

## The malacofauna in infralittoral ground samples from northwest Krk, Croatia

Rudolf Kapeller

Huemerstr. 11, 4020 Linz, Austria

Correspondence: [office@kapeller.eu](mailto:office@kapeller.eu)

**Abstract:** Four ground samples from various depths, 3 to 18 m, were taken at the northwestern coast of Krk near Njivice. 146 species were identified in these samples. Some unclear records and questionable literature records are briefly discussed. Ten species were recorded first time from Krk.

**Keywords:** Mollusca, Krk, Croatia, Adriatic Sea

**Zusammenfassung:** Vier Bodenproben aus verschiedenen Tiefen, 3 bis 18 m, wurden an der Küste von Krk nahe Njivice entnommen. 146 Molluskenarten wurden in diesen Proben identifiziert. Einzelne unklare Funde und Diskrepanzen zu bisherigen Nachweisen werden kurz diskutiert. Zehn Arten wurden erstmals auf Krk nachgewiesen.

**Schlüsselwörter:** Mollusken, Krk, Kroatien, Adria

### Introduction

I have built up a major collection of European mollusks for the reason of taking high quality images for a database for European mollusks with determination key. One of the goals of this project (Kapeller 2019) is to be as complete as possible with high resolution images. The database is now available online (Kapeller 2022) for free use, and can be used for marine gastropods, marine bivalves, freshwater gastropods and freshwater bivalves at the moment, 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.

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. From today's point of view, these are incomplete and there is no reference to an occurrence on Krk. A comprehensive review of the fauna of the Rijeka Bay was prepared by Zavodnik & Kovacic (2000) and they conducted own studies from numerous sites in the bay, including the northwestern coast of Krk, but, unfortunately, they did not assign the species to the particular sites, thus the records from Krk could not be extracted. Anyway, none of the species, first time reported from Krk in the present study, was listed there. Furthermore, this list appears still

rather incomplete, compared to recent studies, in particular for small species, which might have been due to the sampling methods. In the last years the malacofauna of particular Adriatic Isles was intensively studied by sampling at numerous sites, with a focus on micromollusks (Romani et al. 2018; Raveggi et al. 2021), including the eastern and southern part of the island of Krk (Romani et al. 2020) see Fig. 1.

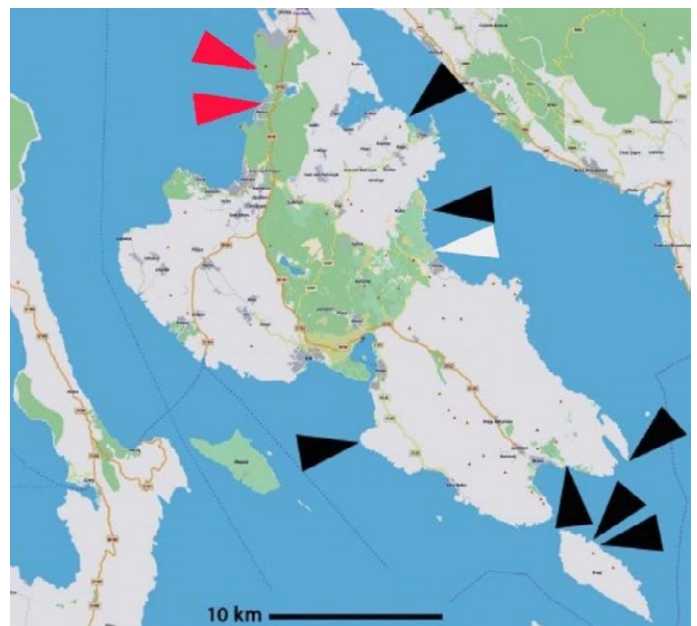


Fig. 1: Map of Krk from Romani et al. (2020) indicating the sites studied therein (black arrows); site studied by Arko-Pijevac et al. (2001) (white arrow); sites studied in this work (red arrows).

## Methods and materials

Four ground samples were taken from various depths, 3 to 18 m, at the coast of Krk near Njivice, during snorkel and scuba dives. The material was taken manually from the ground surface to about 5 cm depth. It consisted mainly of sand, gravel and shell grit. Samples 1 to 3 are from an area with intense tourist activity, sample 1 from inside a demarcated swimming area, 2 and 3 from outside. Sample 4 is from a quiet area, a diving site called ‘Black Rock’, north of Njivice. Coordinates and sample amounts see Table 1.

Table 1: Depths, coordinates and sample sizes.

| Sample | Depth   | Locality                       | Dry weight |
|--------|---------|--------------------------------|------------|
| 1      | 3–5 m   | Njivice, 45.1708°N, 14.5434°E  | 580 g      |
| 2      | 7–8 m   | Njivice, 45.1705°N, 14.5430°E  | 790 g      |
| 3      | 10–11 m | Njivice, 45.1695°N, 14.5441°E  | 2010 g     |
| 4      | 18 m    | ‘Black Rock’, 45.18°N, 14.53°E | 420 g      |

The samples were quantitatively analyzed for contained species. 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. For this purpose, portions of about 100 g were suspended in 5 l water. After sedimentation of sand and shells, the supernatant was discarded in order to remove organic matter. After resuspending in 5 l water and a short time, allowing the sand particles to be sedimented to the bottom, the supernatant, still containing shells of lower density (due to the water within the shells) and lower hydrodynamic diameter (due to the shape of single valves of bivalves) was collected. Repeating the latter step 10 times allowed a fairly complete isolation of the shells in a reduced portion, manageable by stereo microscopy.

All complete and fairly preserved shells were isolated. Exceptionally, fragments were also isolated, as far as they allowed a clear assignment, especially of less common or larger species, of which no complete shells were contained in the samples. The shells were sorted by species and counted. The determination was carried out according to Kapeller (2022) and the literature cited therein.

Species were assumed as recorded first time from Krk, when they are not mentioned in literature explicitly referring to Krk, in particular Zavodnik & Kovacic (2000), containing a comprehensive review of literature records up to 2000, besides intensive sampling at the northwestern coast of Krk, and Romani et al. (2020), who have intensively studied the eastern and southern part of the island.

Photographs were taken with a microphotography station (Fig. 2) consisting of a Canon EOS 60D camera, a bel-

lows and extension tubes to increase the magnification and a Zeiss Photar 25 mm objective, combined by specific adapters, and a Cognisys stacking rails. The items were placed on black velvet, on a manipulator to turn them in an orthogonal position. A direct illumination from above at an angle of approx. 35° was used to optimally accentuate the superficial structures, assisted by a diffuse illumination to avoid underexposed areas. Computing of the stack images was done by self-developed software, optimized for micro-objects on a black background, containing a number of features not being available in commercial software. Just to mention one: Processing starts with the detection of the “outline layer”, being that one with the sharpest outline of the item, and operates from this layer in both directions. This ensures that the scale of the final image matches with an image of a size reference and allows a precise measurement of the size of the item. Stacking in one direction only, will always cause a more or less dramatic perspectival size error, depending on the height of the item and the focal length of the lens, in particular at high magnification.



Fig. 2: Microphotography station. Photo: R. Kapeller

## Results

A total of 2662 shells were isolated, comprising 146 different species. The quantitative results are shown in Table 2. It has to be noted, that the counts of small species in sample 3 (10 to 11 m) are somewhat underrepresented, because the preconcentration of mollusk shells was a bit less efficient in this sample, due to a heavy load of foraminifera.

Determination was uncertain in some cases (even for species which can normally be clearly assigned), because sometimes only less well preserved shells, and from a number of species only juveniles were present in the samples.

## Malacofauna from Krk, Croatia

Table 2: Numbers of specimens isolated from the samples. 0 = species was not found in the sample, but observed during the respective dive. Species in bold letters are first time recorded from Krk.

| Sample   | 1  | 2  | 3   | 4 |     |    |     |     |
|--|----|----|-----|---|-----|----|-----|-----|
| <b>Bivalvia</b>  |    |    |     |   |     |    |     |     |
| <i>Nucula nucleus</i> (Linne, 1758)  |    |    | 7   | 1 |     |    |     |     |
| <b><i>Lembulus pella</i> (Linne, 1767)</b>   |    |    | 3   |   |     |    |     |     |
| <i>Limaria tuberculata</i> (Wood, 1839)  | 1  |    |     |   |     |    |     |     |
| <i>Striarca lactea</i> (Linne, 1758)   | 1  | 1  | 2   | 4 |     |    |     |     |
| <i>Dacrydium hyalinum</i> Monterosato, 1875  | 1  |    | 1   |   |     |    |     |     |
| <i>Gibbomodiola adriatica</i> Lamarck, 1819  |    |    | 4   |   |     |    |     |     |
| <i>Gregariella</i> sp.   |    |    | 1   |   |     |    |     |     |
| <i>Musculus costulatus</i> (Risso, 1826)   |    |    | 3   |   |     |    |     |     |
| <i>Mytilus galloprovincialis</i> Lamarck, 1819   |    |    | 1   |   |     |    |     |     |
| <i>Striarca lactea</i> (Linne, 1758)   | 1  | 1  | 2   | 4 |     |    |     |     |
| <i>Pinna nobilis</i> Linne, 1758   |    |    |     | 0 |     |    |     |     |
| <i>Anomia ephippium</i> Linne, 1758  | 1  | 3  | 20  | 1 |     |    |     |     |
| <i>Pododesmus patelliformis</i> (Linne, 1761)  | 3  |    |     |   |     |    |     |     |
| <i>Talochlamys multistriata</i> (Poli, 1795)   | 2  |    |     |   |     |    |     |     |
| <i>Palliolium incomparabile</i> (Risso, 1826)  |    |    | 1   |   |     |    |     |     |
| <i>Pecten jacobaeus</i> (Linne, 1758)  |    | 1  | 1   |   |     |    |     |     |
| Pectinidae sp.   | 1  |    |     |   |     |    |     |     |
| <i>Ctena decussata</i> (O. G. Costa, 1829)   | 6  |    | 2   | 1 |     |    |     |     |
| <i>Loripes orbiculatus</i> Poli, 1791  | 2  |    | 3   |   |     |    |     |     |
| <i>Loripinus fragilis</i> (Philippi, 1836)   |    |    | 20  | 2 |     |    |     |     |
| <i>Lucinella divaricata</i> (Linne, 1758)  | 62 | 86 | 355 | 9 |     |    |     |     |
| <i>Myrtea spinifera</i> (Montagu, 1803)  |    |    | 3   |   |     |    |     |     |
| <i>Astarte sulcata</i> (da Costa, 1778)  |    |    | 2   |   |     |    |     |     |
| <i>Acanthocardia paucicostata</i> (Sowerby, 1843)  |    |    | 1   |   |     |    |     |     |
| <i>Acanthocardia tuberculata</i> (Linne, 1758)   | 0  |    |     |   |     |    |     |     |
| <i>Laevicardium oblongum</i> (Gmelin, 1791)  |    |    | 1   |   |     |    |     |     |
| <i>Papillicardium papillosum</i> (Poli, 1791)  | 3  | 6  | 73  | 7 |     |    |     |     |
| <i>Parvicardium exiguum</i> (Gmelin, 1791)   | 2  |    | 9   |   |     |    |     |     |
| <i>Parvicardium minimum</i> (Philippi, 1836)   | 3  |    |     |   |     |    |     |     |
| <i>Parvicardium scriptum</i> (Bucquoy, D.& D., 1892)                                     | 4  | 26 | 5   | 9 |     |    |     |     |
| <i>Chama gryphoides</i> Linne, 1758  | 3  |    |     |   |     |    |     |     |
| <i>Kurtiella bidentata</i> (Montagu, 1803)   |    |    | 3   |   |     |    |     |     |
| <i>Spisula subtruncata</i> (da Costa, 1778)  | 2  | 3  | 2   |   |     |    |     |     |
| <i>Arcopella balaustina</i> (Linne, 1758)  |    |    | 4   |   |     |    |     |     |
| <i>Asbjornsenia pygmaea</i> (Loven, 1846)  | 2  | 1  |     |   |     |    |     |     |
| <i>Moerella donacina</i> (Linne, 1758)   | 10 | 23 | 32  |   |     |    |     |     |
| Tellinidae sp.   | 1  |    |     |   |     |    |     |     |
| <i>Callista chione</i> (Linne, 1758)   |    |    | 2   |   |     |    |     |     |
| <i>Clausinella fasciata</i> (da Costa, 1778)   |    | 2  | 2   |   |     |    |     |     |
| <i>Gouldia minima</i> (Montagu, 1803)  | 10 | 43 | 126 | 8 |     |    |     |     |
| <i>Irus irus</i> (Linne, 1758)   | 1  |    |     | 1 |     |    |     |     |
| <i>Pitar rudis</i> (Poli, 1795)  |    | 1  | 19  |   |     |    |     |     |
| <i>Polititapes aureus</i> (Gmelin, 1791)   |    | 4  |     |   |     |    |     |     |
| <i>Polititapes</i> cf. <i>rhomboides</i> (Pennant, 1777)                                 |    |    | 1   |   |     |    |     |     |
| <i>Timoclea ovata</i> (Pennant, 1777)  | 1  | 2  | 4   |   |     |    |     |     |
| <b><i>Turtonia minuta</i> (Fabricius, 1780)</b>  |    |    | 2   |   |     |    |     |     |
| <i>Venus verrucosa</i> Linne, 1758   | 5  | 1  | 3   |   |     |    |     |     |
| <i>Corbula gibba</i> (Olivi, 1792)   |    |    | 5   |   |     |    |     |     |
| <i>Lentidium mediterraneum</i> (O.G. Costa, 1829)  |    |    | 1   |   |     |    |     |     |
| <i>Hiatella arctica</i> (Linne, 1767)  | 2  |    | 6   | 8 |     |    |     |     |
| <i>Thracia phaseolina</i> (Lamarck, 1818)  |    | 2  | 1   |   |     |    |     |     |
| <b>Gastropoda</b>  |    |    |     |   |     |    |     |     |
| <i>Patella rustica</i> Linne, 1758   |    |    | 2   |   |     |    |     |     |
| Patellogastropoda sp.  |    |    |     | 1 |     |    |     |     |
| <i>Diodora gibberula</i> (Lamarck, 1822)   |    | 1  |     | 1 |     |    |     |     |
| <i>Emarginula octaviana</i> Coen, 1939   |    |    |     | 1 |     |    |     |     |
| <i>Haliotis tuberculata</i> Linne, 1758  | 1  |    |     |   |     |    |     |     |
| <i>Tricolia pullus</i> (Linne, 1758)   |    |    |     |   | 3   | 1  | 13  | 1   |
| <i>Clanculus corallinus</i> (Gmelin, 1791)   |    |    |     |   |     |    |     | 2   |
| <i>Gibbula albida</i> (Gmelin, 1791)   |    |    |     |   | 4   | 4  | 19  |     |
| <i>Gibbula guttadauri</i> (Philippi, 1836)   |    |    |     |   | 4   |    |     |     |
| <i>Gibbula magus</i> (Linne, 1767)   |    |    |     |   |     | 10 |     |     |
| <i>Jujubinus striatus</i> (Linne, 1767)  |    |    |     |   |     |    | 3   | 9   |
| <i>Pseudominolia nedyma</i> (Melvill, 1897)  |    |    |     |   |     |    |     | 1   |
| <i>Steromphala divaricata</i> (Linne, 1767)  |    |    |     |   | 10  |    |     |     |
| <i>Similiphora similior</i> (Bouchet & Guillemot, 1978)                                  |    |    |     |   | 2   | 3  | 2   | 7   |
| <i>Bittium reticulatum</i> (da Costa, 1778)  |    |    |     |   | 60  | 43 | 196 | 115 |
| <i>Cerithium vulgatum</i> (Bruguere, 1792)   |    |    |     |   | 5   | 8  | 20  | 6   |
| <i>Euspira nitida</i> (Donovan, 1804)  |    |    |     |   |     | 3  | 12  | 2   |
| <b><i>Tectonatica sagraiana</i> (d'Orbigny, 1842)</b>                                    |    |    |     |   | 5   |    |     |     |
| <i>Caecum auriculatum</i> or <i>C. subannulatum</i> de Folin, 1868                       |    |    |     |   |     |    |     | 7   |
| <i>Caecum trachea</i> (Montagu, 1803)  |    |    |     |   | 16  | 12 | 22  | 8   |
| <i>Alvania aspera</i> (Philippi, 1844)   |    |    |     |   | 6   |    |     |     |
| <i>Alvania beanii</i> (Hanley, 1844)   |    |    |     |   |     |    |     | 2   |
| <i>Alvania cancellata</i> (da Costa, 1778)   |    |    |     |   | 9   | 4  | 4   | 36  |
| <i>Alvania cimex</i> (Linne, 1758)   |    |    |     |   | 1   | 2  | 7   | 2   |
| <i>Alvania geryonia</i> (Chiereghini in Nardo, 1847)                                     |    |    |     |   |     |    | 5   | 15  |
| <i>Alvania lactea</i> (Michaud, 1830)  |    |    |     |   | 2   |    |     |     |
| <i>Alvania tenera</i> (Philippi, 1844)   |    |    |     |   |     |    |     | 1   |
| <b><i>Alvania</i> sp.</b>  |    |    |     |   |     |    |     | 2   |
| <i>Crisilla</i> cf. <i>marioni</i> Fasulo & Gaglini, 1987                                |    |    |     |   |     |    | 3   |     |
| <i>Crisilla semistriata</i> (Montagu, 1808)  |    |    |     |   | 2   |    |     | 17  |
| <i>Manzonina crassa</i> (Kanmacher, 1798)  |    |    |     |   | 9   | 1  | 1   | 7   |
| <i>Obtusella intersecta</i> (Wood, 1857)   |    |    |     |   | 5   | 19 |     |     |
| <b><i>Pusillina ehrenbergi</i> (Philippi, 1844)</b>                                      |    |    |     |   |     |    | 1   | 4   |
| <i>Pusillina</i> cf. <i>inconspicua</i> (Alder, 1844)                                    |    |    |     |   |     |    | 22  |     |
| <i>Pusillina</i> cf. <i>lineolata</i> (Michaud, 1832)                                    |    |    |     |   |     |    | 2   |     |
| <i>Pusillina philippi</i> (Aradas & Maggiore, 1844)                                      |    |    |     |   |     |    |     | 4   |
| <i>Pusillina radiata</i> (Philippi, 1836)  |    |    |     |   | 119 | 20 | 136 | 79  |
| <i>Rissoa frauenfeldiana</i> Brusina, 1868   |    |    |     |   |     |    |     | 1   |
| <i>Rissoa</i> cf. <i>guerinii</i> Recluz, 1843   |    |    |     |   | 8   |    | 1   |     |
| <i>Rissoa</i> cf. <i>similis</i> Scacchi, 1836   |    |    |     |   | 1   |    |     | 1   |
| <i>Rissoa splendida</i> Eichwald, 1830   |    |    |     |   |     |    | 20  |     |
| <i>Rissoa variabilis</i> (v. Mühlfeldt, 1824)  |    |    |     |   |     |    | 8   |     |
| <i>Rissoa</i> cf. <i>ventricosa</i> Desmarest, 1814                                      |    |    |     |   | 24  |    |     | 1   |
| <i>Setia</i> sp. 1   |    |    |     |   | 2   |    |     |     |
| <i>Setia</i> sp. 2   |    |    |     |   | 4   |    |     |     |
| <i>Rissoina bruguieri</i> (Payraudeau, 1826)   |    |    |     |   | 1   |    |     | 2   |
| <i>Hydrobia acuta</i> (Draparnaud, 1805)   |    |    |     |   |     |    |     | 2   |
| <b><i>Circulus striatus</i> (Philippi, 1836)</b>   |    |    |     |   |     |    | 1   |     |
| <i>Vermetus triquetrus</i> Bivona, 1832  |    |    |     |   |     |    |     | 5   |
| <i>Epitonium clathrus</i> (Linne, 1758)  |    |    |     |   | 1   |    | 6   | 1   |
| <i>Opalia coronata</i> (Philippi & Scacchi, 1840)  |    |    |     |   |     |    |     | 1   |
| <i>Cerithiopsis</i> sp.  |    |    |     |   |     |    |     | 1   |
| <i>Melanella lubrica</i> (Monterosato, 1890)   |    |    |     |   |     |    | 1   |     |
| <i>Vitreolina antiflexa</i> Monterosato, 1884  |    |    |     |   | 1   | 4  | 4   | 3   |
| <i>Fusinus</i> sp.   |    |    |     |   |     |    |     | 1   |
| <i>Tritia incrassata</i> (Strom, 1768)   |    |    |     |   | 3   | 1  | 4   | 9   |
| <i>Bela</i> cf. <i>menkhorsti</i> van Aartsen, 1988                                      |    |    |     |   |     |    |     | 1   |
| <i>Mangelia costata</i> (Pennant, 1777)  |    |    |     |   | 4   |    | 6   | 4   |
| <i>Mangelia stosiciana</i> (Brusina, 1868)   |    |    |     |   |     |    |     | 1   |
| <i>Mangelia unifasciata</i> Deshayes, 1835   |    |    |     |   |     | 3  | 8   | 5   |
| <i>Raphitoma</i> cf. <i>atropurpurea</i> (Locard & Caziot, 1900)                         |    |    |     |   |     |    | 3   | 1   |
| <i>Raphitoma</i> cf. <i>brunneofasciata</i> Pusateri, Giannuzzi-Savelli & Oliverio, 2013 |    |    |     |   |     |    |     | 1   |
| <i>Bolinus brandis</i> (Linne, 1758)   |    |    |     |   |     |    |     | 1   |
| <i>Hexaplex trunculus</i> (Linne, 1758)  |    |    |     |   |     |    |     | 1   |
| <i>Granulina marginata</i> (Bivona, 1832)  |    |    |     |   | 8   | 5  |     | 1   |
| <i>Pusia savignyi</i> (Payraudeau, 1826)   |    |    |     |   | 1   |    |     |     |
| <i>Pusia tricolor</i> (Gmelin, 1790)   |    |    |     |   |     |    |     | 2   |

| Sample | 1 | 2 | 3 | 4 |   |    |    |       |
|--------|---|---|---|---|---|----|----|-------|
|        |   |   |   |   | <i>Hyalogyra zibrowii</i> Waren, 1997                             |    |    | 1     |
|        |   |   |   |   | <b><i>Retusa laevisculpta</i> (Granata-Grillo, 1877)</b>          | 2  | 12 | 2     |
|        |   |   |   |   | <i>Retusa mammillata</i> (Philippi, 1836)                         | 6  | 10 |       |
|        |   |   |   |   | <i>Retusa truncatula</i> (Bruguiere, 1792)                        | 16 |    | 11 13 |
|        |   |   |   |   | <i>Retusa umbilicata</i> (Montagu, 1803)                          | 1  | 10 | 2     |
|        |   |   |   |   | <i>Haminoea</i> cf. <i>cyanomarginata</i> Heller & Thompson, 1983 | 2  |    | 1     |
|        |   |   |   |   | <b><i>Roxaniella jeffreysi</i> (Weinkauff, 1868)</b>              |    |    | 5     |
|        |   |   |   |   | <i>Weinkauffia turgidula</i> (Forbes, 1844)                       | 2  | 2  | 8 2   |
|        |   |   |   |   | <i>Philine catena</i> (Montagu, 1803)                             | 1  | 1  | 1 2   |
|        |   |   |   |   | <i>Volvulella acuminata</i> (Bruguiere, 1792)                     |    | 4  | 3     |
|        |   |   |   |   | <i>Berthella</i> sp.  |    |    | 1     |
|        |   |   |   |   | <i>Creseis clava</i> Rang, 1828                                   |    | 1  | 4     |
|        |   |   |   |   | <b>Scaphopoda</b>   |    |    |       |
|        |   |   |   |   | <i>Antalis dentalis</i> Linne, 1758                               | 1  |    | 1     |
|        |   |   |   |   | <i>Dentalium vulgare</i> da Costa, 1778                           | 1  | 5  | 7     |
|        |   |   |   |   | <b>Cephalopoda</b>  |    |    |       |
|        |   |   |   |   | <i>Octopus vulgaris</i> Cuvier, 1797                              |    | 0  | 0 0   |

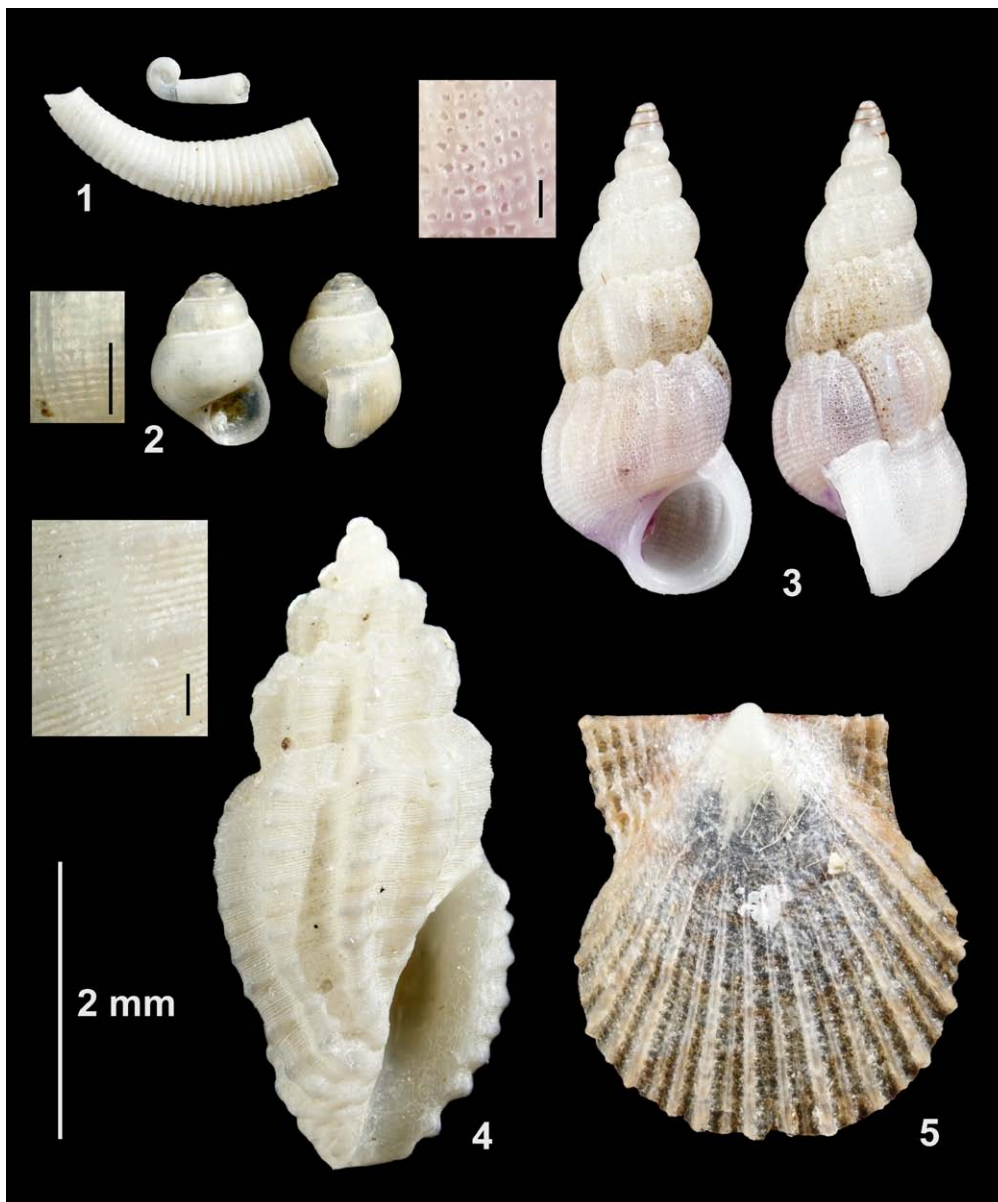


Fig. 3: Examples of images of small species: 1: *Caecum trachea*, including a juvenile with preserved protoconch; 2: *Obtusella intersecta*; 3: *Opalia coronata*; 4: *Mangelia stosiciana*; 5: *Talochlamys multistriata*, juv.; scale bars in the detail enlargements = 100 µm. All photos: R. Kapeller

From some species images were taken. A few examples of interesting small species are shown in Fig. 3.

Due to the limited samples, these results do, of course, not provide a complete overview of the malacofauna in this area, as 372 'shelled micromollusk' species were recorded from other parts of the island (Romani et al. 2020). But nevertheless ten species were recorded for the first time from Krk. These are indicated in bold letters in Table 2 and shown in Figs. 4 and 5.

One *Alvania* species thereof (two specimens in sample 4) could not be assigned to any known species. It is rather thin shelled, strongly and regularly cancellated and with a spiral sculpture on the protoconch, closely resembling *Alvania dalmatica* Buzzurro & Prkic, 2007, but differing from

this species by having a multispiral protoconch.

*Lentidium mediterraneum* (O.G. Costa, 1829) was not regarded as 'new for Krk', as it seems unlikely that this species lives on this type of ground (Poppe & Goto 1993), while it is extremely abundant at the Italian side of the northern Adriatic Sea. It is therefore assumed, that the single shell found in sample 3 could be a result of a dislocation.

*Nucula nucleus* (Linne, 1758) was also not included, as it is a common species and it appears a bit strange that it was not recorded by Romani et al. (2020). Maybe it was contained among the *Nucula nitidosa* Winckworth, 1930 listed there. While *N. nucleus* is common on gravel ground, *N. nitidosa* prefers fine sand and mud (Poppe &



Fig. 4: 1: *Retusa laevisculpta* (Granata-Grillo, 1877) from sample 2; 2: *Acteon tornatilis* (Linne, 1758), juv., from sample 3; 3: *Circulus striatus* (Philippi, 1836), broken, from sample 2; 4: *Pusillina ehrenbergi* (Philippi, 1844) from sample 3; 5: *Ammonicera rota* (Forbes & Hanley, 1853) from sample 4. All photos: R. Kapeller

Goto 1993), therefore *N. nucleus* is more likely to live here.

*Rissoa frauenfeldiana* Bursina, 1868 was also not included, although not explicitly listed in the literature referred to, but known for Krk from earlier records (Kapeller 2022) and probably contained in the records of *Rissoa decorata* Philippi, 1846 in Romani et al. (2020), as *R. frauenfeldiana* was discussed as an uncertain species there, rather a color variant of *R. decorata*.

*Retusa laevisculpta* (Granata-Grillo, 1877) was found in 3 samples and seems therefore not rare, but is not listed by Romani et al. (2020). *Retusa parvula* (Jeffreys, 1883) is listed instead, but this record appears questionable, as this species is known from depths of 80 to 300 m (Crocetta et al. 2015). *Retusa parvula* and *laevisculpta* can hardly be confused, as *R. laevisculpta* has a distinct spiral sculpture,

while *R. parvula* has none (Crocetta et al. 2015). Maybe, Romani et al. (2020) did not distinguish between *Retusa umbilicata* and *R. laevisculpta*, as these species are rather similar. In the samples of the present study a number of both species could be identified. They could be clearly differentiated by the more convex outline of *umbilicata* and the more strictly cylindrical shape and more horizontally truncated upside of *R. laevisculpta*; intermediate forms were not observed.

Another surprising result was that *Bittium latreillii* (Payraudeau, 1826) was not found, although it is one of the most abundant species in the entire Mediterranean (Russo et al. 2002). I have doublechecked hundreds of *Bittium reticulatum*, but could not identify one single *B. latreillii* in any of the samples.

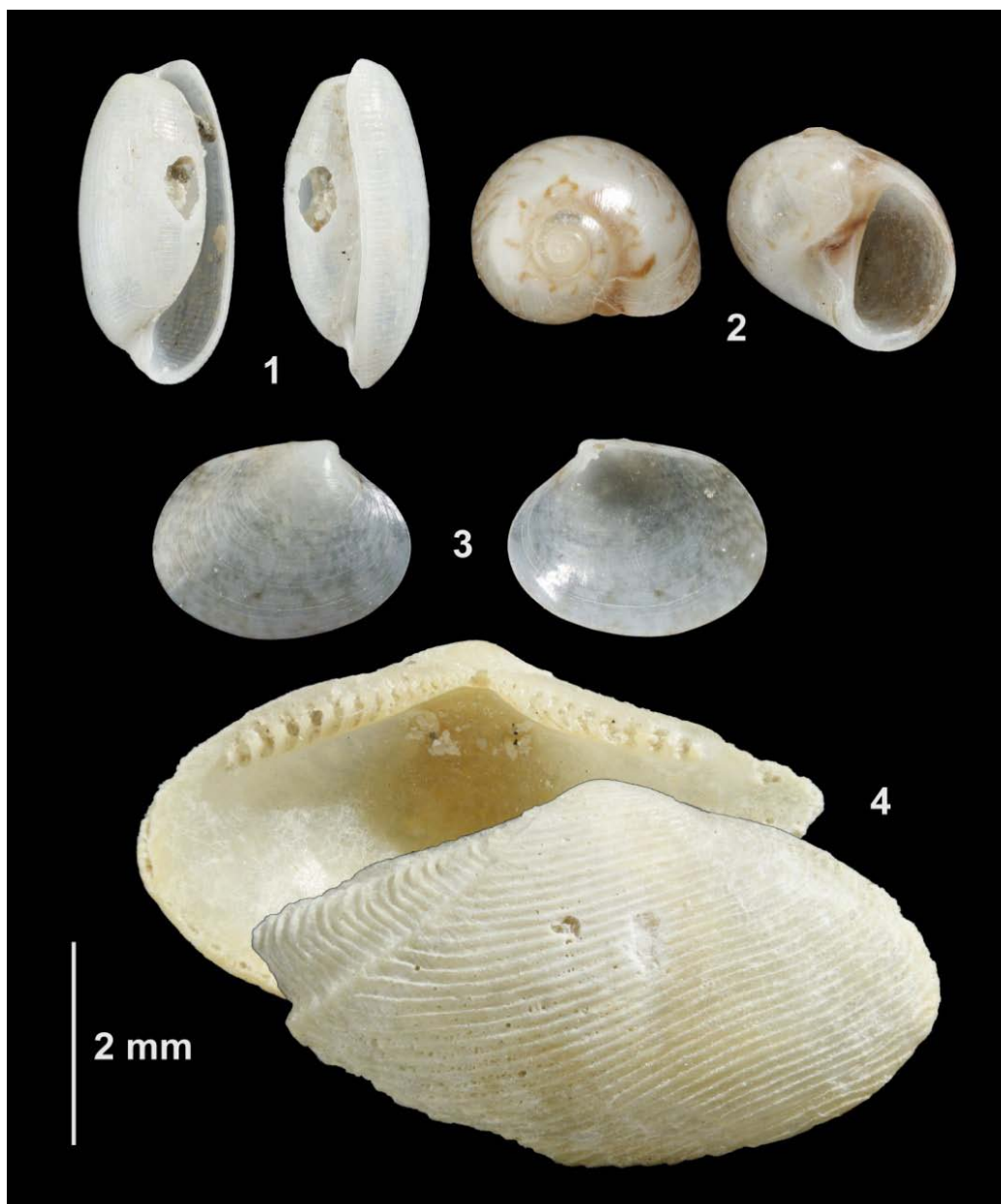


Fig. 5: 1: *Roxaniella jeffreysi* (Weinkauff, 1868) from sample 3; 2: *Tectonatica sagraiana* (d'Orbigny, 1842), juv., from sample 1; 3: *Turtonia minuta* (Fabricius, 1780) from sample 3; 4: *Lembulus pella* (Linne, 1767) from sample 3. All photos: R. Kapeller

## Conclusions

146 species could be isolated from four ground samples from the northwestern coast of Krk near Njivice, 49 to 88 species in the individual samples.

The number of known species of shelled mollusks, living around the island of Krk, is increased by ten. Together with the 372 'micromollusks' listed by Romani et al. (2020), and 25 other (bigger) ones, not listed there, but well known from this area, there are 407 known species at the moment. But all together, the list can still not be regarded comprehensiv.

*Alvania* sp. could be a new species. But there is only one probably subadult and one juvenile specimen at the moment. More material will be collected next year to obtain further information and eventually arrive at a decision.

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