known examples refer to the south-western margin of the basin where scleractinian–sponge communities (i.e. *Madrepora oculata*, *Lophelia pertusa*, *Dendrophyllia cornigera*, *Desmophyllum dianthus, Poecillastra compressa, Pachastrella monilifera*) have been documented in the Bari Canyon, Gondola Slide and Dauno Seamount (Freiwald *et al*., 2009; Bo *et al*., 2012; Sanfilippo *et al.*, 2013).

Scattered occurrences of sub-modern and fresh-looking corals are also reported at many sites in the Adriatic, both in its central (Pomo/Jabuka Pit: Zupanovic, 1969; Taviani *et al*., 2009, 2010, 2011a; Bakran-Petricioli, 2011) and south-western parts (Apulian margin: Trincardi *et al*., 2007).

However, a substantial part of the deep-water domain of the Adriatic basin is still uncharted and related resident biota consequently unknown. Here we present the results of recent surveys of the deep Adriatic Sea, including the largely unexplored south-eastern margin, off Montenegro. Furthermore, besides the already known coral sites in the Bari Canyon, additional live cold-water coral sites have been identified and sampled on the Apulian margin, off Salento peninsula, at Tricase and Otranto.

Material and Methods

The study area is located in the southern Adriatic Sea between 41°40'-39°50' Lat N (Fig. 1). The data presented here have been acquired by R/V *Urania* during CNR cruises ARCADIA in March-April 2010 and ALTRO in

Fig. 1: Location of sites discussed in this study. Bathymetry from EMODnet (European Marine Observation and Data Network) Hydrography portal (resolution 500 m) (http://www.emodnet-hydrography.eu).

December 2012-January 2013, with additional information gathered in April-May 2012 during the MEMA12 cruise. Swath bathymetry data were acquired using three different systems: 1) Kongsberg Simrad EM710 multibeam echo-sounder with nominal sonar frequency of 70-100 kHz, 2) EM3002D with nominal sonar frequency of 300 kHz; 3) Reson 8160 with nominal frequency of 50 kHz. Water column attributes were measured with CTD casts using a Seabird SBE 11 PLUS, using the SEASAVE V5.33 software.

Visual inspection was conducted using the ROV 'Achille M4' (ARCADIA cruise), equipped with a CCD camera, and the ROV 'Pollux III' (ALTRO cruise) equipped with a digital camera (Nikon D80, 10 mega pixels) and a high-definition video camera (SonyHDR-HC7). Sea bottom sampling was performed using a large-volume (60 l) Van Veen grab during the MEMA12 cruise and with the ROV robotic arm during the ALTRO cruise. Ground truthing for taxa identification was based on ROV images and robotic arm samples (ARCADIA and ALTRO cruises) and grab samples (MEMA12 cruise). Voucher specimens are stored in the sample repository of ISMAR-CNR, Bologna.

Results

South-eastern Adriatic Sea: Montenegro

The eastern slope of the southern Adriatic basin has originated from a thick stack of sedimentary prograding units, fed by sediments coming from the adjacent Dinaride-Hellenide fold-and-thrust belt (Argnani *et al*., 2006). The shelf edge is now relict because of the combined contribution of foredeep subsidence and Late Quaternary sea level fluctuations, with sediments currently stored closer to the coastline. Swath bathymetry shows that the eastern slope of the South Adriatic basin is incised by a large number of scars of variable size that are not connected to a subaerial drainage system. These erosional features are possibly due to submarine landslides (Argnani *et al*., 2006, 2011). The frequent scalloped features present along the slope suggest repeated events of retrogressive land sliding (cf. Galloway, 1998) that possibly initiated during the last sea-level lowstand and then continued until present.

Two sites located in canyons indenting the Montenegrin slope at a depth down to 400 m have been surveyed by means of the Achille M4 and Pollux III ROV (respectively st. ARCADIA A63, A65, A67, A68 and ALTRO31, 35 and 36: Fig. 1, Table 1).

The sea bottom (at stations A63, ALTRO31, 35 and 36), at depths between -420 and -490 metres (Fig. 1), is characterized by highly-bioturbated silty-muddy sediment at places colonized by epifaunal organisms such as the sponge *Pachastrella monilifera* and, more uncommonly, the gorgonian *Paramuricea macrospina* (Fig. 2A-B; 3A, F). Rocky substrata emerging from the soft sediment consist of hardground ledges, at times Fe-Mn oxide black-coated, dispersed boulders and blocks up to several meters in size, possibly related to slumping. Such substrata are exploited by a conspicuous megabenthos, namely sponges (i.e. *P. monilifera* and *Desmacella* sp.: Fig. 2B-D, E) and cnidarians (*P. macrospina* and *Callogorgia verticillata*: Fig. 2C, E, H; 3A, E-F), accompanied by serpulids and cemented bivalves (*Spondylus gussonii*). Vagile benthos and visiting nekton include echinoids (*Cidaris cidaris*; Fig. 3A) and *Phycis phycis* (Fig. 3C), respectively. At times, rocky settings serve as substrate for the settlement of large colonies (> 1m in height) of the antipatharian *Leiopathes glaberrima* (Fig. 3B, D-E) and the scleractinian *Madrepora oculata*, in addition to small colonies of *Lophelia pertusa* (~20 cm in height) (Fig. 3B, D-E) and clusters of *Dendrophyllia cornigera* (Fig. 2F; Table 2).

ROV dive A65 was located at a comparable depth (~ -440 m) in an adjacent incision next to A63 and ALTRO31, 35 and 36 stations (Fig. 1). The sea bottom here is characterized by strongly bioturbated soft sediment, interrupted by block boulders and large slabs of black-coated hardgrounds. Soft sediment is inhabited by sparse white fan-shaped sponges and gorgonians (*P. monilifera* and *P. macrospina,* respectively), while hardgrounds are

Table 1. Station list.

Station	Gear	Site	Dive Start/ Sample Site	Dive Start/ Sample Depth (m)	Dive End	Final Depth (m)
A77	ROV	Bari Canyon	41°14.656'N - 17°19.981'E	449	41°12.009'N - 16°56.907'E	422
A208	ROV	Bari Canyon	41°14.235'N – 17°17.053'E	412	41°17.154'N – 17°16.664'E	382
A210	ROV	Bari Canyon	41°17.313'N - 17°17.117'E	478	41°16.765'N – 17°15.935'E	479
MEMA12_10	Box Core	Off Otranto	40°14.632'N - 18°48.424'E	778		
MEMA12_11	Box Core	Off Otranto	40°14.636'N - 18°48.431'E	778		
MEMA12_27	Box Core	Off Tricase	39°52.285'N - 18°53.021'E	720		
MEMA12_26	Grab	Off Tricase	39°52.261'N - 18°52.960'E	720		
MEMA12_34	Grab	Off Tricase	39°52.265'N - 18°52.973'E	724		
MEMA12_36	Grab	Off Tricase	39°53.468'N - 18°55.176'E	786		
A63	ROV	Off Montenegro	41°38.879'N - 18°40.443'E	443	41°38.808'N - 18°41.494'E	441
A65	ROV	Off Montenegro	41°38.800'N - 18°40.490'E	441	41°41.056'N - 18°36.224'E	543
A67	ROV	Off Montenegro	41°41.057'N - 18°36.225'E	543	41°41.073'N - 18°36.343'E	468
A68	ROV	Off Montenegro	41°41.069'N - 18°36.344'E	468	41°17.267'N - 18°36.629'E	434
ALTRO31	ROV	Off Montenegro	41°38.815'N – 18°41.532'E	426	41°38.896'N – 18°41.469'E	420
ALTRO35	ROV	Off Montenegro	41°38.885'N – 18°41.455'E	480	41°38.885'N – 18°41.456'E	470
ALTRO36	ROV	Off Montenegro	41°38.885'N – 18°41.463'E	480	41°38.906'N – 18°41.433'E	490

intensely colonized by sessile megabenthos, most noticeably, flashy colonies of the fan-shaped *C. verticillata,* reaching up to 1 m in height (Fig. 2C, E-F; 3A, E-F). *C. verticillata* colonies are preferentially oriented contrasting the dominant currents co-occurring, in forming a true gorgonian garden with an estimated density of a maximum of 5 individuals/m^2. Other sessile benthos includes the sponge *P. monilifera* and the yellow coral *D. cornigera* (Fig. 2F), plus encrusting serpulids. *C. cidaris* was also observed. Sponges (up to ~20 cm in size) do not appear to show any preferential alignment here, with respect to the dominant currents.

Deeper stations A67 and A68 are both located in a steeper part of the same incision at ~ -545 m and ~ -525 m, respectively (Fig. 1). Dispersed blocks and ledges of patinated hard substrata emerge from soft sediment, inhabited by sparse fauna, such as echinoderms (*C. cidaris*) and unidentified hydrozoans. The hard substrata are colonized at st. A67 by small (≈ 15 cm) colonies of *Madrepora oculata*, some fouling lost longlines (Fig. 2G), *Dendrophyllia cornigera*, and sponges at st. A68 (Table 2).

The visiting vagile fauna includes the large decapod *Paromola cuvieri* and, more commonly, *Plesionika martia*; the decapods *Bathynectes maravigna* and *Munida tenuimana* were observed associated with large colonies of *Madrepora oculata* or asperities in rocky sea bottom (Fig. 4A-D), while the demersal fish *Helicolenus dactylopterus* was often seen next to deep-water coral grounds (Fig. 4A).

a. South-western Adriatic Sea: Bari Canyon

Morphologically, the Bari Canyon is an E-W oriented two-branch incision, with sub-vertical flanks in its southern part and less abrupt flanks northward that represent a levee complex. Flanks evolve basinwards into gentler morphologies and obliterate at depths greater than 1100 m (Trincardi *et al*., 2007; Freiwald *et al*., 2009). The Bari Canyon is active and represents an efficient channel transporting sediments and nutrients from the continental shelf down to the bathyal zone (Turchetto *et al.*, 2007). It is bathed by dense water masses (North Adriatic Dense Water, NAdDW) flowing southward towards the Otranto Strait and the Ionian Sea following the isobaths at intermediate depths (400-700 m; Vilibic & Orlic, 2002).

ROV stations A77, A208 and A210 (Fig. 1, Table 1) in the Bari Canyon roughly re-occupied an area partly explored before (Freiwald *et al*., 2009). The rocky bedrock between ca. 450-500 m is at suitable sites successfully exploited by a variety of cnidarians, sponges and serpulids. *M. oculata* prevails over other cnidarians, with relatively small fan-shaped colonies that rarely exceed 20-30 cm in size (Fig. 5A-D; 6B-F-H; 7E-H); *D. cornigera* is also present but subordinate (Fig. 7C). *M. oculata* is consistently associated with massive sponges such as *P. monilifera* (the white fan-shaped sponge in Fig. 5-7) and *Poecillastra compressa* (the orange fan-shaped sponge in Fig. 5-7), which are principal elements of these deep-water associations in the Mediterranean (Bo *et al.*, 2012; Calcinai *et al*., 2013). Several species of serpulids (i.e. *Serpula vermicularis*: Fig. 5C-D; 6D-E, H), are intimately linked with *M. oculata* and contribute to strengthening carbonate bioconstruction (cf. Sanfilippo *et al*., 2013). Such cnidarian-sponge-serpulid associations show preferential orientation along the canyon wall, a likely response to predominant current regimes (Wainwright & Koehl, 1976). The site is also visited by vagile macrobenthos, noticeably echinoids *C. cidaris* (Fig. 5B)

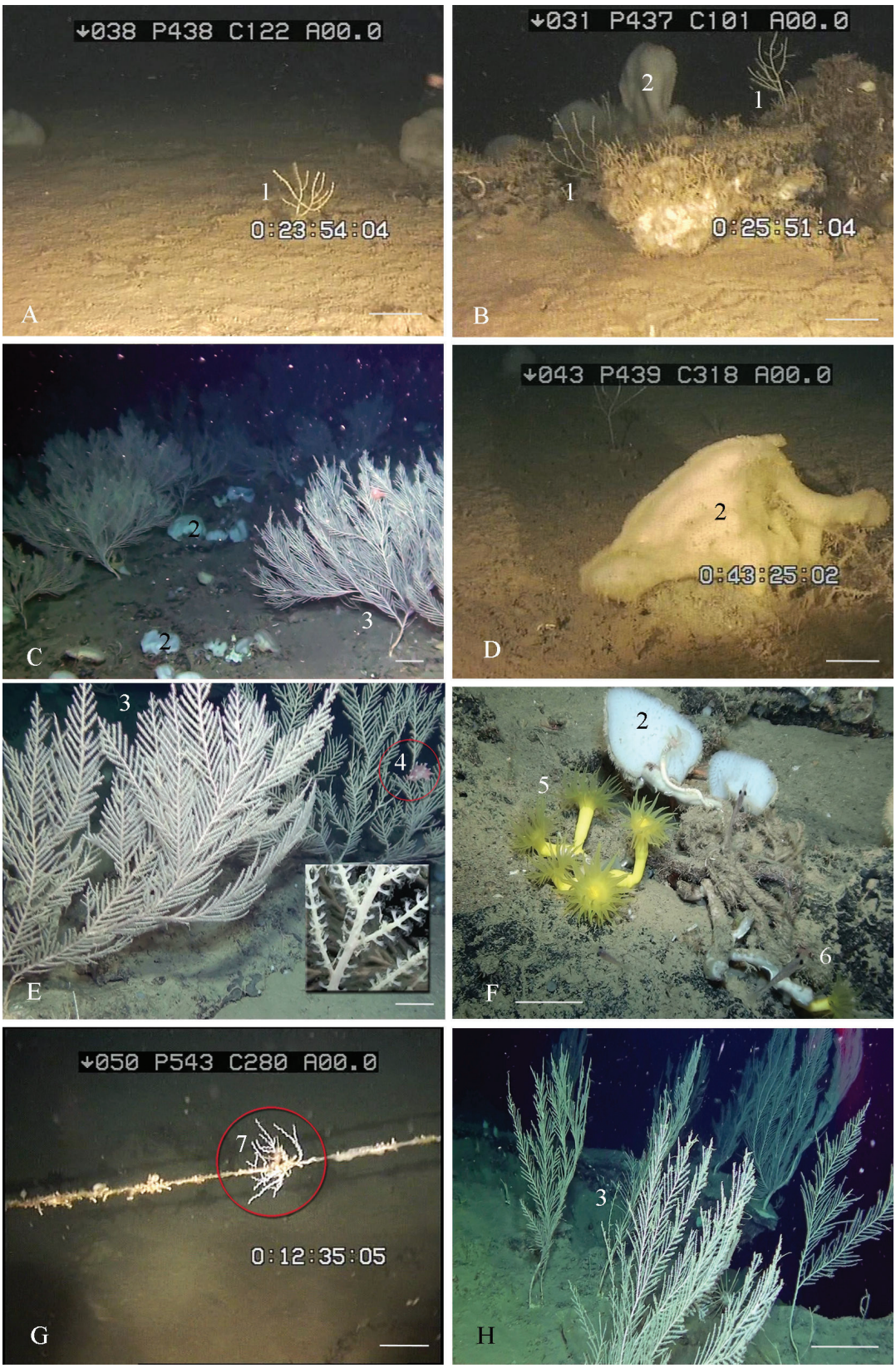

Fig. 2: (A) *Paramuricea macrospina* (1) growing on muddy bottom at st. A65; bar =10 cm; (B-D) Gorgonians (*P. macrospina*: 1 and *Callogorgia verticillata*: 3) and sponges (*Pachastrella monilifera*: 2) co-occurring at st. A65 and ALTRO31; bar = 10 cm; (E) Large colony of *C. verticillata* (3); note the unidentified nudibranch (4, red circle) at st. ALTRO31; bar = 10 cm; (F) The yellow coral *Dendrophyllia cornigera* (5) at st. ALTRO31; note the sponge *P. monilifera* (2) growing on subfossil branches of *D. cornigera* and the Euphasiacean *Stylocheiron* sp. (6); bar = 5 cm; (G) *Madrepora oculata* (7) fouling a lost fishline at st. A67; bar = 10 cm; (H) A gorgonian garden at st. ALTRO31 characterized by many individuals of *C. verticillata* (3) growing over a hardground; bar = 25 cm.

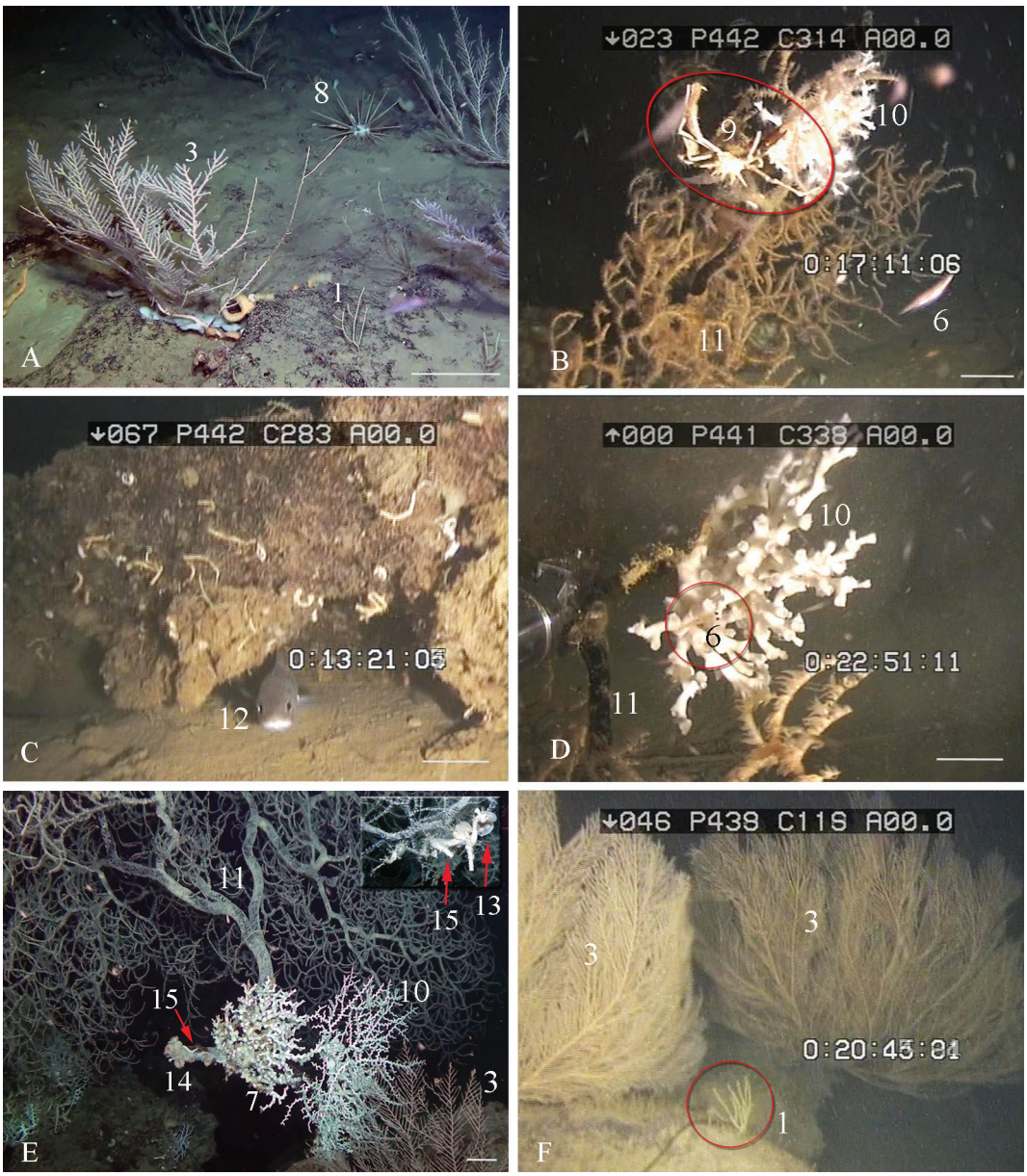

Fig. 3: Montenegrin margin. (A) Hardground at st. ALTRO31 colonized by gorgonians *Callogorgia verticillata* (3) and *Paramuricea macrospina* (1); note the pencil sea urchin *Cidaris cidaris* (8), one of the most common vagile organisms observable at such depths; bar = 25 cm; (B) A large colony of the anthipatharian *Leiopathes glaberrima* (11) settled by the scleractinian *Lophelia pertusa* (10) at st. A63; observe *Rochinia rissoana* (9) in the coral frame and the abundant zooplankton in the surrounding water (i.e. *Stylocheiron* sp.: 6); bar = 10 cm; (C) The fish *Phycis phycis* (12) hidden under a hardground at st. A63; bar = 10 cm; (D) Close-up of *L. pertusa* (10) growing on *L. glaberrima* (11) at st. A63 surrounded by abundant zooplankton (i.e. the euphasiacean *Stylocheiron* sp.: 6), bar = 10 cm; (E) A remarkable cnidarian assemblage at st. ALTRO35 ca. -505 m water depth, formed by a large (up to 2 m) colony of *L. glaberrima* (11), the scleractinians *Madrepora oculata* (7) and *L. pertusa* (10) and *Desmophyllum dianthus* (14); inset shows the byssate bivalve *Delectopecten vitreus* (13) and Annelida (*Serpula vermicularis*: 15) attached to *L. glaberrima* (11). *C. verticillata* (3) is visible below on the right. Scale bar = 10 cm; (F) The "Gorgonian garden" at st. A65 formed by a dense aggregation of *C. verticillata* colonies (3). The red circle shows the gorgonian *P. macrospina* (1). Scale bar = 10 cm.

and *Echinus melo* (Fig. 6A), which have recently been documented grazing and feeding on *Madrepora* (Stevenson & Rocha, 2013) and sponges (Bo *et al.*, 2012). Decapods (*Plesionika martia*: Fig. 6B, H; 7A, H; *Munida tenuimana*: Fig. 7G) are relatively common. The occurrence among cnidarians of the anemone *Peachia* sp. (Fig. 6A) is noteworthy. Fishes spotted at this site include two undetermined species belonging to families Argentinidae and Myctophidae (Fig. 6B; 7C; Table 2), the economically-important *Phycis blennoides* (Fig. 6G) and *Pagellus bogaraveo*, while the presence of the uncommon fish *Gaidropsarus granti* is noticeable.

ROV dive A77 surveyed a previously uncharted sector of this region of the Bari Canyon. The site is a N-S oriented incision characterized by steep flanks and a large U-shaped thalweg. Hard substrata were visually

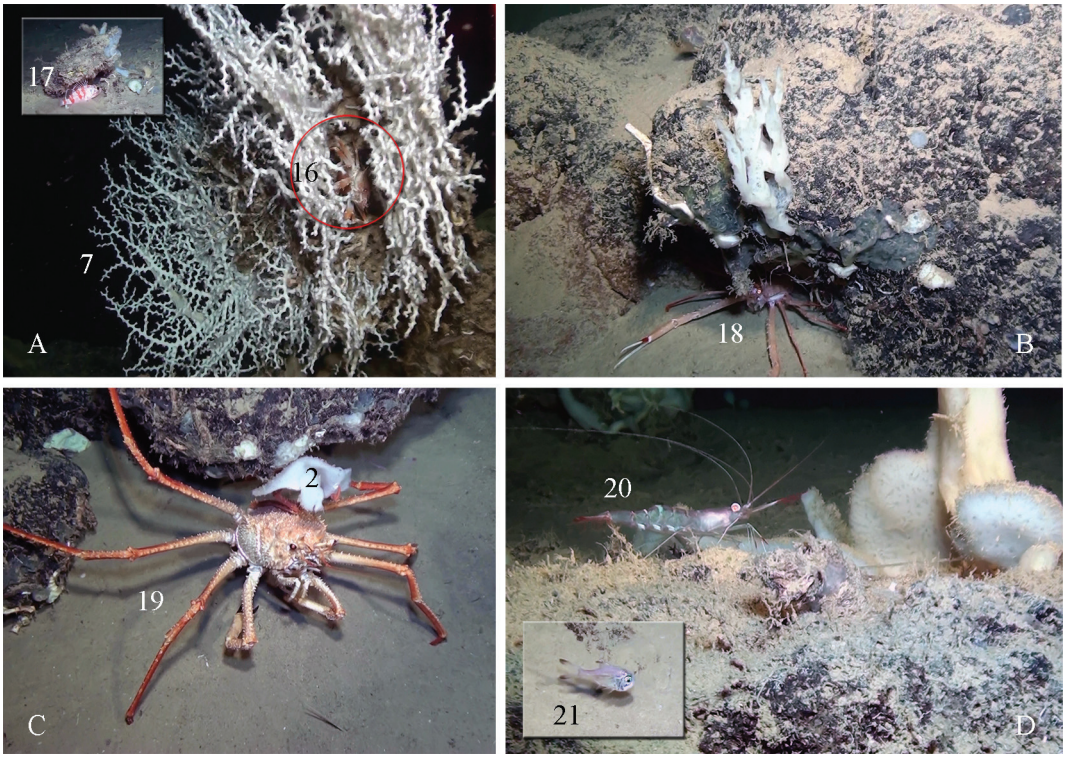

Fig. 4: Non-sessile fauna associated with cnidarian assemblages in the Montenegrin margin. (A) Large *Madrepora oculata* bush (up to 1 m) (7), at st. ALTRO36, hosting the crab *Bathynectes maravigna* (16), inset shows *Helicolenus dactylopterus* (17); (B) *Munida tenuimana* (18) taking shelter under hardground at st. ALTRO31; (C) *Paromola cuvieri* (19) carrying the sponge *Pachastrella monilifera* on its back (2) (possibly an antipredatory strategy: Capezzuto *et al*., 2012); (D) The shrimp *Plesionika martia* (20) and the fish *Hoplostethus mediterraneus* (21) from st. ALTRO31.

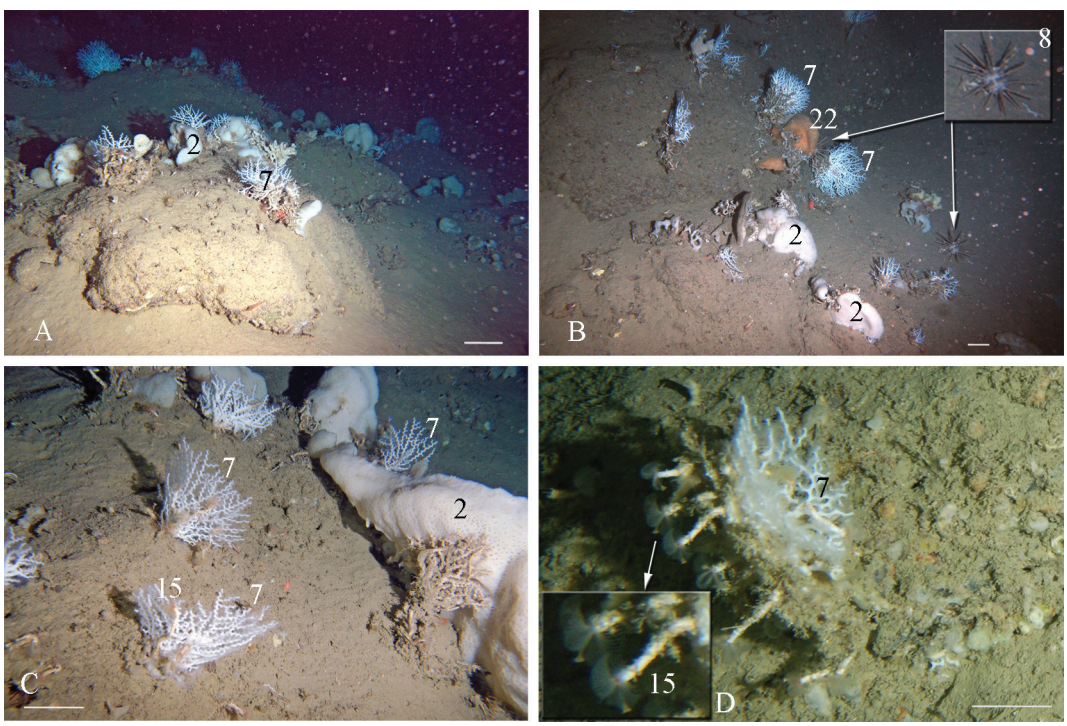

Fig. 5: Underwater photographs from the Bari Canyon. (A, B) Hardgrounds and boulders along the canyon's flank at st. A208 colonized by a cnidarian-sponge assemblage dominated by *Madrepora oculata* (7) and *Pachastrella monilifera* (2); note the occurrence of orange sponge (*Poecillastra compressa*: 22) and *Cidaris cidaris* (8) one of most common elements of the vagile bathyal benthos; bar = 25 cm; (C) Close-up of a cnidarian-sponge assemblage at st. A208 showing the coalescent growth of sponges and corals, and the subordinate presence of *Serpula vermicularis* (15); bar = 25 cm; (D) Intimately associated *S. vermicularis* (15) and *M. oculata* (7) established on a hardground crest at st. A210; bar =10 cm.

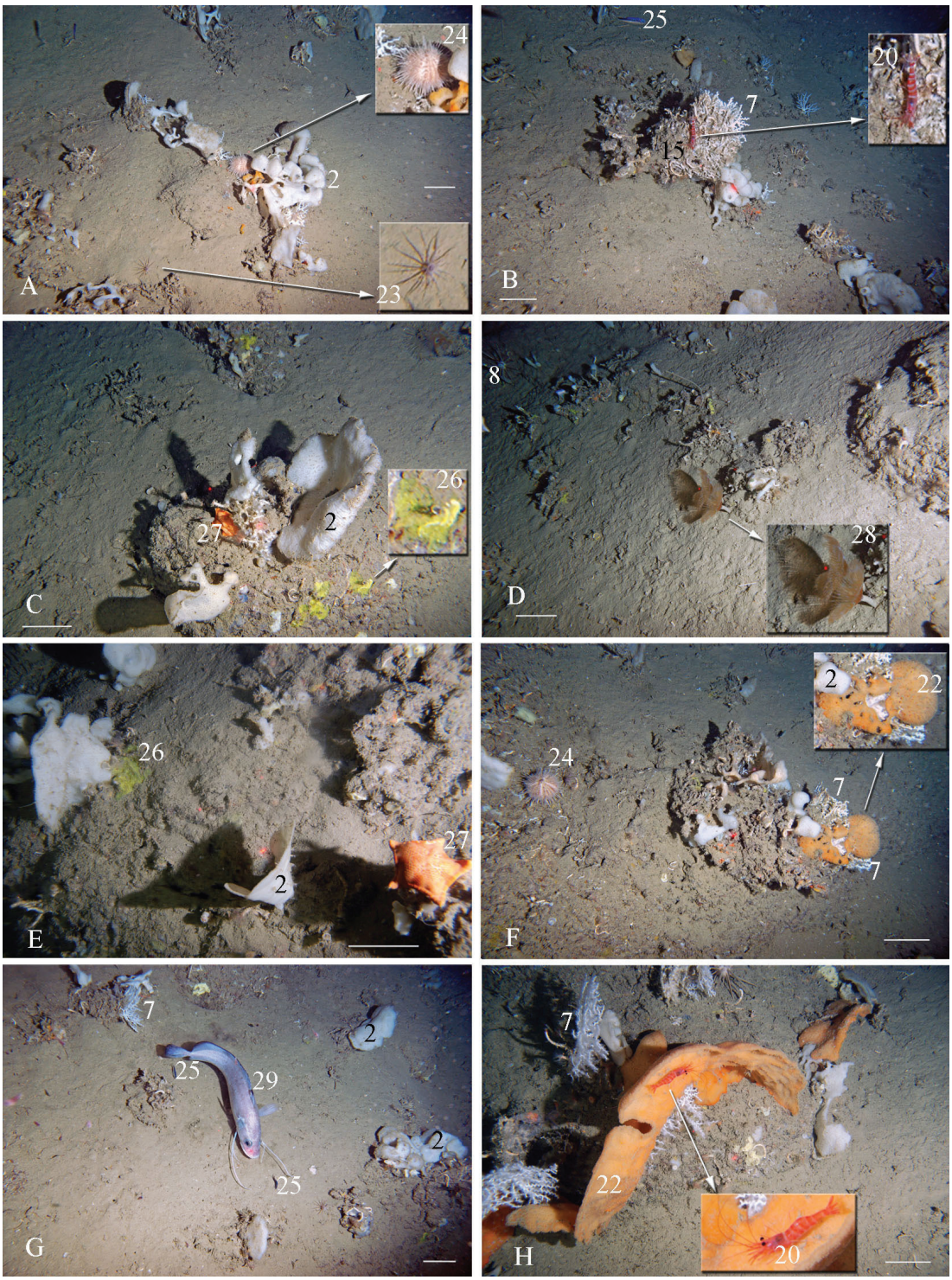

Fig. 6: Coral-sponge assemblages from the Bari Canyon. (A) Assemblage dominated by the white sponge *Pachastrella monilifera* (2) at st. A210; insets show an actiniarian belonging to the genus *Peachia* in the soft sediments (23); and the vagrant echinoid *Echinus melo* (24); bar = 25 cm; (B) The shrimp *Plesionika martia* (20) on *Madrepora oculata* (7) - *Serpula vermicularis* (15) bio-construction at st. A210, undetermined fish belonging to the family Argentinidae (25); bar = 25 cm; (C) *Madrepora-Pachastrella* assemblage at st. A210; note the tiny seastar *Peltaster placenta* (27) hidden under the coral frame, and the encrusting yellow sponge *Hexadella* sp. (26); bar = 10 cm; (D) Canyon's flank at st. A210 showing the conspicuous presence of serpulids, mostly *Bispira* sp. (28) and the presence of the vagrant echinoid *Cidaris cidaris* (8); bar = 10 cm; (E) Benthos at st. A210 showing the encrusting sponge *Hexadella* sp. (26) and the cup-like sponge *P. monilifera* (2); also note the asteroid *P. placenta* (27); bar = 10 cm; (F) Scleractinian-sponge-serpulid cluster at st. A210, inset shows close-up of the sponges *P. monilifera* (2) and *Poecillastra compressa* (22); note the echinoid *E. melo* (24) and the scleractinian *M. oculata* (7); bar =10 cm; (G) The fish *Phycis blennoides* (29) and a fish related to family Argentinidae (25), foraging next to coral-sponge grounds at st. A210 (*M. oculata* 7; *P. monilifera* 2); bar = 10 cm; (H) Close-up of the orange cup-like sponge *P. compressa* (22) at st. A208, sheltering the decapod *P. martia* (20); note *M. oculata* (7) on the left side of the sponge; bar = 10 cm.

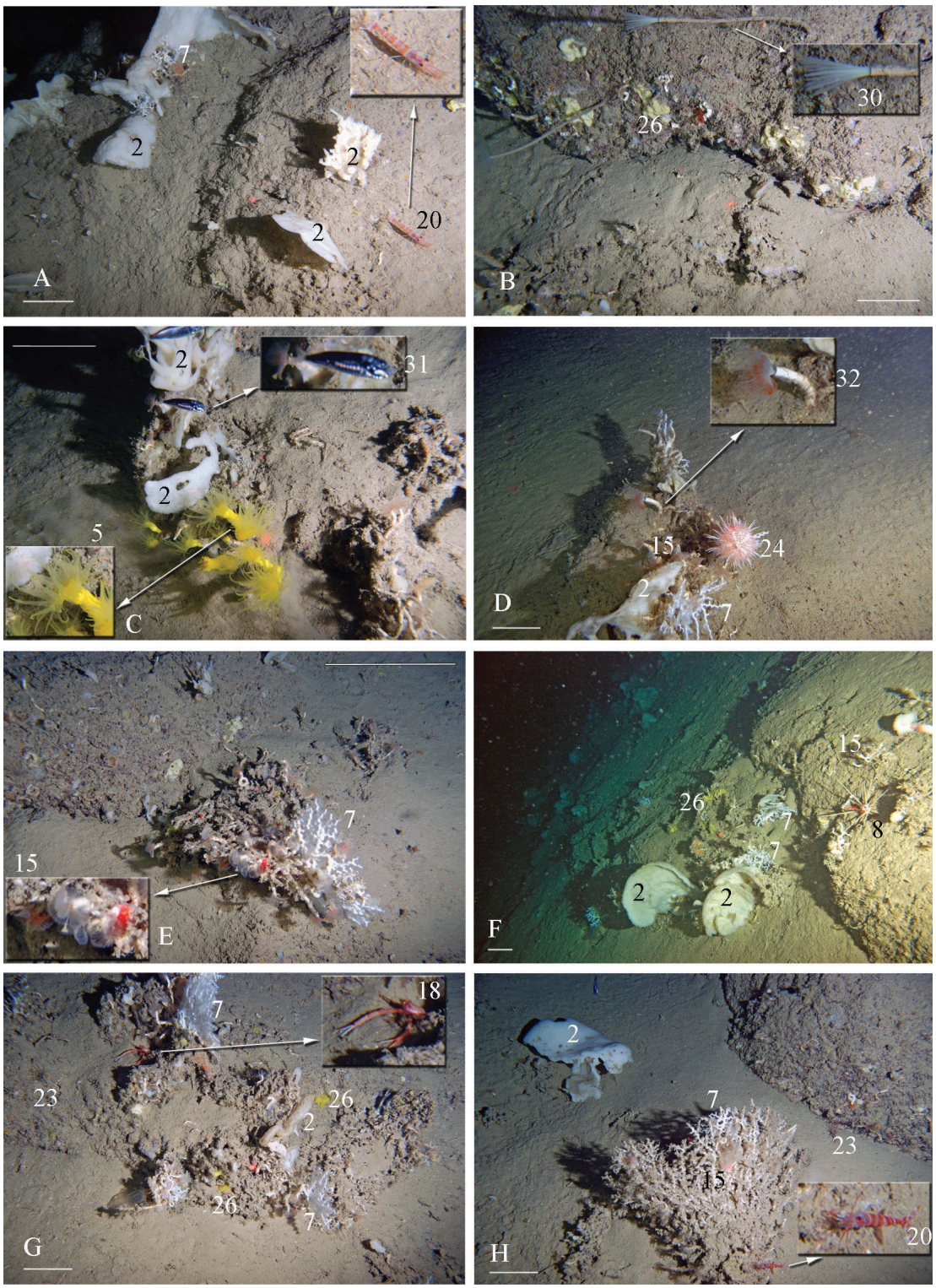

Fig. 7: Cnidarian habitats in the Bari Canyon: (A) Assemblage dominated by white massive sponges (*Pachastrella monilifera*: 2) and scleractinians (*Madrepora oculata*: 7) at st. A208; note *Plesionika martia* (20), one of the most recurrent decapods in such habitats; bar = 10 cm; (B) Hardground at st. A208, colonized by encrusting sponges (*Hexadella* sp.: 26) and serpulids (*Parasabella* sp.: 30); bar =10 cm; (C) Colony of the yellow coral *Dendrophyllia cornigera* (5) at st. A210, note the fish belonging to the family Myctophidae (31); bar = 10 cm; (D) *Vermiliopsis* sp. (32) and *Serpula vermicularis* (15) are the main constituents of the cnidarian-serpulid assemblage at st. A208; *Echinus melo* (24) is probably grazing on a *M. oculata* (7) colony; bar = 10 cm; (E) *M. oculata* (7) - *S. vermicularis* (15) cluster at st. A210; bar =10 cm; (F) Canyon's flank at st. A210, inhabited by sponges (*P. monilifera*, 2; *Hexadella* sp., 26), cnidarians (*M. oculata*, 7) and serpulids (*S. vermicularis*, 15) plus vagile echinoids (*Cidaris cidaris*, 8); bar = 25 cm; (G, H) Scleractinian-sponge dominated habitats at st. A210, (*M. oculata*: 7, *P. monilifera*: 2, *Hexadella* sp.: 26), serving also as refuge for the decapods *Munida tenuimana* (18) and *P. martia* (20); the sea anemone *Peachia* sp. (23) inhabit surrounding soft substrata; bar = 10 cm.

Table 2. List of the taxa collected or identified by images at the study sites in the southern Adriatic Sea (Code: Number code of the species reported in Fig. 2-8; M: Montenegro; B: Bari Canyon; T: Tricase; O: Otranto).

Taxa	code	M	B	T	O
Porifera					
Desmacella sp.	-	x			
Hexadella sp.	26		x		
Pachastrella monilifera Schmidt, 1868	2	x	x		
Poecillastra compressa (Bowerbank, 1866)	22		x	x	
Cnidaria					
Callogorgia verticillata (Pallas, 1766)	3	x			
Dendrophyllia cornigera (Lamarck, 1816)	5	x	x		
Desmophyllum dianthus (Esper, 1794)	14			x	x
Kadophellia bathyalis (Tur, 1991)	-				x
Leiopathes glaberrima (Esper, 1792)	11	x			
Lophelia pertusa (Linnaeus, 1758)	10	x	x	x	x
Madrepora oculata Linnaeus, 1758	7	x	x	x	x
Paramuricea macrospina (von Koch, 1882)	1	x			
Peachia sp.	23		x		
Stenocyathus vermiformis (Pourtalès, 1868)	-			x	
Mollusca					
Asperarca nodulosa (Müller, 1776)	-			x	x
Bathyarca philippiana (Nyst, 1848)	-			x	
Ennucula aegeensis (Forbes, 1844)	-				x
Delectopecten vitreus (Gmelin, 1791)	13	x			
Spondylus gussonii Costa, 1829	-	x		x	
Nudibranchia	4	x			
Annelida					
Bispira sp.	28		x		
Parasabella sp.	30		x		
Serpula vermicularis Linnaeus, 1767	15		x		x
Vermiliopsis sp.	32	x	x		
Crustacea					
Alpheus platydactilus Coutière, 1897	-				x
Munida sp.	-				x
Munida tenuimana Sars, 1872	18	x	x		
Plesionika martia Milne Edwards, 1883	20		x		
Rochinia rissoana (Roux, 1828)	9	x			
Stylocheiron sp.	6	x			
Paromola cuvieri (Risso, 1816)	19	x	x		
Bathynectes maravigna (Prestandrea, 1839)	16	x	x		
Brachiopoda					
Novocrania anomala (Müller, 1776)	-				x
Echinodermata					
Cidaris cidaris (Linnaeus, 1758)	8	x	x		
Echinus melo Lamarck, 1816	24		x		
Odontaster sp.	-	x			
Peltaster placenta (Müller & Troschel, 1842)	27		x		
Pisces					
Argentinidae	25		x		
Myctophidae	31		x		
Phycis blennoides (Brünnich, 1768)	29		x		
Phycis phycis (Linnaeus, 1766)	12	x			
Helicolenus dactylopterus (Delaroche, 1809)	17	x	x		
Hoplostethus mediterraneus Cuvier, 1829	21	x			
Pagellus bogaraveo (Brünnich, 1768)	-	x	x		
Gaidropsarus granti (Regan, 1903)	-		x		

searched for the presence of large cnidarians but appear to be colonized by sponges only (e.g. *P. monilifera* and *P. compressa*) and serpulids (e.g. *S. vermicularis*).

b. South-western Adriatic Sea: Tricase

The escarpment is incised by several canyons (Fig. 1), displaying a wide apron at its base, possibly due to slumping from the margin. Data available at present are limited to bottom sampling evidence (MEMA12_26, 27, 34, 36: Fig. 1, Table 1). No living cnidarians were recovered from the canyon walls, but blocks at the canyon base at 720-786 m appear colonized by living specimens of *Desmophyllum dianthus* (Fig. 8A-C) and, more uncommonly, by *L. pertusa* (Fig. 8B, D), *M. oculata* and *Stenocyathus vermiformis*. Benthic fauna associated with scleractinians include byssate bivalves (*Asperarca nodulosa, Bathyarca philippiana, Spondylus gussonii*) and brachiopods (*Novocrania anomala*), commonly associated with large sponges (*P. monilifera* and *P. compressa*) and decapods (*Alpheus platydactilus* and *Munida* sp.). Subfossil coral frames (i.e. *L. pertusa* and *M. oculata*) appear fouled by various species of serpulids (e.g. *S. vermicularis*) and hydrozoans.

c. South-western Adriatic Sea: Otranto

Live CWC were sampled at the southernmost stations along the Salento peninsula in the Otranto Strait (MEMA12_10, 11: Fig. 1, Table 1), next to the midline between Italy and Albania. These new CWC sites thus extend the known documentation, merging the Adriatic coral grounds with the well-known Ionian sites, off Santa Maria di Leuca (Taviani *et al*. 2005; Mastrototaro *et al*. 2010). In particular, grab samples obtained from the talus at the base of steep slopes (775-778 m) recovered thin hardgrounds or crusts (less than 5 cm thick) colonized by the small actiniarian *Kadophellia bathyalis*, living colonies of *L. pertusa* and *M. oculata*, bivalves (*A. nodulosa*), hydrozoans, sponges, and serpulids. The adjacent muddy bottom is inhabited by infaunal bivalves (*Ennucula aegeensis*) (Table 2). The occurrence of a displaced shallower water skeletal component at this site is documented by bivalve (*Plagiocardium papillosum* and *Timoclea ovata*) and gastropod (*Turritella turbona*) shells, as well as remains of *Posidonia oceanica*.

Conclusions

Recent exploration of the south-eastern Adriatic Sea margin provides significant new documentation of rich and diverse cnidarian-dominated megabenthic communities. At least six species of conspicuous habitat-forming cnidarians inhabit the bathyal depths of the southern Adriatic basin, i.e. the scleractinians *M. oculata*, *L. pertusa*, *D. cornigera*, and *D. dianthus*, the antipatharian *L. glaberrima* and the gorgonian *C. verticillata*. Furthermore, *M. oculata*, *L. pertusa*, *D. cornigera*, *L. glaberrima* and *C. verticillata* are the first live records of such cnidarians in the south-eastern side of the Adriatic.

ROV dive images and bottom sampling information document that deep-sea cnidarian communities are much commoner in the Southern Adriatic than previously sup-

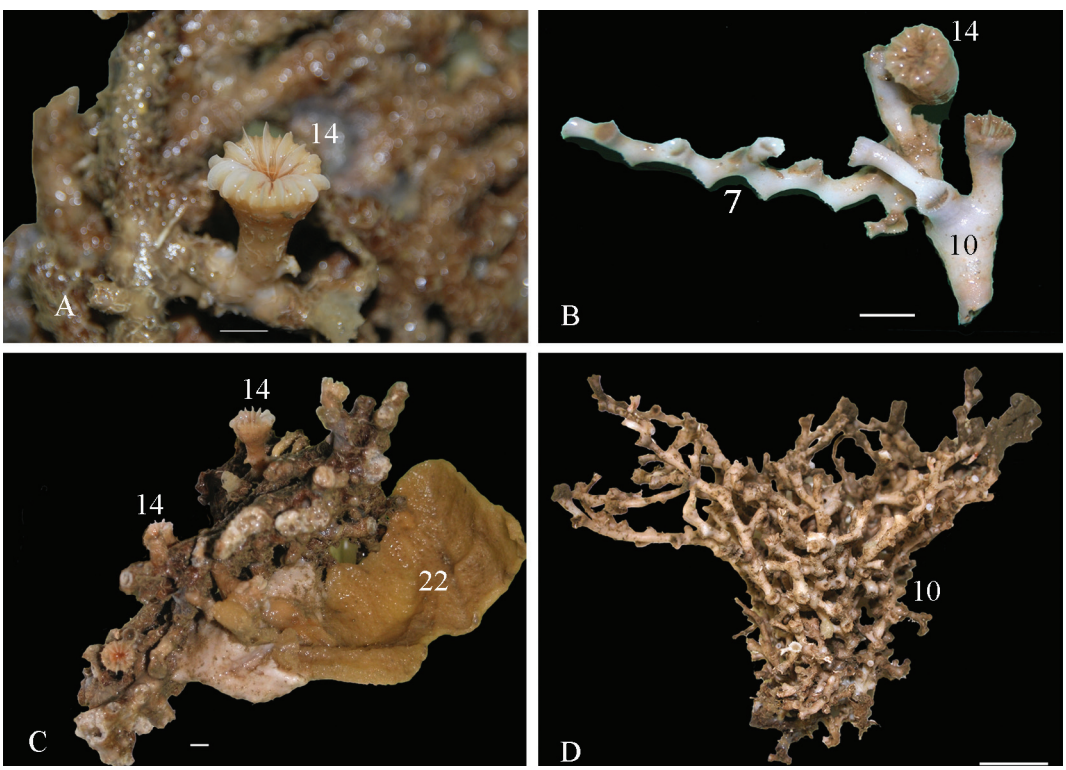

Fig. 8: Live scleractinians from Tricase (all from st. MEMA12-36). (A) Juvenile *Desmophyllum dianthus* (14) growing on subfossil *Madrepora*; bar = 1 cm; (B) Co-occurring live *Lophelia pertusa* (10), *Madrepora oculata* (7) and *D. dianthus* (14); bar = 1 cm.; (C) Dead *Madrepora* frame colonized by *D. dianthus* (14) and *Poecillastra compressa* (22); bar = 1 cm; (D) Live *L. pertusa*; bar = 5 cm.

posed. It further suggests an almost uninterrupted, albeit patchy, belt of CWC sites all along the south-western Adriatic margin from Bari to Otranto, in practice connecting the Adriatic populations to the well known Ionian Santa Maria di Leuca coral province (Taviani *et al*., 2011a). These new occurrences are, therefore, significant in the general frame of understanding the connectivity among discontinuous deep-water coral grounds in this sector of the Mediterranean basin.

In the context of the growing societal interest for deep-sea marine resources, the valuable megabenthic communities described in this study, some of which have been qualified as vulnerable marine ecosystem (Fabri *et al*., 2013), certainly merit attention and sound management.

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