



New Geographical Record of Three Cumacean Species *Eudorella nana*, *Leucon affinis*, *Leucon siphonatus* and One Rare Amphipod Presence Confirmation, *Stenothoe bosporana*, in Adriatic Sea, Italy

P. Strafella¹ · V. Salvalaggio¹ · C. Cuicchi² · E. Punzo¹ · A. Santelli¹ · A. Colombelli¹ · G. Fabi¹ · A. Spagnolo¹

Received: 27 October 2020 / Revised: 8 February 2021 / Accepted: 25 February 2021 / Published online: 5 June 2021
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Abstract

Three cumacean species, *Eudorella nana* Sars, 1879, *Leucon affinis* Fage, 1951, *Leucon siphonatus* Calman, 1905, were recorded for the first time and one rare amphipod presence, *Stenothoe bosporana* Sowinsky, 1898, was confirmed in the Adriatic basin.

Keywords First records · *Eudorella nana* · *Leucon affinis* · *Leucon siphonatus* · *Stenothoe bosporana* · Adriatic Sea

Introduction

The importance of the taxonomist work in biological and ecological research as well as in biodiversity management is well known, even though most of the time it is underestimated. Misidentification of specimens may have some consequences on the accuracy of ecological works and furthermore in fields like medicine, pharmacology, agriculture, conservation biology, ecosystem management and climatology (Dubois et al. 2013).

Some species may be also widely confused by “non-specialized” taxonomists with other similar but common species and this is a possible reason for their rareness.

Three cumaceans belonging to family Leuconidae Sars, 1878 are presented here as first record in the Adriatic Sea. Leuconidae is one of the earliest established cumacean families with no free telson, endopod of the uropod with two articles (rarely one) and which can occasionally have a functional eye (Watling 1991). Currently, the presence of *Eudorella* Norman, 1867 and *Leucon* Krøyer, 1846 genera in the Atlantic Ocean and in the Mediterranean basin (western Mediterranean, Ionian, Aegean and Levantine Seas) is documented by different authors (Lagardère, 1977; Elizalde et al.

1993; Gerken and Watling 1999; Madurell and Cartes 2003; Cartes et al. 2007, 2011; Fanelli et al. 2009; Mühlenhardt-Siegel 2009; Marusso 2010; Frutos and Sorbe 2014, 2017; Corbera and Sorbe 2020). Within the Mediterranean Sea these genera are represented by 3 (*Eudorella*) and 10 (*Leucon*) species (Marusso 2010), while only few studies reported them in the Italian waters (Graeffe 1902; Casellato et al. 2007; Casellato and Stefanon 2008; Klepal and Kastner 1980; Ligas et al. 2009; Coll et al. 2010).

Family Stenothoidae Boeck, 1871 was initially described, together with Amphilochidae Boeck, 1871, as a subfamily of Leucothoidae Dana, 1852 (Boeck 1871; Bousfield 1982), due to the presence in these families of very close characters at pereopods, uropods and mouthparts levels. Subsequently, Sars (1892) classified both Stenothoidae and Amphilochidae at family level (Krapp-Schickel and Koenemann 2006).

Among the 46 genera included within Stenothoidae the most represented is *Stenothoe* Dana, 1852 with 60 valid species already described, closely followed by *Metopa* Boeck, 1871 with 54 species (WoRMS Editorial Board 2020).

In 2006, Krapp-Schickel proposed a classification of the genus *Stenothoe* based on the presence of carinate body, prehensile pereopods and a naked or spinose telson. In 2015 the same author re-described the entire genus dividing the 55 valid species attributed since then in two groups: the largest one comprehending those species more similar to *S. valida* and the smaller one including those species similar to *S. monoculoides* (Krapp-Schickel 2015, 2006).

The genus *Stenothoe* is widely distributed all over the world from boreal to temperate regions (Myers 1985; Bellan-Santini 2005; Hayward and Morley 2005; Krapp-

✉ V. Salvalaggio
vera.salvalaggio@cnr.it

¹ CNR IRBIM - National Research Council – Institute of Marine Biological Resources and Biotechnologies, Ancona, AN, Italy

² Cooperativa Mare Ricerca, Ancona, Italy

Schickel 2006; Krapp-Schickel et al. 2015; Krapp-Schickel and Lo Brutto 2015), both as free-living and in association with sea anemones (Vader 1984; Vader and Krapp-Schickel 1996; Krapp-Schickel 2015).

Up to date, only 14 out of 60 amphipods belonging to the genus *Stenothoe* are known to be distributed within the Mediterranean Sea (Marin and Sinelnikov 2018) and within them only *S. bosporana* Sowinsky, 1898 is still considered as an endemic species (Krapp-Schickel 2015). There was only one old record of this species along the coast of Zlarin Island, Croatia (Krapp-Schickel 1976) without any further information since then.

The contribution of this paper is to rise the knowledge on the macrozoobenthos biodiversity, adding four smalls, but not less important, crustacean species to the Adriatic Sea fauna.

It is well known the importance of the biodiversity, to the point that the first descriptor of the “Good Environmental Status (GES)” of the EU Marine Strategy Framework Directive (MSFD; Directive 2008/56/EC) is, quoting: “Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climate conditions”. In this contest, it is clear the role of taxonomists and the relevance of knowing the distribution of every single species in the biodiversity point of view; furthermore, to understand the spreading of some species (alien and/or invasive) due to climate changes and human activities is extremely crucial to have a clear picture of the native or already present species in a certain place.

Materials and Methods

Study Area The Adriatic Sea is an elongated basin in the northernmost part of the Mediterranean, between the Italian Peninsula and the Balkans countries, with the major axis in the NW-SE direction. The northern area is very shallow, gently sloping, with an average depth of about 35 m, while the central part is on average 140 m depth, with 2 pits, the Pomo pit reaching \approx 260 m and the South Adriatic pit reaching \approx 1200 m. The northern and central parts of the basin are affected by a great number of rivers along the Italian coast, with the Po River being the most relevant in terms of water inflow (Artegiani et al. 1997). River runoff and wind stress are the main drivers of the water circulation. West Adriatic Current (WAC) and East Adriatic Current (EAC), flowing along the coasts, are the main currents affecting the Adriatic circulation. There are three main cyclonic gyres, one in the northern part, one in the middle and one in the south (Artegiani et al. 1997).

In the southern Adriatic Sea, the cyclonic gyre is observed in all seasons and a relatively strong western coastal current and a weaker eastern current are observed during

summer. A strong annual thermal variation affects the northern and central Adriatic Sea and it is more pronounced at the surface (e.g., 5–28 °C) than close to the bottom (e.g., 12–17 °C). The water column from the coast to the 11–12 km offshore is characterized by low temperature (5–6 °C) and salinity (<37‰) in winter, while the offshore waters are warmer (10–12 °C) and thicker (>38‰). A vertical thermohaline front, parallel to the coast and extended throughout the water mass, divides the coastal waters from the open sea. In summer, instead, a horizontal stratification characterizes the water column, separating the warmer surface waters with lower salinity, from the deeper, colder and more saline ones (Artegiani et al. 1997).

The area is affected by a heavy marine traffic from cargo ships, supplier vessels for offshore activities (e.g., gas platforms), ferryboats, trawl-fishing vessels, cruise and recreational crafts (Coll et al. 2007; Pranovi et al. 2016). It is also characterized by intense mussel aquaculture along the Italian coast and by fish farming along the Croatian one (Ponti et al. 2007; Fabi et al. 2009).

Samples Collection and Analysis Macrozoobenthos samples were collected during different surveys, from 2012 to 2019, within a multi-annual monitoring program aimed to assess the environmental effects of offshore gas extraction platforms.

Sampling was performed at three different square areas (A, B, C) of the central Adriatic Sea, each having a surface area of \approx 16 km² (Fig. 1; Table 1).

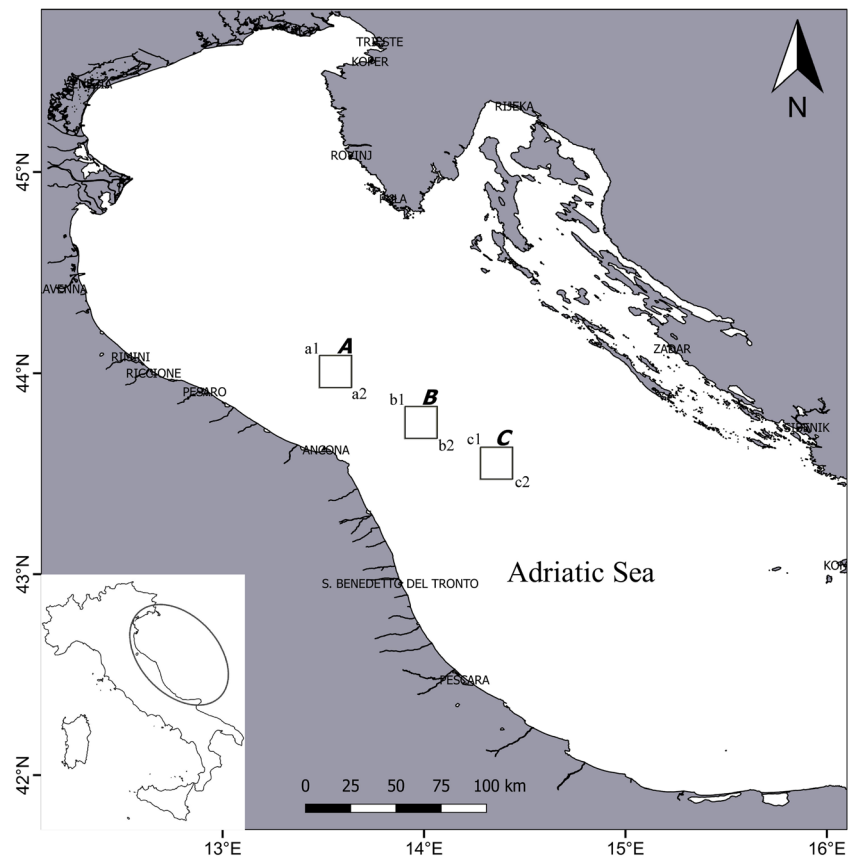
Twenty-four sites were randomly chosen within each area and six samples were collected at each site using a Van-Veen grab (capacity 13.0 L; surface 0.1 m²). The grab samples were sieved in situ through a 0.5 mm mesh, preserved in 5% buffered formalin and later transferred to 70% ethanol. Macrozoobenthos was sorted and identified in the laboratory using a stereomicroscope Zeiss Stemi 2000C and a compound microscope Zeiss Axiolab 5 equipped with eyepiece reticles, stage micrometers and camera.

The specimens herein examined and described are the first of the total recorded (Table 2) during the whole surveys period. All the specimens were measured in size (Total Body Length, TL), dissected when necessary, examined under higher magnification and identified following the below-mentioned systematic keys and descriptions.

Bellan-Santini et al. (1993) and Krapp-Schickel (2015) for the amphipod and Băcescu (1951), Fage (1951), Jones (1976) and Shalla (2011) for the cumaceans were followed for the systematic keys and description.

For some individuals of each species, pictures of body parts were taken using Zeiss Axiocam ERC5s 5mpx. The handmade draws were obtained from the pictures, using XP-PEN Graphic Tablet Deco 02 Pen 8192 and Autodesk SketchBook software.

Fig. 1 Geographical overview of the Adriatic Sea with the details of the surveyed areas



The nomenclature herein follows the World Register of Marine Species (WoRMS Editorial Board 2020). Voucher specimens are presently kept in the reference collection of CNR-IRBIM in Ancona, Italy.

Results

During the overall sampling period, 7 *E. nana* and 11 *L. affinis* were found in A and B areas, 274 *L. siphonatus* in A, B and C areas and 3 *S. bosporana* were only found in C area (Table 2).

Systematic

Class Malacostraca Latreille, 1802.

Order Amphipoda Latreille, 1826.

Family Stenothoidae Boeck, 1871.

Subfamily Stenothoinae Boeck, 1871.

Genus *Stenothoe* Dana, 1852.

***Stenothoe bosporana* Sowinsky, 1898.**

Material examined: Three male specimens (cod. StB-1, StB-2, StB-3) collected in C area in 2018.

Diagnosis: The species presents a sexual dimorphism (Ruffo, 1993).

Table 1 Survey areas with geographical position, mean depth and bottom type

Area	Vertex	Long	Lat	Mean Depth	Bottom Type	Location
A	a1	44°04' 12",84 N	13°31' 57",54E	75 m	silty-sands	45 km from the Italian coast in front of Pesaro
	a2	44°02' 28",38 N	13°34' 32",34E			
B	b1	43° 48' 53"N	14° 0' 20"E	75 m	clay-silt	45 km from the Italian coast in front of Ancona
	b2	43° 47' 6"N	14° 2' 51"E			
C	c1	43°36' 47"N	14° 19' 03"E	80 m	silty-sand	60 km offshore, further south-east than area B
	c2	43° 34' 56"N	14° 21' 37"E			

Table 2 Specimens of *E. nana*, *L. affinis*, *L. siphonatus* and *S. bosporana* recorded from 2012 to 2018 surveys in the three areas

	Number of records	Area	Survey
<i>Eudorella nana</i>	6	A	2012
	1	B	2017
<i>Leucon affinis</i>	6	A	2012
	1	A	2014
	1	B	2015
	2	B	2018
	1	B	2019
<i>Leucon siphonatus</i>	16	A	2012
	2	A	2013
	7	A	2014
	6	B	2013
	16	B	2014
	42	B	2015
	31	B	2016
	70	B	2017
	64	B	2018
	13	B	2019
	3	C	2013
	2	C	2014
	1	C	2016
1	C	2018	
<i>Stenothoe bosporana</i>	3	C	2018

According to Bellan-Santini et al. (1993) and Krapp-Schickel (2015).

TL: 3.5–4.1 mm. Submarginal spines and marginal setae on the telson. Body smooth. Pereopods not prehensile. Eyes present. Antenna 1 and 2 long and slender. Gnatopod 1 feeble, propodus slender and oval, carpus free posterior margin parallel to the anterior one, palm undefined, merus a little shorter than carpus. Gnatopod 2 propodus strong, palm distally serrated with 5–6 protuberances (Fig. 2a). Pereopod 7 (P7) merus reaching distal end of carpus (Fig. 2b).

Ecology and distribution: *S. bosporana* is known to live on muddy bottoms between 35 and 360 m (Bellan-Santini et al. 1993).

As above mentioned, *S. bosporana* is still considered an endemic species in the Mediterranean Sea (Krapp-Schickel 2015), where it is distributed in the eastern part of the basin, from the Sea of Marmara and North Aegean Sea to the Levantine Sea (Krapp-Schickel 1976; Manoudis et al. 2005; Bakir et al. 2014). Fewer records were also registered in the western part of the Mediterranean, particularly in Saint-Tropez Gulf and alongside the Tunisian coast (Chevreux and Fage 1925; Zakhama-Sraieb et al. 2009).

Up to date, no further records are available in literature for this species, except for an uncertain one at the Azores which is still under debate (Krapp-Schickel 1976; Bellan-Santini 2005).

Order Cumacea Krøyer, 1846.

Family Leuconidae Sars, 1878.

Genus *Eudorella* Norman, 1867.

***Eudorella nana* Sars, 1879.**

Material examined: Six female individuals (cod. EuN-1, EuN-2, EuN-3, EuN-4, EuN-5, EuN-6) collected in A area in 2012.

Diagnosis: According to Băcescu (1951), Fage (1951), Jones (1976) and Shalla (2011).

TL: 1.2–3.8 mm. Carapace anteriorly truncate without prominent pseudorostrum (Fig. 3); efferent orifice dorsal. Anterior lateral part of carapace shaped in an evident, horizontal, elongated tip forming a unique tooth in the male and few much shorter teeth in the female; immediately above, a V-shaped excavation with a single upwards pointed tooth on top; an evident sheaf of long bristles on the posterior margin of the fifth abdominal segment.

Ecology and distribution: *E. nana* is considered typical of circalittoral habitats, living in different types of sediment, from sandy bottoms to coastal terrigenous mud, as well as in coastal detritic, muddy detritic, and shelf-edge detritic bottoms (Carpine 1970; Ledoyer 1983; Corbera and Cardell 1995). It is considered an endemic species recorded in the Western Mediterranean Sea (Fage 1940, 1951; Carpine 1970; Reyss 1972; Ledoyer 1983, 1987; Coll et al., 2010; Marusso 2010), in the Ionian Sea and in the Aegean Sea (Mühlenhardt-Siegel 2009; Reyss 1974).

Even though Watling (1991) questioned the validity of the species *E. nana*, he included it in the species list belonging to the genus, while Cartes and Sorbe (1997) did not separate the species *E. nana* and *E. truncatula* (Bate, 1856), considering both as *E. truncatula*. Several taxonomists still discriminate *E. nana* and *E. truncatula* as two different species (Fage, 1951; Carpine 1970; Reyss 1972; Ledoyer 1983; Corbera and Cardell 1995; Mühlenhardt-Siegel 2009; Coll et al., 2010; Marusso 2010; Koulouri et al. 2016; WoRMS Editorial Board 2020).

Genus *Leucon* Krøyer, 1846.

Subgenus *Leucon* Krøyer, 1846.

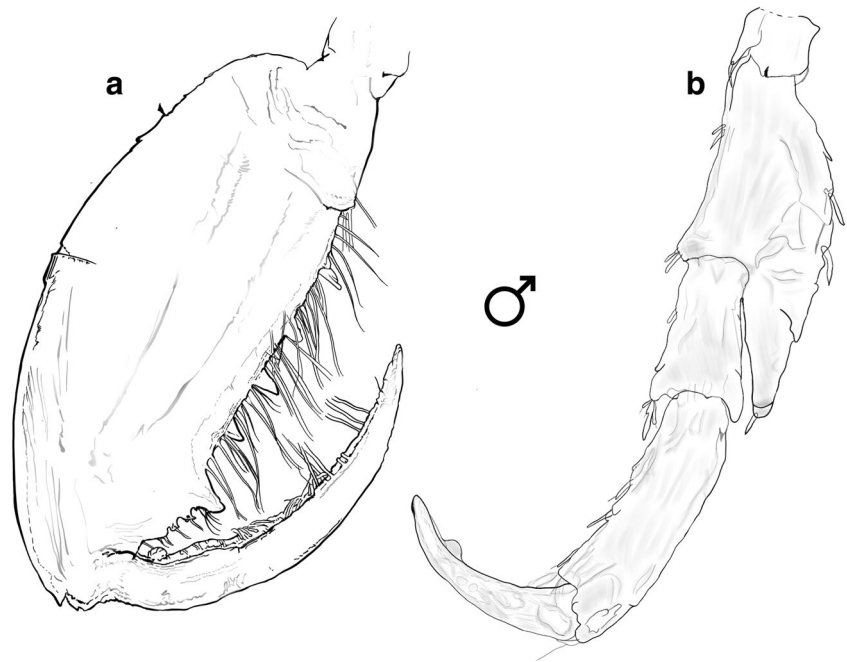
***Leucon (Leucon) affinis* Fage, 1951.**

Material examined: Six females (cod. LeAff-1, LeAff-2, LeAff-3, LeAff-4, LeAff-5, LeAff-6) collected in A area in 2012.

Diagnosis: According to Băcescu (1951), Fage (1951), Jones (1976) and Shalla (2011).

TL: 1.8–3.6 mm. Carapace 1/4 of the total length; pseudorostrum straight largely cut off at the top; dorsal ridge with an anterior batch of 16 contiguous teeth, followed by a smooth and concave depression and by another series of 4

Fig. 2 *Stenothoe bosporana* Sowinsky, 1898. Male StB-1; a: Gn2, b: P7



teeth extending up to the rear edge of the carapace; peduncle of uropods with the same length of endopod, which is a little shorter than exopod.

Ecology and distribution: *L. affinis* is a bathyal species, living from 180 to 415 m depth (Mühlenhardt-Siegel 2009) in sandy bottoms and in deep-sea muds (Carpine 1970; Ledoyer 1983, 1987; Corbera and Cardell 1995).

Some authors recorded this species in northeast Atlantic Ocean (Corbera and Sorbe 2020), in Western Mediterranean (Fage 1951; Carpine 1970; Reyss 1972; Ledoyer 1983; Mühlenhardt-Siegel 2009; Coll et al., 2010) and in Ionian and Levantine seas (Mühlenhardt-Siegel 2009; Coll et al., 2010), specifying that it might be confused with *L. fulvus* Sars, 1865 and *L. acutirostris* Sars, 1865, which are common in the northern Atlantic Ocean (Fage 1951; Gerken and Watling 1999).

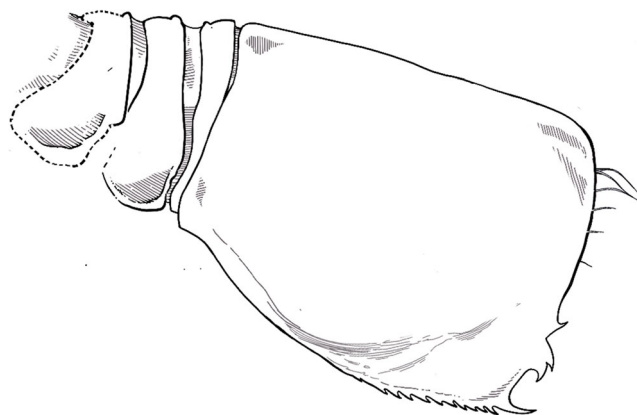


Fig. 3 *Eudorella nana* Sars, 1879, female EuN-1, carapace

Subgenus *Macrauloleucon* Watling, 1991.

***Leucon (Macrauloleucon) siphonatus* Calman, 1905.**

Material examined:

Sixteen female specimens (cod. LeSip-1, LeSip-2, LeSip-3, LeSip-4, LeSip-5, LeSip-6, LeSip-7, LeSip-8, LeSip-9, LeSip-10, LeSip-11, LeSip-12, LeSip-13, LeSip-14, LeSip-15, LeSip-16) collected in A area in 2012.

Diagnosis: According to Băcescu (1951), Fage (1951), Jones (1976) and Shalla (2011).

TL: 1.7–3.1 mm. Elongated branchial siphon developing from the front of pseudorostrum, accompanied by long bristles; dorsal and antero-lateral edge of carapace with some teeth; distal end of endopod with a long apical plumose bristle and four internal spines, exopod with internal and external bristles on margins.

Distribution: *L. siphonatus* is reported as a bathyal species, typical of sandy bottoms and deep-sea muds (Carpine 1970; Ledoyer 1987, 1983; Corbera and Cardell 1995).

It was recorded in the Atlantic Ocean, in the west coast of Iceland, Ireland, in the Bay of Biscay (Hansen 1920; Fage 1929; Reyss 1972; Gerken and Watling 1999; Corbera and Sorbe 2020), and in different areas of the Mediterranean Sea: Western Mediterranean Sea (Calman 1906; Fage 1940; Reyss 1972; Ledoyer 1987, 1983), Tyrrhenian, Ionian and Levantine Seas (Klepal and Kastner 1980; Madurell and Cartes 2003; Mühlenhardt-Siegel 2009; Coll et al., 2010).

Remarks

The A area bottom, with an average depth of 75 m, was characterized by sand (Shepard's classification). The

Table 3 Total amphipod and cumacean taxa recorded from 2012 to 2018 surveys in the three areas

Taxa	A	B	C	Total
Order Amphipoda Latreille, 1802				
Fam. Acidostomatidae Stoddart & Lowry, 2012				
<i>Acidostoma obesum</i> (Spence Bate, 1862)		81	19	100
Fam. Ampeliscidae Krøyer, 1842				
<i>Ampelisca diadema</i> (Costa, 1853)	870	650	183	1703
<i>Ampelisca intermedia</i> Bellan-Santini & Diviacco, 1990	3		4	7
<i>Ampelisca rubella</i> A. Costa, 1864		1	1	2
Fam. Amphiloichidae Boeck, 1871				
<i>Amphiloichoides</i> sp.			1	1
<i>Apolochus brunneus</i> (Della Valle, 1893)		2	3	5
<i>Apolochus neapolitanus</i> (Della Valle, 1893)		1		1
<i>Apolochus</i> sp.			2	2
Fam. Ampithoidae Boeck, 1871				
<i>Ampithoe ramondi</i> Audouin, 1826	4	4	5	13
<i>Ampithoe</i> sp.			1	1
Fam. Aoridae Stebbing, 1899				
<i>Aora gracilis</i> (Spence Bate, 1857)		10	5	15
<i>Aora</i> sp.	12		1	13
<i>Aora spinicornis</i> Afonso, 1976			2	2
Fam. Aristiidae Lowry & Stoddart, 1997				
<i>Perrierella audouiniana</i> (Spence Bate, 1857)	2			2
Fam. Atylidae Lilljeborg, 1865				
<i>Nototropis guttatus</i> Costa, 1853	1			1
Fam. Bathyporeiidae d'Udekem d'Acoz, 2011				
<i>Bathyporeia</i> sp.		1		1
Fam. Calliopiidae G.O. Sars, 1893				
<i>Apherusa</i> sp.	10			10
Fam. Caprellidae Leach, 1814				
<i>Caprella acanthifera</i> Leach, 1814	1			1
<i>Caprella rapax</i> Mayer, 1890	130	1		131
<i>Caprella</i> sp.	344	9	8	361
Caprellidae ind.		1		1
<i>Liropus elongatus</i> Mayer, 1890		1		1
<i>Pariambus typicus</i> (Krøyer, 1845)	47			47
<i>Phtisica marina</i> Slabber, 1769	486	121	69	676
<i>Pseudolirius kroyeri</i> (Haller, 1879)	56		1	57
<i>Pseudoprotella phasma</i> (Montagu, 1804)	62	1	17	80
Fam. Cheirocratidae d'Udekem d'Acoz, 2010				
<i>Cheirocratus sundevallii</i> (Rathke, 1843)		3		3
Fam. Colomastigidae Chevreux, 1899				
<i>Colomastix pusilla</i> Grube, 1861	3			3
Fam. Corophiidae Leach, 1814				
<i>Corophium</i> sp.	76	155	48	279
<i>Leptocheirus guttatus</i> (Grube, 1864)		27		27
<i>Leptocheirus mariae</i> Karaman, 1973		28	1	29
<i>Leptocheirus</i> sp.		3		3
Fam. Cyproideidae J.L. Barnard, 1974				
<i>Peltocoxa</i> sp.	2	1		3

Table 3 (continued)

Taxa	A	B	C	Total
Fam. Dexaminidae Leach, 1814				
<i>Dexamine spinosa</i> (Montagu, 1813)	17	3		20
Fam. Eriopisidae Lowry & Myers, 2013				
<i>Eriopisa elongata</i> (Bruzellius, 1859)	1		94	95
Fam. Eusiridae Stebbing, 1888				
<i>Eusirus longipes</i> Boeck, 1861	4	12	7	23
Fam. Iphimediidae Boeck, 1871				
<i>Iphimedia</i> sp.	163	2	3	168
Fam. Ischyroceridae Stebbing, 1899				
<i>Erichthonius brasiliensis</i> (Dana, 1853)	6	35	60	101
<i>Erichthonius punctatus</i> (Spence Bate, 1857)		5	6	11
<i>Jassa marmorata</i> Holmes, 1905		13		13
Fam. Leucothoidae Dana, 1852				
<i>Leucothoe incisa</i> Robertson, 1892		67	18	85
<i>Leucothoe lilljeborgi</i> Boeck, 1861	12	29	45	86
<i>Leucothoe oboa</i> Karaman, 1971		21	12	33
<i>Leucothoe pachycera</i> Della Valle, 1893			1	1
<i>Leucothoe</i> sp.	8			8
<i>Leucothoe spinicarpa</i> (Abildgaard, 1789)		2		2
Fam. Liljeborgiidae Stebbing, 1899				
<i>Liljeborgia psaltrica</i> Krapp-Schickel, 1975	1	1	3	5
Fam. Lysianassidae Dana, 1849				
<i>Lysianassa</i> sp.	429	13	11	453
Fam. Maeridae Krapp-Schickel, 2008				
<i>Elasmopus rapax</i> Costa, 1853		1	7	8
<i>Maera grossimana</i> (Montagu, 1808)	57	1	6	64
<i>Othomaera schmidtii</i> (Stephensen, 1915)	12	35	34	81
Fam. Microtopidae Myers & Lowry, 2003				
<i>Microtopus maculatus</i> Norman, 1867	52		2	54
Fam. Oedicerotidae Lilljeborg, 1865				
<i>Kroyera carinata</i> Spence Bate, 1857	44	9	1	54
<i>Perioculodes aequimanus</i> (Kossmann, 1880)		4		4
<i>Perioculodes longimanus</i> (Spence Bate & Westwood, 1868)	80	123	4	207
<i>Synchelidium haplocheles</i> (Grube, 1864)	84	13	1	98
<i>Westwoodilla rectirostris</i> (Della Valle, 1893)	57	50	1	108
Fam. Pardaliscidae Boeck, 1871				
<i>Halice abyssii</i> Boeck, 1871		6		6
<i>Halicoides walkeri</i> (Ledoyer, 1973)	6	8	2	16
Fam. Photidae Boeck, 1871				
<i>Gammaropsis</i> sp.	112	60	18	190
<i>Photis longicaudata</i> (Spence Bate & Westwood, 1862)	334	13	12	359
Fam. Phoxocephalidae G.O. Sars, 1891				
<i>Harpinia antennaria</i> Meinert, 1890		58		58
<i>Harpinia crenulata</i> (Boeck, 1871)		24	4	28
<i>Harpinia dellavallei</i> Chevreux, 1910	178	667	92	937
<i>Metaphoxus simplex</i> (Spence Bate, 1857)	12	1	3	16
<i>Paraphoxus oculatus</i> (G. O. Sars, 1879)		350	208	558
Fam. Podoprionidae Lowry & Stoddart, 1996				
<i>Podoprion bolivari</i> Chevreux, 1891			3	3

Table 3 (continued)

Taxa	A	B	C	Total
Fam. Stegocephalidae Dana, 1852				
<i>Stegocephaloides christianiensis</i> Boeck, 1871	1			1
Fam. Stenothoidae Boeck, 1871				
<i>Stenothoe bosporana</i> Sowinsky, 1898			3	3
<i>Stenothoe</i> sp.	16	53	25	94
<i>Stenothoe tergestina</i> (Nebeski, 1881)		51	3	54
Fam. Tryphosidae Lowry & Stoddart, 1997				
<i>Hippomedon bidentatus</i> Chevreux, 1903		1		1
<i>Hippomedon massiliensis</i> Bellan-Santini, 1965	21	2	2	25
<i>Hippomedon oculatus</i> Chevreux & Fage, 1925			1	1
<i>Lepidepcreum longicornis</i> (Spence Bate, 1862)	10			10
<i>Orchomene grimaldii</i> Chevreux, 1890	257	154	199	610
Fam. Uristidae Hurley, 1963				
<i>Ichnopus taurus</i> Costa, 1853		6	10	16
Fam. Urothoidae Bousfield, 1978				
<i>Urothoe</i> sp.	30	1		31
Order Cumacea Krøyer, 1846				
Cumacea ind	286	462	28	776
Fam. Bodotriidae T. Scott, 1901				
<i>Bodotria scorpioides</i> (Montagu, 1804)	72	4	1	77
<i>Iphinoe serrata</i> Norman, 1867	89	10		99
<i>Iphinoe</i> sp.	12			12
Fam. Diastylidae Bate, 1856				
<i>Diastylis doryphora</i> Fage, 1940	4	1		5
<i>Diastylis rugosa</i> Sars, 1865		1		1
<i>Diastylis</i> sp.	61	31	2	94
<i>Ekleptostylis walkeri</i> (Calman, 1907)		1		1
<i>Makrokylindrus</i> sp.		21	1	22
Fam. Leuconidae Sars, 1878				
<i>Eudorella nana</i> Sars, 1879	6	1		7
<i>Eudorella truncatula</i> (Bate, 1856)	948	1057	60	2065
<i>Leucon (Leucon) affinis</i> Fage, 1951	7	4		11
<i>Leucon (Leucon) mediterraneus</i> Sars, 1878	75	60	1	136
<i>Leucon (Macrauloleucon) siphonatus</i> Calman, 1905	25	242	7	274
Fam. Nannastacidae Bate, 1866				
<i>Campylaspis nitens</i> Bonnier, 1896		3		3
<i>Campylaspis</i> sp.	30	14	1	45
<i>Nannastacus</i> sp.	60			60

macrozoobenthos community herein was dominated by the following taxa: *Ditrupa arietina* (O. F. Müller, 1776), Sabellidae nd. Latreille, 1825, *Prionospio cirrifera* Wirén, 1883, Paraonidae nd. Cerruti, 1909 and *Aphelocheata filiformis* (Keferstein, 1862). Area B, 75 m mean depth, was characterized by a silty-sand bottom and the dominant macrozoobenthos taxa were Paraonidae nd., *Ophelina cylindricaudata* (Hansen,

1879), *Paradiopatra calliopae* Arvantidis & Koukouras, 1997, *Aphelocheata filiformis* and *Prionospio cirrifera*. The sea bottom of C area was mainly silty-sand with an average depth of 80 m. The most abundant taxa in the macrozoobenthos community herein were Paraonidae nd., *Ophelina cylindricaudata*, *Prionospio cirrifera*, *Paradiopatra calliopae*, *Callianassa subterranea* (Montagu, 1808) and *Aphelocheata filiformis*.

Considering the amphipods and cumaceans associated with the species recorded in this paper, in the three areas A, B and C a total of 57, 71 and 60 taxa were respectively found (Table 3). *E. truncatula* was the most abundant species in both areas A and B. *Ampelisca diadema* (Costa, 1853) was one of the dominant species in all the considered areas, together with *Phtisica marina* Slabber, 1769 (A area), *Harpinia dellavallei* Chevreux, 1910 (B area), *Paraphoxus oculatus* (G. O. Sars, 1879) and *Orchomene grimaldii* Chevreux, 1890 (C area).

Discussion

The taxonomic misidentification issue plays an important role in the marine biodiversity management, especially for very small-sized marine species. Furthermore, genetic analysis on these specimens is problematic as the small and fragile body makes difficult to collect suitable samples.

This study is aimed to contribute to the knowledge on the families Leuconidae and Stenothoidae distribution. In fact, several authors, as well as both European Register of Marine Species (Costello et al. 2020) and World Register of Marine Species (WoRMS Editorial Board 2020), report the distribution of the four species here recorded in different areas of the Mediterranean Sea (Watling 2001; Coll et al. 2010; Watling and Gerken 2014; WoRMS Editorial Board, 2020) without any (or only one old record in the case of *S. bosporana*) information on their presence in the Adriatic Sea; moreover the “Italian Checklist of Marine Fauna” (Marusso 2010) does not report *E. nana* and *L. siphonatus* in the Adriatic section, and *L. affinis* and *S. bosporana* in all Italian seas.

Only 3 specimens of *S. bosporana* were found in silty-sand bottom at 80 m depth in Adriatic Sea during the overall sampling period (from 2012 to 2019), highlighting the rareness of this species in this basin. Since this taxon was previously only reported living on muddy bottoms, this record adds a different bottom type where it can be found, also widening the living area.

The *E. nana* living habit fit with the environmental characteristics of the A and B areas where it was found, considered typical of the circalittoral zone and living in a wide range of bottom type, this record adds the Adriatic Sea to the *E. nana* living area, giving new information on its distribution.

In this study, *L. affinis* and *L. siphonatus*, until now considered as bathyal species living mainly on sandy and muddy deep-sea bottom, were found in shallow waters living in sand and silty-sand bottom of the Adriatic Sea, between 75 and 80 m depth, thus providing further information on their habitat and distribution.

The new record of the four species in the Adriatic Sea could be explained by the hypothesis that these species were already present in Adriatic, although not common, but had not yet been identified due to the poor knowledge about these taxa

and the limited number of studies on these orders of crustacea, their small size and fragility and the difficulties to collect undamaged specimens using the common sampling techniques.

Further specific studies would be essential to better know the distribution of these taxa in this basin and therefore understand their ecological role in the benthic community.

Availability of Data and Material Voucher specimens are presently kept in the reference collection of CNR-IRBIM in Ancona, Italy. No other data sets are generated during this study.

Code Availability Not applicable.

Authors' Contributions Pierluigi Strafella main author, draft the work, participated to sampling survey, analyzed the samples and validated the taxonomic records; Vera Salvalaggio analyzed the samples, cooperated in the paper writing and the taxonomic validation, managed the sampling survey; Clara Cuicchi supported the paper writing and the taxonomic validation; Elisa Punzo contributed in the paper writing and the taxonomic validation; Angela Santelli analyzed the samples, supported the paper writing and the taxonomic validation; Alessandro Colombelli supported the paper writing, drew the images;; Gianna Fabi coordinator of the research, organized and led the scientific cruise, approved the version to be published; Alessandra Spagnolo responsible of the research, contributed in the paper writing and approved the version to be published.

Funding This study received funding from ENI S.p.A.—UPSTREAM DICS.

Declarations

Conflicts of Interest/Competing Interests The authors declare that they have no conflict of interest or competing financial and/or non-financial interests in relation to this work.

Ethics Approval This article does not contain any studies with animals performed by any of the authors.

Consent to Participate Sampling and observational field studies do not require any permits.

Consent for Publication Not applicable.

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