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The malacofauna in infralittoral ground samples from west Istria, Croatia

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Abstract: Ten ground samples from various depths, 0 to 26 m, were taken at the western coast of Istria, south of Porec. Altogether 245 species of mollusks were identified in these samples. High resolution images were taken of micromollusks, to be published in an online determination key. A particular focus was on images of juveniles, which often look much different than adults and are therefore often difficult to identify. Remarkable records are briefly discussed. Three species were recorded in different forms: *Bittium reticulatum* seems to develop a brackish water variant and for two taxa, *Ammonicera fischeriana* and *Hemilepton nitidum*, so far undescribed kryptic species may be assumed.

Keywords: Mollusca, Gastropoda, Bivalvia, Adriatic Sea, Istria

Zusammenfassung: Zehn Bodenproben aus verschiedenen Tiefen, 0 bis 26 m, wurden an der Küste von Istrien, südlich von Porec entnommen. In diesen Proben wurde 245 Molluskenarten identifiziert. Fotografien von Mikromollusken in hoher Auflösung für einen online Bestimmungsschlüssel konnten angefertigt werden. Ein besonderer Fokus lag dabei auf Juvenilstadien, die häufig deutlich anders aussehen als die adulten Schalen und deshalb oft schwer zu bestimmen sind. Bemerkenswerte Funde werden kurz diskutiert. Drei Arten wurden in unterschiedlichen Formen vorgefunden: *Bittium reticulatum* scheint eine Brachwasser-Form zu entwickeln und zwei Taxa, *Ammonicera fischeriana* und *Hemilepton nitidum*, könnten bisher unbeschriebene kryptische Spezies enthalten.

Schlüsselwörter: Mollusken, Gastropoda, Bivalvia, Adria, Istrien

Introduction

For a database of European mollusks (Kapeller 2019), a major collection of European mollusks was built up with the aim to provide high quality images for the use of the database and the determination key established therein. The database is now freely available online (Kapeller 2022), and can presently be used to identify marine gastropods, marine bivalves, freshwater gastropods and freshwater bivalves, but concerning images there are still some gaps. Besides completion of the database for terrestrial mollusks, taking images from species available in Austrian museums is in progress and my ongoing collecting activities have the main focus on small mollusks, for which high resolution images are still lacking.

A particular focus is on images of juveniles. The fact that juvenile shells often look much different than the adult ones make their identification difficult and has often resulted in misidentifications. For example, Ovalis (2018) provided a specimen of "*Ennucula corbuloides*" as a rarity, but later it turned out to be a juvenile of the common *Nucula nucleus* (Kapeller 2022). While the former has the ligament pit between the teeth rows, it is located below the anterior teeth row in the latter. However, it was overlooked, that in very young juveniles of *Nucula* spp. the ligament pit is also situated between the teeth rows. An image is shown in Kapeller (2022), demonstrating this fact. Even new species have erroneously been described based on juveniles of well-known species. For example, *Puncturella piccirida* was described by Palazzi & Villari (2001) from a juvenile *Diodora* spp. (Daniel Geiger in Albano et al. 2017). While an adult *Diodora* spp. has an apical keyhole, juveniles look much different, resembling a puncturellid shell with a slit in front of the apex (Scaperrotta et al. 2013; Kapeller 2022). Although the growth stages of Mediterranean mollusks are well studied (Scaperrotta et al. 2009-2022), it seems therefore desirable to provide more information about the morphology of juveniles and more images of juveniles also in freely available databases and determination aids.

Although the malacofauna of the Mediterranean is the best studied in the world (Oliverio 2003), there is still a need to deepen the knowledge of the faunas of individual regions. Brusina (1865) published the first list of shell-bearing mollusks of the Dalmatian coast, and (1870) for the Adriatic Sea. Yet, from today's point of view, these are incomplete and there is no reference to particular areas, such as Istria. Graeffe (1902) provided a species list from the Gulf of Triest, representing the knowledge at that time quite comprehensively, but which is rather incom-

plete from today's point of view. A review of the fauna of the Rijeka Bay was prepared by Zavodnik & Kovacic (2000) and they conducted own studies involving numerous sites in the bay. However, their list appears rather incomplete, in particular for small species, which might have been due to the sampling methods. An actual, comprehensive checklist of the Mediterranean mollusks was provided by Ramazzotti et al. (2016), but without specific references to the Adriatic Sea. In the last years the malacofauna of particular northern Adriatic Isles was intensively studied by sampling at numerous sites, with a focus on micromollusks (e.g., Arko-Pijevac et al. 2001; Romani et al. 2018; Romani et al. 2020; Raveggi et al. 2021; Kapeller 2023).

For Istria, Odhner (1914) provided a first species list, which is also very incomplete, in particular for small species. Vatova (1928) provided a compendium of the Fauna of the Adriatic Sea near Rovinj in Istria. Starmühlner (1969) studied sites near Rovinj, but listed abundant species only for the particular sites, often just mentioning the genus, and sometimes with the remark 'and other rare species'. More actual studies were presented by Passamonti et al. (1993) for the marine mollusks from Banjole Bay near Pula, by Vio & de Min (1999) for littoral marine mollusks from Cerva, north of Porec, and by De Min & Vio (1997) for shell-bearing littoral mollusks from the Slovenian coast. These studies seem to provide a rather comprehensive overview of the mollusk fauna in this area. For Slovenia 232 gastropod species and 139 bivalve species were listed, for Cerva 280 gastropod species and 107 bivalve species, for the Banjole Bay 144 gastropod species and 65 bivalve species. Furthermore, a lot of particular georeferenced records are available in databases and catalogs of museums and institutions, such as Academy of Natural Sciences USA, Arduino & Nappo, Biologiezentrum Linz, Conchiglie del Mediterraneo, Foundation for Research and Technology Hellas, GBIF - Global Biodiversity Information Facility, Hellenic Centre for Marine Research-Institute of Marine Biological Resources and Inland Waters, National Museum of Natural History - Smithsonian Institution, Natural History Museum Rotterdam, Naturalis Biodiversity Center Leiden, Olivier Caro, Swedish Museum of Natural History, University Marine Biological Station Millport.

Here, I report on the species encountered in the course of the survey, in Istira, which was performed in August 2023.

Methods and materials

Ten soil samples were taken from various depppths (0-26 m) at the west coast of Istria, south of Porec, during snorkel and scuba dives. The material was taken manually from the sediment surface to about 5 cm sediment depth. Sample 1, off Funtana, consisted mainly of mud; Sample 2, near Veli Skolj, mainly of gravel and shell grit. Sample 3 was taken inside a small cave near Banjol; Samples 4 to 6, off Banjol, and 7 to 9, off Figarola, consisted mainly of fine sand with a minor component of gravel and shell grit. Sample 10 was taken at the coastline of the brackish

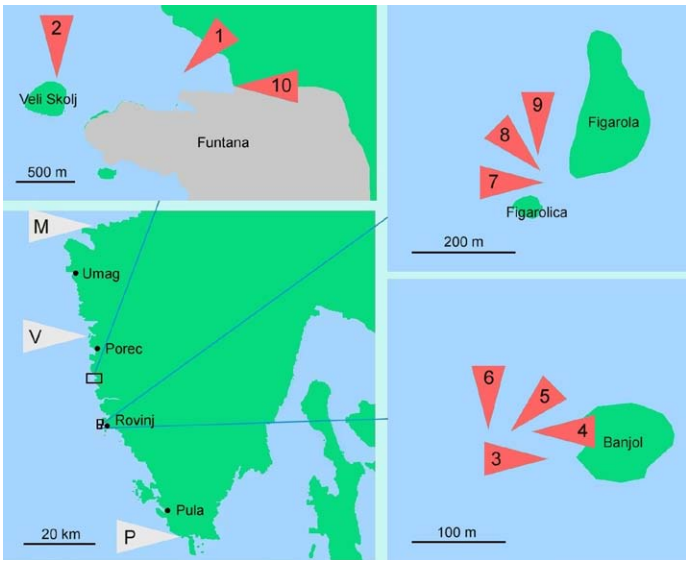

Fig. 1: Sampling sites along the west coast of Istria, Croatia. Numbers within the red arrowheads refer to the sample numbers in table 1 and 2. White arrowheads: Sites recently studied by other authors; P: Passamonti et al. (1993); M: De Min & Vio (1997); V: Vio & De Min (1999).

Table 1: Depths, coordinates and sample amounts. * Sample 1 and 10, about 0.6 and 1 kg respectively, consisted mainly of mud, which was removed before drying and weighing.

Sample	Depth	Coordinates	Dry weight
1	4 m	45.17964°N, 13.59924°E	240 g*
2	5 m	45.17961°N, 13.58547°E	1020 g
3	10 m	45.07399°N, 13.61008°E	370 g
4	18 m	45.07415°N, 13.60986°E	950 g
5	22 m	45.07416°N, 13.60959°E	1160 g
6	26 m	45.07417°N, 13.60926°E	890 g
7	8 m	45.09347°N, 13.61929°E	910 g
8	9 m	45.09373°N, 13.61930°E	1010 g
9	10 m	45.09399°N, 13.61932°E	730 g
10	0 m	45.17791°N, 13.60313°E	210 g*

Fig. 2: Shells from sample 8 after sorting by species.

zone inside Funtana Bay and consisted mainly of mud and half-rotted reeds and seaweed. For details on the localities and sample amounts see Fig. 1 and Table 1.

The samples were quantitatively examined for molluscan species present. The samples were first split into size fractions by wet sieving. The size fractions >2 mm were inspected visually, while the size fractions 0.25 mm to 1 mm and 1 mm to 2 mm were further split into density fractions by sedimentation to preconcentrate the mollusk shells (procedure described in Kapeller 2023).

All complete and fairly preserved shells were isolated. Fragments were isolated, only when a clear assignment was possible, in particular of less abundant, larger or fragile species, of which no or hardly any complete shells were contained in the samples. The shells were sorted by species (Fig. 2) and counted. The determination was carried out according to Kapeller (2022) and the literature cited therein.

Photographs were taken with a microphotography station (components and procedure described in Kapeller 2023).

Results

A total of 18.589 shells were isolated from the samples, comprising 245 species. The quantitative results are shown in the Appendix. It has to be noted, that the counts given refer to the isolated shells. Concerning the total number of shells in the samples, the efficiency of the preconcentration process must be taken into account. In particular for the smallest size fraction recovery may be poor in samples with a high content of fine sand (in particular samples 4 to 9), where a sharper 'cut' (slightly longer sedi-

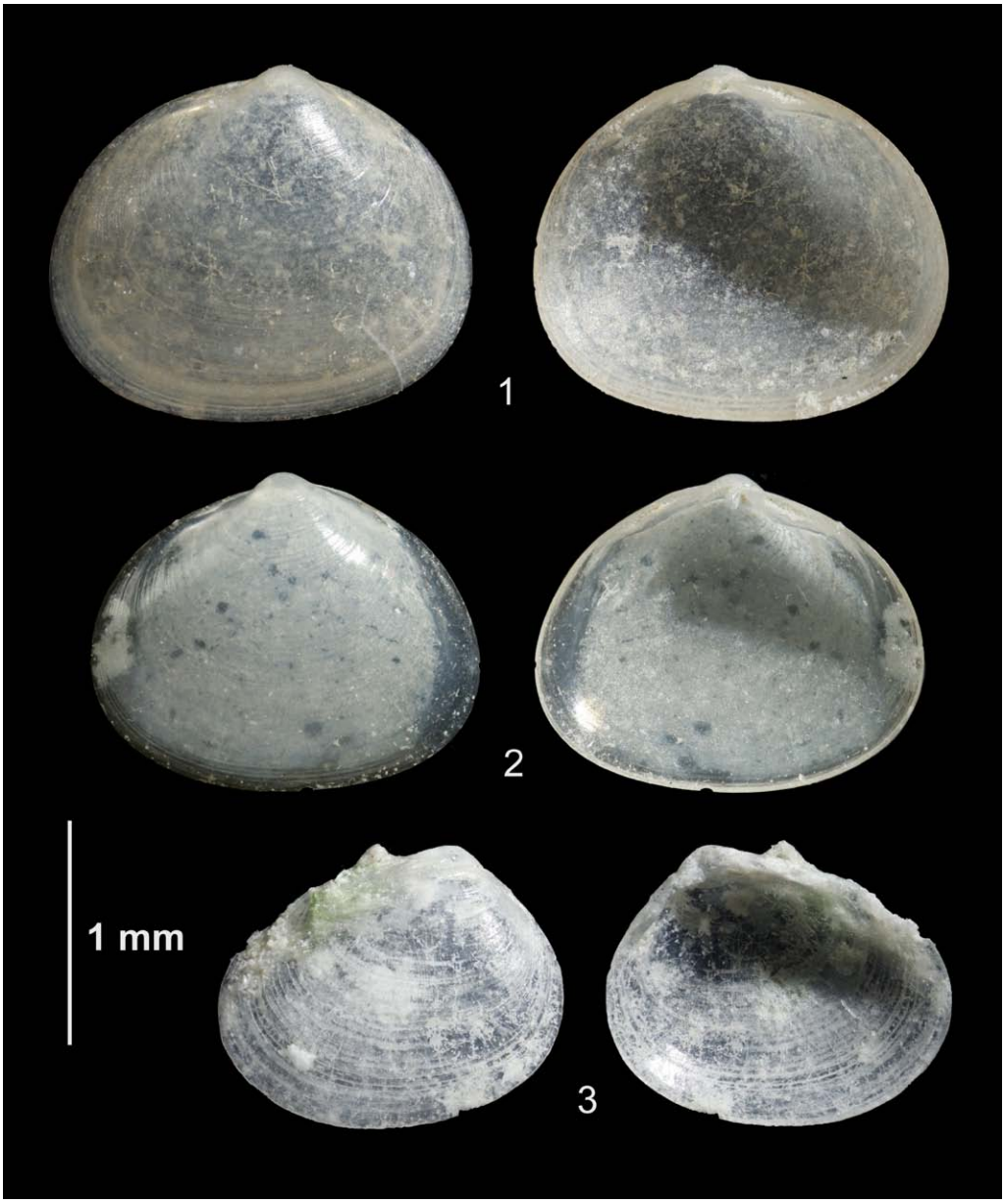

Fig. 3: Examples of small Bivalvia. 1: *Hemilepton nitidum*, 'form A', left valve; 2: *Hemilepton nitidum*, 'form B', left valve; 3: *Epilepton clarkiae*.

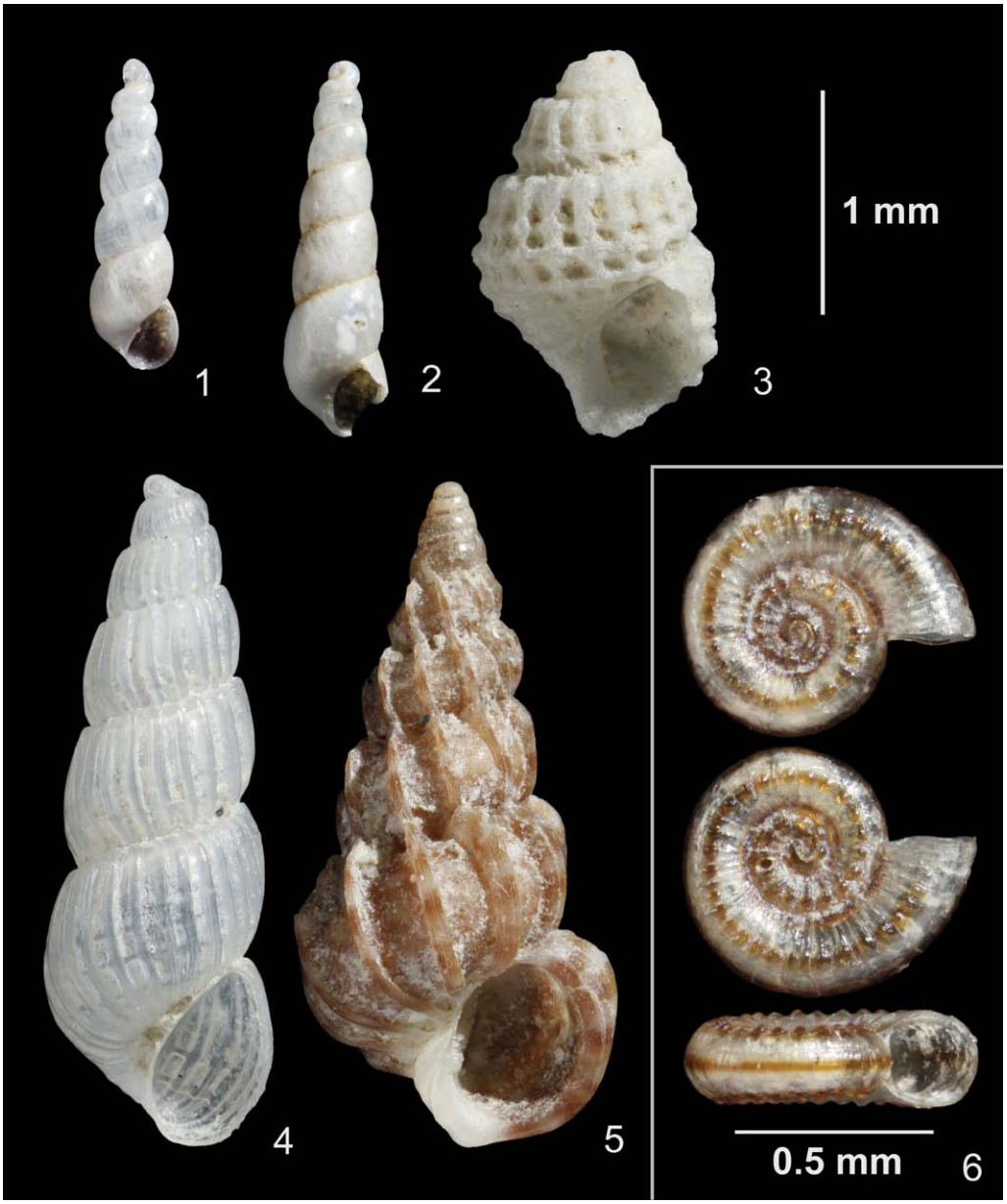

Fig. 4: Examples of small Gastropoda. 1: *Ebala nitidissima*, juv. (5 teleoconch whorls); 2: *Ebala pointeli*, juv. (5.5 teleoconch whorls); 3: *Folinella ghisottii*; 4: *Parthenina clathrata*; 5: *Epitonium clathrus*, juv.; 6: *Ammonicera fischeriana*, heavily sculptured form.

mention time, referring to the procedure described in Kapeller 2023) had to be applied to keep the isolated portion manageable by stereo microscopy. To estimate the efficiency of preconcentration in these cases, the 'waste'-fraction of sample 8 was inspected. It contained only few shells of very small species, e.g., *Ammonicera* spp., and thin shelled species, such as *Caecum* spp., in relation to their abundances in the picked fraction. Thus, that efficiency of density separation can be assumed to be good for these species. But quite some *Parthenina* species were found in the refuse, indicating a poorer efficiency for thicker shelled species. For some Pyramidellidae, as well as species of the genus *Granulina* and similarly thick shelled species, efficiency can be estimated in the range of 20–50%.

Determination was uncertain in some cases, even for species which can normally be clearly assigned, because sometimes only poorly preserved shells and, for a number of species, only juveniles were contained in the samples.

Images were taken of interesting small species to be incorporated in the database (Kapeller 2022). A few examples are shown in Figs. 3 and 4. Due to the very high number of immature specimens in the samples, images of very young juveniles of many species could be taken. Some examples are shown in Fig. 5.

Comments on some taxa

Some species were found in the samples, which are known from the northern Adriatic Sea, but not reported from the Istrian coast in recent studies (Passamonti et al. 1993; De

Fig. 5: Examples of small juveniles. 1: *Arca noae*, even very small juveniles look like the adults, including the typical terminal notch; 2: *Mytilus galloprovincialis*, very small juveniles of *Mytilus* have a not entirely terminal beak, resembling a modiolid shell; 3: *Pseudochama gryphina*, a microscopic granulation is present on the brown prodissoconch; 4: *Haliotis tuberculata*, the first whorls show a characteristic reticulate sculpture; 5: *Spondylus gaederopus*, the isodont hinge is poorly developed in small juveniles; 6: *Moerella distorta*; 7: *Venus verrucosa*, small juveniles look somewhat like *Irus irus*, but are distinguished by the more central beak; 8: *Petricola lithophaga*, juveniles are less irregular; 9: *Polititapes rhomboides*, young juveniles are less elongated; 10: *Ctena decussata*, juveniles have a relatively coarser sculpture, reminding of *Gafrarium*, but differing by the pointed beak; 11: *Lucinella divaricata*, in young juveniles the oblique sculpture may be hardly developed; 12: *Gouldia minima*; 13: *Ringicula auriculata*; 14: *Crepidula moulinsii*, the spiral protoconch can be recognized on top of the septum.

Min & Vio 1997, 1999), nor are there any records from Istria in the databases listed in the introduction. *Crenella arenaria* Monterosato, 1875, *Limatula subauriculata* (Montagu, 1808), *Epilepton clarkiae* (Clark, 1852), *Peronidia albicans* (Gmelin, 1791), *Circulus striatus* (Philippi, 1836), *Epitonium pulchellum* (Bivona, 1832), *Dizoniopsis concatenata* (Conti, 1864), *Chauvetia lineolata* (Tiberi, 1868), *Raphitoma farolita* F. Nordsieck, 1977, *Cima minima* (Jeffreys, 1858), *Liostomia afzelii* Waren, 1991, *Parthenina clathrata* (Jeffreys, 1848) and *Tomura depressa* (Granata-Grillo, 1877).

Chauvetia affinis (Monterosato, 1889) has not yet been reported unambiguously from this area, but was mentioned from Krk as 'cfr' by Romani et al. (2020). The presence of this species in the northern Adriatic Sea is hereby confirmed.

Ondina anceps Gaglini, 1992, *Ondina crystallina* Locard, 1892, and *Ondina neocrystallina* Gaglini, 1992 seem to be present, but only incomplete shells and juveniles were found, not allowing an unambiguous assignment.

Ammonicera fischeriana (Monterosato, 1869) was found in two very distinct forms. The majority of specimens was rather smooth, as *A. fischeriana* mostly is. The other form was heavily sculptured with distinct, coarse, nodose ribs. Rather heavily sculptured forms of *A. fischeriana* were reported (Oliver & Rolan 2015), but were not observed with such strong and regular ribs and nodes as in these samples, see Fig. 4. This form closely resembles *Ammonicera andresi* Oliver & Rolan 2015, but is clearly distinguished by the size of the smooth part of the protoconch, being ½ whorls in *A. andresi* and ¾ whorls in *A. fischeriana* (Oliver & Rolan 2015). Although they occur sympatrically, as in four samples both forms were present, no intermediates were observed; all specimens could be clearly assigned to the one or the other. This leads to the assumption that two species could be involved. It was already mentioned by Oliver & Rolan (2015) that *A. fischeriana* probably comprises more than one species, but further studies (primarily biological and molecular) are needed to reach a sound definition of this taxon.

Ebala nitidissima (Montagu, 1803) seems to be abundant in this area, found in almost all samples, while *Ebala pointeli* (de Folin, 1868) seems to be rare, found in only one sample. These species are not always easy to distinguish. Most criteria mentioned in the literature (van Aartsen et al. 1984; van Aartsen 1994; Wilke & van Aartsen 1998; Kapeller 2022; Arduino et al. 2022) are not conclusive and not reliable with respect to the variability of these species. A spiral sculpture is said to be present in *E. nitidissima*, and hardly recognizable in *E. pointeli*. But it may also be practically absent in *E. nitidissima*. Even the size of the protoconch, supposedly stouter in *E. nitidissima*, is often not different. In this study, *E. pointeli* could be clearly identified by the much shallower suture (see Fig. 4, where one specimen of each species from the same locality is shown for comparison). But even this feature is not reliable due to the variability of *E*. *pointeli*. While the suture is never shallow in *E. nitidissima*, it may be equally deep in *E. pointeli*. Furthermore, a difference in shell size at the same number of whorls is claimed. The first six teleoconch whorls were reported to measure about 2 mm in *E. nitidissima* and about 2.5 mm in *E. pointeli*. But the difference might be much smaller, hardly significant, as illustrated in Fig. 4 where in *E. nitidissima* the length is 1.4 mm with 5 teleoconch whorls and in *E*. *pointeli* 1.7 mm with 5.5 teleoconch whorls.

Bittium reticulatum (da Costa, 1778) was very abundant in all samples, including the brackish habitat sample 10, but was present in a rather different form in the latter. The specimens were much bigger than in samples 2 to 9, the sculpture rather acicular and the 4th spiral cord was developed rather late, if at all. In many big, adult specimens the 4th spiral cord was even lacking. This is probably due to the muddy ground and brackish conditions there. Such bigger specimens were found also in sample 1, where, despite the distance from the shore, the depth was still shallow and the bottom still muddy. A brackish water variant of *B*. *reticulatum* was described as 'var. *paludosa*' by Bucquoy, Dautzenberg & Dollfus (1882-1886), but so far is unaccepted (MolluscaBase eds. 2023).

Hemilepton nitidum (Turton, 1822) seems to exist in two forms. The 'normal' shape, as figured by Oliver et al. (2016) from the British Isles, hereby called 'form A', is rather symmetrical and high, outline somewhat similar to *Lepton squamosum*. A less high form with a trace of a wing edge, hereby called 'form B' was observed in the eastern Mediterranean, see Kapeller (2022). I had regarded the latter as a Mediterranean form so far. Now both forms were observed in Istria at the same locality (see Fig. 3). Furthermore, in these specimens, form B has a stronger cardinal tooth in the left valve. Thus, the question arises whether *Hemilepton nitidum* comprises two species.

Turtonia minuta Fabricius, 1780 was not found. This species is probably not present in the Adriatic Sea. I have erroneously reported it from Krk (Kapeller 2023), which is corrected hereby. The specimen figured there is a juvenile shell of *Polititapes rhomboides.*

Conclusions

In 10 ground samples from the western coast of Istria 245 species were found.

Altogether, 64 to 130 species were found in the individual samples, with the exception of sample 10, which contained many shells, but only 30 species. Only *Bittium reticulatum* was also abundant in that sample. Otherwise sample 10 had a very different community composition, most probably due to the brackish conditions at the sampling site.

Disregarding sample 10, in Istria (239 species in samples 1 to 9) the most abundant mollusks were quite similar to those from Krk (146 species) in Kapeller (2023), while differences seem to be quite pronounced for less abundant taxa. While 104 species were found in both areas (mean abundance 11.1 specimens per sample), while 41 species were found in Krk only, and 135 in Istria only (mean abundances 1.0 and 3.9 specimens per sample, respectively). Even within the samples from Istria, the less abundant species were distributed very differently.

Due to the limited number of samples and sample volumes, the results of this study, in addition to the records in the literature, do still not provide a complete overview of the infralittoral malacofauna of Istria, further species are recorded in every study. In this survey, 13 species were recorded that are not mentioned for Istria in the literature cited herein (Passamonti et al. 1993; De Min & Vio 1997; Vio & de Min 1999), nor in the databases listed in the introduction. Furthermore, for two taxa, *Ammonicera fischeriana*

and *Hemilepton nitidum* so far undescribed kryptic species may be assumed.

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Appendix: Numbers of specimens isolated from the samples. '0' means that the species was not found in the sample, but observed during the respective dive. For coordinates of samlples see Table 1.

Sample	1	2	3	4	5	6	7	8	9	10
Bivalvia										
Nucula nucleus (Linné, 1758)	17	2		7	16	19	1	1	1	
Lima lima (Linné, 1758)		0	6			2	2	1	1	
Limaria tuberculata (Wood, 1839)		5	2	6	2	8	7	15	4	
Limatula subauriculata (Montagu, 1808)						1				
Crenella arenaria Monterosato, 1875								1		
Gibbomodiola adriatica Lamarck, 1819	6	1	2				11	4	3	4
Lithophaga lithophaga (Linné, 1758)	0	0	12	1	3		3	8	4	
Musculus costulatus (Risso, 1826)	8	7	5	5	6	4	7	10	4	
Mytilaster cf. *minimus* (Poli, 1795)									2	
Mytilus galloprovincialis Lamarck, 1819	0	14	5	4		4	10	3	6	4
Arca noae Linné, 1758		1	12	7	4	4	2	8	4	
Barbatia barbata (Linné, 1758)			1	2		1				
Glycymeris nummaria (Linné, 1758)				2		1	0			
Striarca lactea (Linné, 1758)	10	8	14	32	20	24	10	17	13	1
Pinna nobilis Linné, 1758	0	0	0				0	0		1
Ostrea edulis Linné, 1758	1	0	3				0			3
Anomia ephippium Linné, 1758	1	27	37	34	21	25	39	35	21	2
Pododesmus patelliformis (Linné, 1761)		6	12	5	8	5		4	5	
Aequipecten opercularis (Linné, 1758)						2			1	
Mimachlamys varia (Linné, 1758)			1				1			
Palliolum incomparabile (Risso, 1826)	1	5	3	1						
Pecten jacobaeus (Linné, 1758)	5	0	1				0			
Talochlamys multistriata (Poli, 1795)	1	5	10	7	10	17	4	5	8	1
Spondylus gaederopus Linné, 1758	0	0	0				0		1	
Ctena decussata (O. G. Costa, 1829)		12	10	8	5	15	9	17	7	
Loripes orbiculatus Poli, 1791	35		1			1				
Loripinus fragilis (Philippi, 1836)	32	15	1				11	1	3	
Lucinella divaricata (Linné, 1758)	71	150	8	3	3	8	23	23	29	
Glans trapezia Linné, 1758		8			3	1	3		3	
Cerastoderma glaucum (Pioret, 1789)										7
Laevicardium cf. *crassum* (Gmelin, 1791)							1			
Laevicardium oblongum (Gmelin, 1791)							0			
Papillicardium papillosum (Poli, 1791)	3		16	46	88	58	44	61	57	2
Parvicardium exiguum (Gmelin, 1791)	54			2	1	2				1
Parvicardium scabrum (Philippi, 1844)				2						
Parvicardium scriptum (Bucquoy D.& D., 1892)		26	26	25	21	24	26	25	13	
Pseudochama gryphina (Lamarck, 1819)		8	22	21	8	9	12	12	7	
Galeomma turtoni (Sowerby, 1825)		2	2			1		1	1	
Kellia suborbicularis (Montagu, 1803)			1			1				
Hemilepton nitidum (Turton, 1822)							1	1		2
Lasaea adansoni (Montagu, 1803)							5	4		
Lepton squamosum (Montagu, 1803)						3				
Epilepton clarkiae (Clark, 1852)							1			
Kurtiella bidentata (Montagu, 1803)	23	7		4		2	8	2	3	1
Spisula subtruncata (da Costa, 1778)	5	46	1		2	3		1	1	
Gari depressa (Pennant, 1777)					1		0	3	1	
Gari fervensis (Gmelin, 1791)			1	1		2				
Abra alba (W. Wood, 1802)	13	2				1	1	6	2	
Abra segmentum (Recluz, 1843)										186
Solecurtus scopula (Turton, 1822)								1		
Azorinus chamasolen (da Costa, 1778)						1				
Arcopella balaustina (Linné, 1758)				1		2		13	3	
Gastrana fragilis Linné, 1758	3		1							5
Moerella distorta (Poli, 1795)				4	2	1	1			
Moerella donacina (Linné, 1758)	24	42	2	3	12		11	22	17	
Peronidia albicans (Gmelin, 1791)							1			
Tellinidae sp.				1						
Callista chione (Linné, 1758)									1	
Chamelea gallina (Linné, 1758)	0	0		1			0	2		
Clausinella fasciata (da Costa, 1778)		6	1	1	2		1			

Sample	1	2	3	4	5	6	7	8	9	10
Dosinia exolata (Linné, 1758)		0								
Gouldia minima (Montagu, 1803)	12	20	13	74	144	91	25	46	36	
Irus irus (Linné, 1758)		1	5			1	1			
Petricola lithophaga Retzius, 1786									1	
Pitar rudis (Poli, 1795)				6	2	3				
Polititapes aureus (Gmelin, 1791)	3	2	8		16				1	7
Polititapes rhomboides (Pennant, 1777)	15	9	3	4		7	13	10	4	
Ruditapes decussatus (Linné, 1758)		2	3	1				1		4
Timoclea ovata (Pennant, 1777)			6	3	19	8	2		2	2
Venus verrucosa Linné, 1758	0	7	2	7	11	9	5	6	4	
Corbula gibba (Olivi, 1792)	1		1	2	6	8	4	6	4	
Rocellaria dubia (Pennant, 1777)	1	1	4	1	1	2	2	1		
Hiatella arctica (Linné, 1767)	1	13	55	68	59	59	40	40	36	
Thracia corbuloides Deshayes, 1824									1	
Thracia pubescens Pulteney, 1799	2		2		3	3	3		4	
indet. Bivalvia sp. 1		1				1			2	
indet. Bivalvia sp. 2									2	
Gastropoda										
Williamia gussonii (O. G. Costa, 1829)				1	1					
Patella rustica Linné, 1758	0	0					0			
Diodora gibberula (Lamarck, 1822)		3	2	9	6	3	5	9	11	
Emarginula adriatica O. G. Costa, 1829								3		
Emarginula octaviana Coen, 1939			1	1						
Emarginula sicula Gray, 1825				1			2	1	1	
Haliotis tuberculata Linné, 1758				1	1	1		1	2	1
Scissurella costata d'Orbigny, 1824				5	8	14	1	2	2	
Sinezona cingulata (O. G. Costa, 1861)		2					2			
Calliostoma laugieri (Payraudeau, 1826)					4	11			2	
Calliostoma virescens Renieri in Coen, 1933			2					5		
Smaragdia viridis Linné, 1758	9	2								
Tricolia pullus (Linné, 1758)		7	2	3	16	12	3	6	6	
Clanculus corallinus (Gmelin, 1791)		6	33	29	20	23	32	36	32	
Gibbula albida (Gmelin, 1791)	5	4	2	9	5	5	3	4	18	
Gibbula leucophaea (Philippi, 1836)							1			
Gibbula magus (Linné, 1767)		4	1	4		1	6	18		4
Jujubinus exasperatus (Pennant, 1777)	1	9	20	42	27	32	34	45	28	2
Jujubinus striatus (Linné, 1767)	1									
Phorcus articulatus Lamarck, 1822	0			1						
Phorcus mutabilis Philippi, 1846								1		
Bolma rugosa (Linné, 1767)		3	0	3	4	6	0	4	3	
Marshallora adversa (Montagu, 1803)			1							
Similiphora similior (Bouchet & Guillemot, 1978)		5	3	10	45	19	16	28	7	
Calyptraea chinensis Linné, 1758	6	1								
Crepidula moulinsii Michaud, 1829	1				1		1	4	1	
Bittium latreillii (Payraudeau, 1826)	9	163	584	406	352	255	622	511	378	3
Bittium reticulatum (da Costa, 1778)	88	269	193	335	301	341	467	735	310	659
Cerithium vulgatum (Bruguiere, 1792)	4	10	10	13	12	18	32	46	43	
Turritella communis Risso, 1826			2	5	2					
Melarhaphe neritoides (Linné, 1758)			1		1		6	2	2	
Euspira nitida (Donovan, 1804)				1	2			1		
Natica sp.		1	2							
Naticarius stercusmuscarum (Gmelin, 1791)						1	1			
Neverita josephina Risso, 1826								1		
Tectonatica sagraiana (d'Orbigny, 1842)							1	1		
Barleeia unifasciata (Montagu, 1803)		4						1		
Caecum armoricum (de Folin, 1869)		6	3		3	4	7	6	1	
Caecum auriculatum de Folin, 1870 or *subannulatum* de Folin, 1868	2	9	8	34	47	68	55	34	17	
Caecum trachea (Montagu, 1803)		2	5	3	15	13	3	40	12	
Parastrophia asturiana de Folin, 1870				1	1	5	1			
Alvania beanii (Hanley, 1844)		1								
Alvania cancellata (da Costa, 1778)		2	24	52	87	55	25	56	38	
Alvania carinata (da Costa, 1778)		2	4	23	27	16	10	7	5	
Alvania cimex (Linné, 1758)		5	12	50	26	33	55	70	61	
Alvania geryonia (Chiereghini in Nardo, 1847)		1		5	14	14		6	2	

Sample	1	2	3	4	5	6	7	8	9	10
Alvania lactea (Michaud, 1830)			1				4			
Alvania lineata Risso, 1826	1	17	26	14	46	46	39	89	62	
Alvania punctura (Montagu, 1803)					1					
Crisilla semistriata (Montagu, 1808)	2	2	58	60	36		35	41	29	
Manzonia crassa (Kanmacher, 1798)		7	10	31	28	43	30	31	24	1
Pusillina cf. *ehrenbergi* (Philippi, 1844)	1	1		1		3				
Pusillina inconspicua (Alder, 1844)		1								
Pusillina radiata (Philippi, 1836)	147	79	92	376	392	430	53	63	87	
Rissoa cf. *membranacea* (J. Adams, 1800)	21	4	2	5		1				
Rissoa parva (da Costa, 1779)		1								
Rissoa cf. *variabilis* (v. Mühlfeldt, 1824)		6	23	20	17	19	13	15	8	20
Rissoa cf. *ventricosa* Desmarest, 1814	26	4	1	10	2	13	3	6	1	
Rissoa violacea Desmarest, 1814			1		10	1			5	
Rissoina bruguierei (Payraudeau, 1826)		8	35	40	49	77	69	74	50	
Hydrobia acuta (Draparnaud, 1805)										108
Circulus striatus (Philippi, 1836)						1	1			
Petaloconchus glomeratus (Linné, 1758)			1						1	
Vermetus cf. *granulatus* (Gravenhorst, 1831)										1
Vermetus cf. *triquetrus* Bivona, 1832	9	4	8	5	1	2				
Epitonium clathrus (Linné, 1758)			2	1	1	1	2	4	1	
Epitonium pulchellum (Bivona, 1832)			1				1		1	
Cerithiopsis tubercularis (Montagu, 1803)		1	1		1	1	5	21	10	
Dizoniopsis concatenata (Conti, 1864)						1				
Metaxia metaxae (delle Chiaje, 1828)			1	5	3	1		2	2	
Aclis minor (Brown, 1827)						2		1		
Eulima glabra (da Costa, 1778)				8	1	3				
Melanella cf. *lubrica* (Monterosato, 1890)		1	1							
Vitreolina philippi (de Rayneval & Ponzi, 1854)			12	11	31	41	10	4	3	
Vitreolina curva (Monterosato, 1874)			1		1	3				
Megalomphalus cf. disciformis (Granata-Grillo, 1877)				2		5		1		
Chauvetia affinis (Monterosato, 1889)					4		2			
Chauvetia lineolata (Tiberi, 1868)						1				
Euthria cornea (Linné, 1758)					1					
Columbella rustica (Linné, 1758)			1							
Mitrella scripta (Linné, 1758)					5	6		4	4	
Pseudofusus cf. *pulchellus* (Philippi, 1844)							1			
Pseudofusus rostratus (Olivi, 1792)						2				
Tritia cuvierii (Payraudeau, 1826)			1							
Tritia incrassata (Strom, 1768)	5	16	35	51	33	27	35	52	41	
Tritia neritea (Linné, 1758)										10
Tritia cf. *nitida* (Jeffreys, 1867)						1				
Aplus sp.				4						
Enginella leucozona (Philippi, 1844)					1					
Conus ventricosus Gmelin, 1791		2					0	3	1	3
Bela cf. *fuscata* (Deshayes, 1843)		1						1	1	
Mangelia brusinae van Aartsen & Fehr de Wal, 1978	1							2	1	
Mangelia cf. *costata* (Pennant, 1777)						1			1	
Mangelia scabrida (Monterosato, 1890)			1	1						
Mangelia stosiciana Brusina, 1868		1	4	3	1	1	1	5	4	
Mangelia unifasciata Deshayes, 1835	3		4	14	11	17	9	12	12	1
Mitromorpha columbellaria Mifsud, 2001								1	3	
Mitromorpha cf. *karpathoensis* (Nordsieck, 1969)				7	3	3	7	6	6	
Mitromorpha olivoidea (Cantraine, 1835)								1		
Raphitoma atropurpurea (Locard & Caziot, 1900) or *purpurea* (Montagu, 1803)		4	4	12	7	7	11	17	19	
Raphitoma farolita F. Nordsieck 1977		2								
Raphitoma horrida (Monterosato, 1884)				1						
Raphitoma laviae (Philippi, 1844)							1			
Raphitoma linearis (Montagu, 1803)			1	7	2	4	2	2	2	
Raphitoma philberti (Michaud, 1829)									1	
Episcomitra cornicula (Linné, 1758)				2						
Hexaplex trunculus (Linné, 1758)	1	0					0	4		
Murexsul aradasii (Monterosato in Poirier, 1883)				2		2	9	5		
Muricopsis cristata (Brocchi, 1814)			15	2	5	2	2	1		
Ocinebrina cf. *aciculata* (Lamarck, 1822)			1	2	3	9	2	3	8	

Sample	1	2	3	4	5	6	7	8	9	10
Trophonopsis muricata (Montagu, 1803)							2	5		
Typhinellus labiatus (de Cristofori & Jan, 1832)						1				
Gibberula miliaria (Linné, 1758)				2				1	2	
Gibberula philippi (Monterosato, 1878)			1			4				
Granulina marginata (Bivona, 1832)										
or *boucheti* Gofas, 1992		1		1	16	18		3	1	
Pusia ebenus (Lamarck, 1811)		2	4	7	11	6	3	15	3	
Acteon tornatilis (Linné, 1758)					1					
Cima minima (Jeffreys, 1858)		1								
Ebala nitidissima (Montagu, 1803)	2	2	1		5	2	10	5	19	
Ebala pointeli (de Folin, 1868)	3									
Ammonicera fischeriana (Monterosato, 1869)	1	36	3	5	6	5	73	48	19	
Ammonicera cf. *fischeriana* (Monterosato, 1869), ribbed form		6	1		2	7				
Omalogyra atomus (Philippi, 1841)		1								
Omalogyra simplex (O. G. Costa, 1861)		3	1	1	5	3	1			
Brachystomia eulimoides (Hanley, 1844)			6	12	7	22	3			
Clathrella clathrata (Philippi, 1844)			1			1				
Eulimella acicula (Philippi, 1836)				1		1	1	1		
Folinella excavata (Philippi, 1844)			20	12	11	30	5	21	3	
Folinella ghisotti (van Aartsen, 1984)								1		
Liostomia afzelii Waren, 1991						1				
Megastomia conoidea (Brocchi, 1814)		2								
Odostomia acuta Jeffreys, 1848				1	5					
Odostomia plicata (Montagu, 1803)					2	3				
Odostomia turriculata Monterosato, 1869		1						2		
Odostomia turrita Hanley, 1844			6					4		
Ondina cf. *anceps* Gaglini, 1992					3					
Ondina cf. *crystallina* Locard, 1892						1	2		1	
Ondina dilucida (Monterosato, 1884)			1			1				
Ondina cf. *neocrystallina* Gaglini, 1992							1	1	1	
Ondina obliqua (Alder, 1844)		1	1	4	6	5	1	6	1	
Ondina vitrea (Brusina, 1866)								1		
Ondina warreni (Thompson, 1845)						1				
Parthenina clathrata (Jeffreys, 1848)					1	1				
Parthenina emaciata (Brusina, 1866)		3	20	3	20	20		11	2	
Parthenina indistincta (Montagu, 1808)								1		
Parthenina interstincta (Montagu, 1808)	15	1	6	1		10	5	7		
Parthenina terebellum (Philippi, 1844)		1								
Pyrgiscus jeffreysii (Jeffreys, 1848)				1	4	4	2	2		
Spiralinella incerta (Milaschewitch, 1906)			1					3		
Syrnola sp.							3			
Turbonilla lactea (Linné, 1766)	14	9	6		8	4	2	31	3	
Ringicula auriculata (Menard de la Groye, 1811)								1		
Tomura depressa (Granata-Grillo, 1877)							1			
Retusa laevisculpta (Granata-Grillo, 1877)	5	1		1			1			
Retusa mammillata (Philippi, 1836)			2	23	17	15	8	2	1	
Retusa truncatula (Bruguiere, 1792)	4	7	15	10	21	25	8	28	6	
Retusa umbilicata (Montagu, 1803)		1	1	2	2	15	1	2	1	
Haminoea cf. *cyanomarginata* Heller & Thompson, 1983	4	2		3	3		3	6		
Weinkauffia turgidula (Forbes, 1844)		1	3	4	7	13	8	11	9	
Philine catena (Montagu, 1803)			2	8	1	1	1	8		
Berthella sp.							1		1	
Creseis clava Rang, 1828		2	2	1	3	6	5	6	7	
Leucophytina bidentata (Montagu, 1808)										1
Myosotella myosotis (Draparnaud, 1801)				1						
Scaphopoda										
Antalis dentalis Linné, 1758	1	6	1	1	2	2	4	4	11	
Antalis vulgaris da Costa, 1778						2				
Polyplacophora										
Chiton cf. *olivaceus* Spengler, 1797				1				1		
Total number of species	**64**	**108**	**118**	**115**	**110**	**130**	**126**	**128**	**111**	**30**