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Ecological study of Prosobranchiata (Gastropoda) in the eastern part of the Adriatic Sea and their relationship to benthic biocoenoses

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The present study is based on critically observed data on the taxonomy, ecology and biocoenology of Prosobranchiata from the eastern Adriatic Sea.

The data were collected for more than 20 years, during which period a large number of information was obtained for individual gastropod species. The data on some of the recorded gastropods, largely exceed those presented here.

The research was carried out in different biotopes of the northern, middle and southern Adriatic, including shallow coastal and deeper open littoral, that is bionomic steps from supralittoral to the bathyal of hard and mobile bottoms.

All the authors working in the Adriatic, who could be found in the available literature, were cited for individual species, whereas only more significant authors were reported for the Mediterranean and Atlantic. The paper then presents the species distribution in world seas, vertical and horizontal distributions in the Adriatic and abundance of each species and its relationship to benthic biocoenoses. The reports of other authors were discussed for each individual species. The data from the western Adriatic coast were presented for some species to give as complete account as possible. The most important synonymy is also given.

To be sure that the sites of records were authentic only live gastropod specimens were taken into consideration.

INTRODUCTION

The first records on the Adriatic gastropods came from PLANCHUS (1739). OLIVI (1792) reported the species of Mollusca collected from the area of Venice along with other systematic groups. This work is very valuable since it for the first time mentioned scientific names of some shellfish. NARDO (1847) published the paper with the report on the Chiereghini collection. The importance of this work is in its contribution to the diagnosis of each individual species and some essential data on the bottom and area wherefrom a particular species was recorded. DANILO and SANDRI (1856) gave the list of Mollusca from the Zadar area. GRUBE (1861) supplied the list of fauna from the areas of Trieste and Kvarner, report-

ing 68 species of Prosobranchiata group and describing the fauna of the Lošinj Island (1864). The work by HELLER (1864) included the submarine fauna of some Dalmatian islands (Hvar, Vis, Korčula). Thanks to S. BRUSINA (1865, 1866, 1869, 1870a, 1870b, 1871, 1904, 1907) we have available the most complete data on Mollusca for the Adriatic. A. STOSSICH (1865) dealt with the Mollusca from the area of Trieste and the paper by M. STOSSICH (1880) not only covered the distribution of Mollusca in the Adriatic but focused on the character of the bottom where a particular species was discovered and on its presence. WIMMER's (1883) lists of Molluscan species from the areas of Rovinj and Dalmatia should also be mentioned. Along with the bottom characteristics this authors reports the depth of species record. GRAEFFE (1902) investigated Mollusca from the Gulf of Trieste. ZIMMERMANN (1905-1906) provided the list of 57 Posobranchiata species from the area of Rovinj and ODHNER (1914) reported 47 species from the same area. The paper of KRUMBACH (1918) contrributed important details on the two species of genus *Patella (Patella lusitanica* Gmelin and *P. scutellaris* Blainville) from the aea of Rovinj. Between 1928 and 1949 VATOVA investigated benthic zoocoenoses in the middle and northern Adriatic. Of a large number of his papers some (1928, 1935, 1949) supplied the data on the record site, bottom properties, depth and number of individuals of Prosobranchiata among other systematic groups. COEN and VATOVA (1933) gave the list of Mollusca from the Rovinj area with depths and bottom type wherefom they were recorded. COEN (1937) published the paper with complete list of the Mollusca in the Adriatic. Studying the biocoenoses of marine littoral of the rocky west Istrian shores ZEI (1955) presented the data on found gastropods. GAMULIN-BRIDA devoted her life long research to the Adriatic benthos. Of her numerous papers only those conributing the knowledge on the distribution of Mollusca in different Adriatic biocoenoses are mentioned (1962, 1965, 1967, 1974). The paper by PÉRÈS and GAMULIN-BRIDA (1973) counts among these papers. HORVATH (1963) reported on Mollusca distribution as affected by substratum in the Split area. RIEDL's (1963, 1983) papers include some basic data on the species of Prosobranchiata group from the Adriatic and Mediterranean. With his numerous reports dealing with benthos ZAVODNIK made a significant contibution to the investigations of the Adriatic and particularly of its northern part. Of these papers I would like to mention only those (1967a, 1971) presenting the data on the quantities and distribution of individual Prosobranchiata species in individual benthic biocoenoses of hard and mobile bottoms of the wider area of Rovinj. ZAVODNIK (1967b) also published a paper describing the record sites and behaviour of the species *Mitra zonata* Marryatt under aquarium conditions. GRUBIŠIĆ (1967, 1982) published a papers on fish, crustaceans and shellfish in the Adriatic Sea. STJEPČEVIČ (1967) reported on the vertical and horizontal distribution of Mollusca in the Bay Boka kotorska. STJEPČEVIĆ and PARENZAN (1980) giving the biocoenological description and ecological map presented a detailed list of Mollusca of the Bay Boka kotorska. RADIĆ (1969) described the distribution of the species *Mitra zonata* in the Adriatic Sea, and published the paper (1982) on the distribution of gastropods in the benthic biocoenoses of the Makarska area. ŠIMUNOVIĆ (1970), studying faunistic settlements of rocky shores of the middle Adriatic, provided data on the distribution and abundance of 14 gastropod species along with those of some other systematic groups.

Very valuable papers concerning malacology of the Adriatic Sea deal for the most part with the systematics whereas, on the other hand there is a substantial number of papers with very scarce information on the ecology of individual species. Since I intended to provide a more comprehensive data on individual species, rather complex bionomic and biocoenological research was undertaken aiming at studying taxonomy and ecology of the Prosobranchiata group.

MATERIAL AND METHODS

Study area and a review of benthic biocoenoses

Dubrovnik area

Studies of Prosobranchiata in benthic and animal settlements were carried out on steep rocky shores from the cape Petka to Danče cove and the area of less steep deeper bottom (down to 100 m), stretching two to three km offshore (Fig. 1). Studied coast (t.* 1,2,3) mainly consists of rocks almost vertically descending to the depth of 10-15 m extending further as slightly sloping rocky shelf covered with several metres high stone blocks. At greater depths, where the slope is more steep, stone blocks are much smaller and shorter (most of the infralittoral step). The space between stone blocks is covered by smaller and bigger stones. Between 40 and 45 m (circalittoral step) bottom is far less steep mainly covered by gravelly-sandy sediment. At depths exceeding 50 m rocky substrate is almost completely covered by sediment forming different types of mobile sea beds. Bottom at transect 4 (Danče cove) is still more horizontal. Vertical rocky shore descends to 7-8 m depth where the slope is changed, becoming rather horizontal and covered by big stone blocks. At 12 m depth it stretches as a relatively horizontal gravelly-sandy bottom wherefrom 1-2 m wide rocks or stones protrude.

Studies of the above mentioned transects were carried out on three occasions in the years 1971-1972.

A total of 11 benthic biocoenoses and their aspects were recorded from the study area, from supralittoral to greater depths of circalittoral:

The biocoenosis of supralittoral rocks well developed throughout the area. The depths of supralittoral is about 2 m at less exposed localities (t. 4) and up to 7-8 m (t. 1, 2, 3) at exposed localities to reach 14 m (t. 2) at very exposed localities (t.2).

The biocoenosis of upper and lower mediolittoral rocks. Both biocoenoses are well developed throughout the study area. The depth of mediolittoral is about 0.5 to 0.7 m with a varying shore slopes which are for the most part about 80^0.

The biocoenosis of photophilic algae is well developed on all the rocks and rock-slides all round the study area down to 10 m depth.

Precoralline aspect of coralline biocoenosis occupies the sites with reduced light, either in the fissures of vertical rocks or on the bottom sides of bigger stone blocks.

The biocoenosis of *Posidonia oceanica* (L.) DEL** meadows is developed throughout the area at depths of 10 (t.4) or 20 (t. 1, 2, 3) to greater depths (exceeding 50 m).

The coralline biocoenosis is well developed at transects 1, 2, and 3 whereas it is considerably poorer at transect 4. Only one type of this biocoenosis is well developed, the so called lower horizon of littoral rocks, abundant between 20-25 and 45-50 m. The other type of this biocoenosis, the so called coralline plateau occurs as small enclaves of biogenically fixed substrate in areas of sandy-detritic bottoms.

The biocoenosis of coastal detritic bottoms is developed at transects 1, 2, 3, and 4. This biocoenosis forms an almost uninterrupted belt between the 25 and 65 m isobaths. It is best developed at transect 4, 26 m depth (sandy-shelly bottom).

The biocoenosis of coastal terrigeneous muds stretches between 65 and 85 m depth.

* t = transect

** The name of an author for a species is given only when mentioned in the text for the first time

The biocoenosis of detritic bottoms of the open sea is developed throughout the area between the 80 and 100 m isobaths. The facies of *Ostrea cochlear* POLI is well developed at station 1 (Fig. 1). It dominates in number and weight all over the area. Apart from a large quantity of dead shells live collonies were also found.

Split area

Study was carried out along a part of the coast stretching from Stobreč, east from Split to the pleasure yacht port "Split" on the northern shore of the Marjan Peninsula (Fig. 2) on three occasions in the 1973-1974. A total of 19 transects were examined, three of which were longer (covering both hard and mobile bottoms from the surface down to 40 m depth). Other transects were shorter, not going deeper than 4-5 m and covered rocky shore with shallower mobile bottom.

For the most part the coast was rocky. It frequently descends steeply to 3-4 m depth extending further as plain bottom descending slightly and gradually to greater depths. Next to steep rocky shore bottom is frequently covered by bigger or smaller stone blocks and stones. At localities where the coast descends at a smaller angle the bottom is covered by gravel and at the surface by pebbles and gravel (t. 3, 10). Submarine low rocks occur at such bottoms. They, as a rule, run parallel to the coast or diverge in different directions from individual promontories. Somewhat off the rocky shore the bottom slope is less and covered by sandy-gravelly sediment and by sand and mud at greater depths. Now and then wide and relatively low rocks and bigger stones, covered partly by different sediment types, rise from the bottom.

Biocoenological examinations recorded 11 biocoenoses and their aspects:

The biocoenosis of supralittoral rocks well developed on the rocky shore throughout the area. It is considerably better developed at south exposed shore where it reaches 3 to 4 m height (t. 4, 6, 9) than at sheltered shores of Marjan Peninsula, where it does not exceed 70 cm height. Settlements of lytophilic cyanophiceae, looking like a lighter or darker coloured belts, make the basic component of this biocoenosis.

The biocoenosis of upper and lower mediolittoral rocks. Both biocoenoses are well developed throughout the study area. The depth of mediolittoral is about 50 cm, the slope of the shore varying at angles between 20^0 and 90^0.

The biocoenosis of photophilic algae is better developed at more eastern transects (t. 3, 4, 5, 6, 7) than at western transects where it is much poorer.

Precoralline aspect of coralline biocoenosis occurs in the shaded rock fissures or on the bottom side of bigger stone blocks at somewhat greater depths.

The biocoenosis of *Cymodocea nodosa* (UCRIA) ASCH. and *Zostera noltii* meadows. The *C. nodosa* meadows inhabit shallower areas of mobile sandy bottoms. At some transects (t. 2, 3, 6, 17, 18, 19) it is in spots replaced by *Z. noltii* which is, however, considerably thinner and more poorly developed.

The biocoenosis of *Posidonia oceanica* meadows. Meadows of *Cymodocea nodosa and Zostera noltii* are after a break and at greater depths (most frequently from 5-6 m deeper) succeeded by *Posidonia oceanica* which forms abundant dense settlements.

The biocoenosis of muddy sands developed between 15 and 30 m inserting itself between the marine phanerogams biocoenosis and biocoenosis of coastal terrigeneous muds.

The biocoenosis of coastal terrigeneous muds is distributed in deeper waters in front of Split (t. 8, 9, 13) and on the trawling grounds at stations 2 and 3 (Fig. 2).

Enclaves of coralline biocoenosis (coralline plateau) occur as small biogenically fixed substrate in areas of mobile bottom and slightly greater depths.

Šibenik area

Parts of the coast of Šibenik Channel and Šibenik Bay were studied (Fig. 3) including rocky shores, gravelly-sandy and sandy-muddy bottoms at greater depths.

Three transects were set in Šibenik Channel, extending north-southwardly from the mainland coast towards the islands Zlarin and Drvenik. Transect 1 was set to stretch from Grmine cape to Plovište cape on the Zlarin Island. Coast of Grmine cape is low and rocky. It descends down to 3-4 m depth stretching further as mobile gravelly and thereupon sandy bottom going gradually down to 43 m depth. Rocky shore on the Zlarin Island descends down to 8-9 m, and in less steep spots it is covered with gravelly-sandy sediment which becomes sandy-muddy at greater depths. Transect 2 stretches from Ražine to the middle of Šibenik Channel and further in the direction between the islands Zlarin and Drvenik towards the greater depths (69 m). The study covered also southeastern (outer) part of Zlarin coast which descends into the sea rather steeply down to 7-8 m thereupon being far less steep and covered by smaller stone blocks and stones. Bottom is sandy at depths of about 28-30 m and sandy-muddy at 40 to 60 m. Transect 3 is shallowest stretching from the land accross the Kraplun shoal to Drvenik Island. Northern Drvenik shore is rocky sloping gently to 5-6 m stretching further as rather flat gravelly-sandy or sandy bottom down to 20 m depth.

Studies were carried out at four transects in Šibenik Bay. Transect I stretches from the eastern cape of the Vrulja cove to the opposite side. The coast is rocky gently sloping down to 6-7 m, bottom is mainly sandy already at 9-10 m and therefrom sandy-muddy. Transect II was set from the cape of the Panikovac cove towards the Kulina cape. The coast is rocky and stony sloping obliquely to 5-6 m, becoming more flat from that depth deeper and covered by shelly and gravelly sediment. Bottom is sandy at 10-11 m and sandy-muddy at 15-20 m. Transect III stretches along the central axis of the port from the lighthouse on the Južni Turan cape to the town waterfront. Rocky shore is oblique descending to greater depth. At almost all the sites where the coast is not steep it is covered by bigger or smaller stone blocks and stones, and shelly and gravelly sediment respectively. The bottom is gravelly-sandy with the shelly ingredients at slightly greater depths (30-35 m) and sandy-muddy at 40 m. Waterfront in the town port was built on hard stony bottom covered by shells and descends to 20 m depth stretching further to rather flat sandy and sandy-muddy substrate towards the middle of the town port. The transect IV is set southeastern from the bridge and stretches from the small cove Nova Pošta on the southwestern coast to the opposite northeastern coast. The greatest depth of the transect was 34 m. Rocky, steep, in spots covered by bigger or smaller stones, the southwestern coast descends down to 20 m and there becomes more flat sandy or sandy-muddy bottom. Northeastern rocky shore rather steeply descends down to 8-9 m extending as slightly less steep bottom covered by bigger or smaller stone blocks, stones and shells. The bottom is sandy-muddy between 30 and 40 m.

Samplings were performed repeatedly and included summer (1973) and winter (1974) aspects of benthic biocoenoses.

These two study areas may be clearly distinguished as to their ecological properties. Apart from being much more closed and sheltered, Šibenik Bay is strongly affected by freshwater of the Krka River discharge. On the contrary, Šibenik Channel, as a more open basin, is strongly affected by clean water of the open, middle Adriatic. So such different ecological properties caused the formation and development of individual biocoenoses.

A total of 10 biocoenoses and their aspects were established:

The biocoenosis of supralittoral rocks is well developed in the island area of Šibenik Channel at transects 1, 2, and 3 and particularly well on the southeastern coast of Zlarin Island. On the contrary, in Šibenik Bay where the wave exposure and power are weaker this biocoenosis is considerably less developed.

The biocoenosis of upper and lower mediolittoral rocks. The depth of mediolittoral is about 50 cm, the slope of the shore varies at angles between 300 and 900. Angle of inclination of the coast is lowest, 10 to 15° at transects 2 and 3. Both biocoenoses are much better developed in the Šibenik Channel, particularly between the islands (Zlarin and Drvenik) where all characteristic plant and animal species are present, which was not recorded from Šibenik Bay.

The biocoenosis of photophilic algae. The settlements of species of genus *Cystoseira* are developed throughout the study area. All transects showed regular occurrence of the species: *Cystoseira adriatica* SAUV., *Cystoseira ercegovicii* GIACC. *f. latiramosa* (ERCEG.) GIACC., *Cystoseira compressa* (ESPER.) GERLOFF et NIZAMUDIN, *Cystoseira corniculata ssp. laxior* ERCEG., whereas *Cystoseira stricta* (MONT.) SAUV. *v. spicata* (ERCEG.) GIACC. and *Cystoseira crinita* (DESF.) BORY developed at wave exposed shores and *Cystoseira barbata* (GOOD et WOODW)C.AG. and *Cystoseira crinytophylla* ERCEG. at somewhat calmer localities. In Šibenik Bay this biocoenosis has been considerably changed. So, of the cistosiras only *Cystoseira barbata* was found at the surface at transect IV and rare specimens of *Cystoseira adriatica ssp.compressa* (ERCEG.) GIACC. at transect I.

Precoralline aspect of coralline biocoenosis occurs in the shaded microbiotopes (rock fissures and depressions) or on the bottom side of bigger stone blocks at somewhat greater depths. Of algae: *Halimeda tuna* (ELL. et SOL.) LAM., *Udotea petiolata* (TURRA) BÖRG., *Peyssonnelia squamaria* (GMEL.) DEC., *Peyssonnelia rubra* (GREV.) J.AG. were dominant and *Petrosia ficiformis* POIRET of the animals. Such biotopes were found particularly between the islands of the Šibenik Channel (t. 1, 2, 3) being considerably rarer in Šibenik Bay.

The biocoenosis of *Cymodocea nodosa* meadows inhabits shallower areas (down to 15 m) of rather flat sandy bottoms. It is very frequent and occupies very large areas of shallow bottoms. It was absent from Šibenik Bay.

The biocoenosis of *Posidonia oceanica* meadows comes in succession of the *Cymodocea nodosa* meadows from 10-15 m deeper. It occupies rather large areas of mobile bottom of Šibenik Channel along the southeastern coast of the Zlarin Island.

The biocoenosis of coastal detritic bottoms is well developed in front of southeastern coast of Zlarin island at 40-50 m depth at station 4 (Fig. 3).

The biocoenosis of detritic, more or less muddy bottoms is developed throughout the study area of Šibenik Bay between 25 and 40 m. It was recorded from about 40 m depth in Šibenik Channel. It is there characterised by the presence of sponges and echinoderms. At depths exceeding 40 m the bottom is more muddy and the species *Stichopus regalis* (CUV.) and *Turritella communis* RISSO, normally characteristic for the biocoenosis of terrigeneous muds.

Enclaves of coralline biocoenosis (coralline plateau) form small islets of biogenically fixed substrate in the biocoenosis of coastal detritic bottoms and the biocoenosis of detritic, more or less muddy bottoms of Šibenik Channel (t. 1 and 2) and Šibenik Bay (t. III and IV). Limestone algae of the genera *Lithothamnium* and *Pseudolithophyllum,* characteristic of these enclaves, are rather rare and poorly developed due to intensive settling. Substrate is bor-

dered mainly by the species such as *Petrosia ficiformis, Axinella damicornis* (ESPER.), *Porella cervicornis* (PALL.) and *Halocynthia papillosa* L. along with the species *Vidalia volubilis* (L.)J. AG., *Halimeda tuna* and *Peysonnelia squamaria.* The occurrence of the enclave of a "clean" coralline biocoenosis in Šibenik Bay or, to be more precise, at 20-40 m in the town port (t. III) appears paradoxal. However, the development of these enclaves may be accounted for by the inflow of clean sea waters through the channel Sv. Ante diffused throughout Šibenik Bay and further to the lake Prokljansko jezero, providing favourable conditions for the development of some biocoenoses in deeper layers which could live only in the clean waters.

Biograd area

The area was sampled along four transects set along a part of the coast from Drage and Filip Jakov (Fig. 4) on four occassions in 1977. Transect 1 (Drage) is set in an offshore direction from Žakan cove northeastern down to 30 m depth. Transect 2 (Pakoštane) starts from the coast at Pakoštane towards the islet Bubuljaš down to 20 m depth in the northeast-southwest direction. Transect 3 (Biograd) goes from the Biograd town breakwater to the eastern part of the islet Sv. Katarina down to 11 m depth on the southern side of the islet in the northwest-southeast direction. Transect 4 (Filip Jakov) stretches from the coast west of Filip Jakov to the greatest depth of 11 m on the southern side of the islet Babac in northeast-southwest direction. The coast along all the transects is rocky and slightly sloping continuing at already the small depths as gravelly-sandy bottom interrupted at spots by smaller submarine rocks protruding from mobile gravelly bottom.

Seven biocoenosis and their aspects were recorded:

The biocoenosis of supralittoral rocks occurred at all the transects but differently developed. On low and flat rocky parts of the coast it is not well developed since the rocks do not overtop much the sea level so that the belt of this biocoenosis does not exceed 20-30 cm (t. 2 and 4).

The biocoenosis of upper and lower mediolittoral rocks is developed on all the transects, but considerably better at transects 1 and 3 than at the transects 2 and 4 where the coast gently discends into the sea.

The biocoenosis of photophilic algae is developed on rocky and stony parts of the bottom of almost all the transects, even though not evenly aboundant. It is most abundant at transects 1 and 4 where the settlements of the species of genus *Cystoseira (Cystoseira barbata, Cystoseira corniculata* HAUCK, *Cystoseira adriatica, Cystoseira ercegovicii*) provide the basis for the development of this biocoenosis. A number of plant species: *Padina pavonia* (L.) *GAIL., Dictyota dichotoma* (HUDS.) LAM, *Halopteris scoparia* (L.) SAUV. and *Laurencia obtusa* (HUDS.)LAM. are also present there.

The biocoenosis of coarse sands and fine gravel, affected by bottom currents is developed on mobile bottoms down to maximum 10-12 m at transects 3 and 4.

The biocoenosis of *Posidonia oceanica* is developed on mobile bottoms of 4 - 11 m depth on transects 3 and 4. Smaller patches occur already at 5-6 m. *Pinna nobilis* L. forms whole fields at individual spots of this biocoenosis. This biocoenosis is most frequently developed between the biocoenosis of coarse sands and fine gravels and the biocenosis of coastal detritic bottoms around the islet Babac near Filip Jakov, Sv. Katarina near Biograd and Babuljaš near Pakoštane.

The biocoenosis of coastal detritic bottoms is well developed on mobile bottoms at depths exceeding 10 m. It is better developed on transects 1 and 2 than on 3 and 4 where due to small depths it occurs mixed with the meadows

of *Posidonia oceanica* and the biocoenosis of coarse sands and fine gravels affected by bottom currents.

Zadar area

The study covered a part of the coast in the vicinity of Zadar, from Foša to Kolovare promontory and deeper bottom in Zadar Channel (Fig. 6). Three transects were set in this area, sampled on two occasions in 1976.

The transect 1 stretches from Foša to the Ošljak islet with the greatest depth of about 40 m. Scattered stone blocks on mobile gravelly-sandy bottoms reach 5 m depth. Therefrom less steep mobile bottom gradually descends to greater depths (40 m) in Zadar Channel. Mobile bottom is interrupted in places by bigger or smaller rocks protruding from sand sediments and covered partly by sand. At depths exceeding 27 m bottom is mainly muddy to become predominantly muddy at depth below 30 m. The transect 2 starts from the shore below Arbanasi towards the shore of Ugljan Island between the Rahovača promontory and Otrić promontory. Its greatest depth is 36 m. Mainly marly layers form the coast which slopes vertically down to the sea level and therefrom marly plateaus descend gently to 8-9 m. Smaller stone blocks and rocks occur at the very surface of which some stick out of the sea. Detritic sediment fills the depressions between slab-like rocks between 1 and 8-9 m. Original detritic bottom, with rare smaller and bigger scattered rocks and stones emerging from the mobile bottoms occur below the 10 m isobath and continues down to 25-30 m. A wider belt of low table-like rocks is encountered between 18 and 20 m. Down from the 30 m isobath the bottom is more and more muddy to be mostly muddy below 35 m. The transect 3 is set from the Kolovare promontory towards the eastern coast of the Oštrić promontory on the Ugljan Island, with 33 m greatest deptgh. The coast is rocky consisting of rocks reaching approximately 1 m depth. They run in several parallel series where shallow sheltered pools are formed in constant contact with the seawater. In the area of rocks flatter stone bottom is formed stretching down to 5-6 m depths and followed deeper to 9-10 m by mostly detritic bottom with scatterred stone blocks. The bottom therefrom passes to flatter and finer detritic bed wherefrom rare, low, table-like rocks partly covered by sandy sediment emerge. Around 25-30 m the bottom becomes more and more muddy to be markely muddy at depths ecxceeding 30 m. Trawls were hauled at 33 m depth from the Gaženica cove to Bibinje (station 5, Fig. 6) and at 40 m from the promontory Oštri Rat to the Skala promontory (station 7, Fig. 6).

A total of seven biocoenoses and their aspects were recorded:

The biocoenosis of supralittoral rocks was recorded from all the transects and it is relatively well developed. Of plant species lithophilic cyanophiceae are well developed.

The biocoenosis of upper and lower mediolittoral rocks is well developed on all the transects. Characteristic animal species: *Chthamalus stellatus* (POLI), *Middendorphia caprearum* (SCACCHI), *Patella sapera* LAM. and *Mondonta turbinata* (BORN) are relatively well represented at all the transects. Limestone algae *Lithophyllum incrustans* PHIL. and *Phymatholython lenormandii* (ARESCH.) FOSL. occur only at transects 1 and 3. The presence of alga *Ulva rigida* C. AG. and the shellfish *Mytilus galloprovincialis* LAM. at all the transects is indicative of slightly higher eutrophication of water or the impact of town effluents.

The biocoenosis of photophilic algae is best developed on a part of infralittoral where the settlements of genus *Cystoseira* are developed. It is poorest at transect 1 where *Cystoseira compressa* may mainly be found. *Cystoseira* settlemets are rather well developed at transects 2 and 3. Best represented species are: *Cystoseira barbata, Cystoseira compressa,*

Cystoseira ercegoviccii, Cystoseira corniculata HAUCK. Of animal species: *Paracentrotus lividus* LAM.,*Arbacia lixula* (L.), *Echinaster sepositus* GRAY, *Verongia aerophorba* (SCHM.), *Spongia officinalis* L. and gastropods *Pastella caerulea* L. and *Gourmya vulgata* (BRUG.). The biocoenosis of phtophillic algae is well devloped at 20-30 m depth, as well. Of genus *Cystoseira* the frequent species are: *Cystoseira adriatica, Cystoseira adriatica* ssp. *compressa, Cystoseira corniculata* ssp. *laxior, Cystoseira ercegovicii* ssp., *latyramosa,* and of animal species *Echinaster sepositus, Sphaerechinus granularis* LAM., *Spongia officinalis.*

The biocoenosis of meadows of *Cymodocea nodosa* occurs between 5 and 10 m on sandy bottoms. It was not recorded from transect 1. It is not abundant in the study area although it covers rather large areas of the sea bed.

The biocoenosis of *Posidonia oceanica* meadows is distributed all over the study area between approximately 10 and 20 (25) m. It may occur shallower or deeper but forming only small patches. This biocoenosis stretches over rather large areas of mostly detritic bottoms in Zadar Channel and is characterised by high biomass.

Precoralline aspect of coralline biocoenosis occurs on the shaded smaller or bigger stone blocks and rocks. It is characterised and dominated by the noncalcified algae: *Halimeda tuna, Udotea petiolata, Peyssonnelia squamaria, Cystoseira ercegovicii* ssp. *latiramosa.* Of animal species: *Schizobrachiella sanguinea* (NORMAN) and *Chondrilla nucula* SCHM. are well represented.

The biocoenosis of coastal detritic bottoms is well developed at depths from approximatelly 20 to 30 m covering larger part of the Zadar Channel. Apart from algae *Rytiphloea tinctoria* (CLEM.)C.AG. and *Rhodymenia ardissonei* (ARDISS.)FELDM. the animal species are also frequent: *Chlamys varia* (L.), *Pitar rude* (POLI), *Ditrupa arietina* (O.F. MÜLLER), *Astropecten irregularis* (LINCK) and *Anseropoda placenta* (LINCK).

The biocoenosis of coastal terrigeneous muds is developed at muddy bottom the depth of which exceeds 30 m. It is rather poor in abundance since the depths in Zadar Channel are not great enough to allow its better development.

The area of Vir Island

Prosobranchiata were studied in plant and animal settlements of a total of 12 transects (Fig. 5). In October 1974 the transects 1,2,5,7 and 8 were sampled for analyses and in August and September 1975 and in January, May, July and September 1976 the transects 1, 3, 4, 5, 7, 8, 9. 10, 11 and 12. In this way all four seasonal aspects of biocoenoses were examined in the course of two years. Thus a rather complete image of the distribution of Prosobranchiata in individual biocoenoses was obtained for the wider area of Vir Island.

The shores of the area around Vir (t. 6, 7, 8, 9, 10 and 11), Pag Island (t. 1 and 2, west and east from the Fortica promontory (Jasenovo Peninsula (t. 3) and Kulina promontory near Privlaka (t. 4) are mostly rocky, sloping gently to become soon a mobile sandy bottom (t. 5, 6, 7, 8, 9, 10, 11). Rocky shores rarely slope steeply to form oblique stone substrate favourable for the development of algal settlements (t.1). It is on the other hand mainly gravelly criss-crossed by rare and smaller rocks (t.4). The northern coast of Vir Island, Jasenovo Peninsula and Kulina promontory are exposed to strong bora, and its southern shores to southeastern wind. These circumstances affected adversely the development of, particularly, surface biocoenoses of hard substrate. However, soft bottom biocoenoses are well devloped, partucularly the biocoenoses of marine phanerogams and biocoenoses of deep detritic and muddy bottoms.

A total of 12 biocoenoses and their aspects were recorded:

The biocoenosis of supralittoral rocks was recorded from all the transects, being far better developed on transects where rocky shores descend steeply into the sea (t. 1,3,5,7). litophillic cyanophiceae, forming wider or narrower belts of light to dark grey colour are the basic component of this biocoenosis. This belt is best developed at transects 3, 6 and 7 where it in places reaches 1 m above the sea level. It is much poorer on shallow rocky shores (t. 8,9, 10 and 11) where it never exceeds 0.5 m. Characteristic representatives of the animal component are regularly present on all the trasects, better represented on the transects 1, 2, 3, 4, 5, 7, than at transects 6, 8, 9, 10 and 11.

Mediolittoral is occupied by the biocoenosis of mediolittoral rocks developed in two horizons. Characteristic plant and animal species are considerably better represented at transects 1, 2, 3, 5, 6, 7, 9, and 10 than at transects 4, 8 and 11.

The biocoenosis of photophilic algae is characterised by the differences in the level of development. This distinction is particulyrly evident in the uppermost part of infralittoral between the transects on the northern side of Vir Island (t. 5, 6), Jasenovo Peninsula and Kulina promontory (t. 3 and 4) and those on the southern side of the island (t. 7,8,9,10,11) and near the strait Ljubačka vrata (t. 1 and 2) where it is well developed. From surface to 3-4 m at transects 3, 4 and 6 the rocks are quite bare lacking the algae of genus *Cystoseira* and all the accompanying species. Rocky shores with no algal covering are full of the specimens of sea urchins (*Arbacia lixula*) and the sponge *Verongia aerophoba* is rather frequent. The settlements of photophillic algae occur on low rocks emerging from detritic bottom. The species *Cystoseira ercegovicii, Cystoseira corniculata* ssp. *laxior* and *Sargassum salicifolium* J.AG., *Dasycladus vermicularis* were dominant as well as a number of other algae and animals.

Precoralline aspect of coralline biocoenosis occurs as smaller enclaves highly reduced in species composition. They may be found on the shaded surfaces and bottom sides of vertical rocks and blocks.

The biocoenosis of *Cymodocea nodosa* meadows is developed on mobile bottoms of all studied transects. It occurs between 2 and 3 m, in places at depths below 1 m and can even reach 11-12(15) m, covering larger areas of detrititic-sandy bottoms. The species: *Pinna nobilis* and *Cerianthus membranaceus* (SPALL.) are rather frequent.

The biocoenosis of *Posidonia oceanica* meadows stretches from approximately 15 m depth, smaller patches occurring at already 2 - 3 m, down to 25 - 30 m. It mainly comes in succession of the biocoenosis of *Cymodocea nodosa* meadows. It covers large areas of detritic bottom at almost all studied transects around Vir Island.

The biocoenosis of fine uniform sands was recorded from transect 4, where it occupies a larger area (between 2 and 6 m). Shellfish species: *Glycimeris glycimeris* (L.), *Rudicardium tuberculatum* (L.), *Gourmyra vulgata* and *Truncullariopsis trunculus* (L.) are dominant there.

The biocoenosis of coastal detritic bottoms is distributed down to 50 m depth covering rather large areas of deeper detritic bottoms of Vir Island.

The biocoenosis of detritic, more or less muddy bottoms is particularly well developed between 50 and 60 m at transects 6,10 and 11 and dominated by the species *Vidalia volubilis*. It was recorded from 40 m depth at transects 7 and 9 and from 15 m at transect 1.

The biocoenosis of muddy bottoms of the open sea comes in succession of the biocoenosis of detritic bottoms inhabiting muddy bottoms at depths exceeding 60 m (stations 7 and 8, Fig. 5).

The biocoenosis of coastal terrigeneous muds is developed at station 9 (Fig. 5) at 45 m depth. Of characteristic species of this biocoenosis the following were recorded: *Sternaspis scutata* (RENIER), *Turritella communis, Trachythyone tergestina* (SARS), *Trachythyone elongata* DÜB. et KOR.

The area of Krk Island

The studies covered the western part of Krk Island from the islet Sv. Marko to the Glavotok promontory in the south. Ten transects set in that area (Fig. 7) were sampled on two occasions in 1976.

Studied shores of Krk Island are mainly rocky, most frequently gently sloping and soon becoming mobile sandy bottom (t. 1, 2, 4, 5, 8, 10). Rocky shores descend steeply into the sea only at places forming slightly larger oblique rocky substrate favourable for the development of algal settlements (t. 6,7 and 9).

A total of 12 biocoenoses and their aspects were recorded:

The biocoenosis of supralittoral rocks is distributed on all the transects and better developed on wave exposed rocks (t, 1, 2, 3, 5, 6, 7, 8, 9, 10) than at sheltered and shallower parts of the shore (t.4,6).

The biocoenosi of upper and lower mediolittoral rocks is well developed throughout the study area of the western Krk Island coast. Most of characteristic animal species are well represented at all the transects. Of characteristic calcareous algae *Phymatolithon lenormandi* is present oat all the transects, whereas *Lithophyllum incrustans* was found on trasnects 1, 3,5,8 and 9 whereas *Lythophyllum tortuosum* (ESPER) FOSLIE was recorded only from trasnects 8 and 9.

The biocoenosis of photophilic algae. The settlements of principal elements of this biocoenosis - the species of genus *Cystoseira* are well developed on the rocky bottoms of upper infralittoral of Krk Island. The biocoenoses are accompanied by well represented and numerous other plant and animal species. With respect to different ecological conditions at different transects, *Cystoseira stricta* v. *spicata* is developed on wave exposed shores (t. 5,7,9). On the contrary *Cystoseira adriatica* was encountered at less wave exposed transects and on different depths.

Precoralline aspect of coralline biocoenosis. Since this area is rather shallow this aspect is not so developed as in some areas of the middle and southern Adriatic. Of algae: *Halimeda tuna, Udotea petiolata, Peyssonnelia squamaria* and *Peyssonnelia rubra* were present as well as animal species *Schizobrachiella sanguinea, Chondrilla nucula, Petrosia ficiformis.*

The biocoenosis of fine uniform sands and the biocoenosis of coarse sands and fine gravel are distributed all along the western Krk Island coast, from Sv. Marko islet to the Glavotok promontory. They mainly occur at small depths, between 3 and 10 m indicative of cotinuous water mass exchange. These biocoenoses developed in hardly few centimetre thick layer of pure, at places coarse sand settled on compact rocky substrate at transects 1 through 4 and 10.

The biocoenosis of *Cymodocea nodosa* meadows is developed all along the western coast of Krk Island. It occurs at several meters depths, partly inhabiting the parts of fine uniform sands biocoenosis. It is dominant between 10 and 15 m depth occurring as a continuous belt all along the western Krk coast.

The biocoenosis of coastal detritic bottoms. Its typical form occurs between 15 and 20 m. Shallower than that it mixes with the biocoenosis of *Cymodocea nodosa* meadows and deeper with the biocoenosis of detritic, more or less muddy bottoms.

The biocoenosis of detritic, more or less muddy bottoms is developed between 20 and 30

m inserted between the biocoenosis of coastal detritic bottoms and coastal terrigeneous muds.

The biocoenosis of coastal terrigeneous muds cover large surfaces of the study area at depth below 30 m.

Coralline biocoenosis developed on vertical cliffs of the transect 9. Of incrusted red algae the species *Pseudolithophyllum expansum* (PHIL.) LEM, *Peyssonnelia squamaria, Phymatolithon calcareum* (PALL.) ADEY & KIBBIN were recorded and of animal species: *Axinella damicornis, Axinella canabina* (ESPER), *Porella cervicornis, Myriapora truncata* (PALL.), *Halocynthia papillosa, Eunicella singularis* (ESPER) were frequent. The presence and the extent of the development of this biocoenosis is indicative of the purity and considerable bottom water mass dynamics with minimum sedimentation in this locality.

Individual records of gastropods not a part of term investigations

Koločep Island (Fig. 1)

- Northwestern side (July 18, 1972; 45-50 m depth, lithotamnium bottom). Coralline biocoenosis.

Makarska (Fig. 11)

- Western entrance to the port (15 July, 1977; 24 August, 1977). Rocky coast stepply descends down to 15 m depth of the sea, gradually being transformed into a mobile substrate. Frequent algae between 7 and 10 m are: *Cysoseira corniculata* ssp. *laxior, Dictyota linearis* (C. AG.) GREV, *Halimeda tuna, Udotea petiolata, Padina pavonia* and frequent animal species: *Flustra securifrons* (PALL.), *Hippospongia communis* (LAM.), *Chondrilla nucula.* The biocoenosis of photophilic algae is well developed in photophilic part, whereas precoralline aspect of coralline biocoenosis occurs in the scyaphilic part. The species *Vidalia volubilis* dominates deeper than 30 m.

- The fissure near the village Bratuš (24 August, 1977; 20 July 1986; 1 August 1986; depth: 0 - 12 m: bottom: vertical rocky). Precoralline aspect of coralline biocoenosis occurs at alraedy 0.5 m depth in shaded parts of the coast.

Kaštela Bay (Fig. 2)

- Marjan shoal (7 June, 1974; 3 March, 1975; depth: 12 m; bottom rocky with the islets of sandy bottom. Of animal species *Verongia aerophoba* and *Cladocora cespitosa* were frequent. Plant species were well represented on mobile bottom: *Peyssonnelia polymorpha* (ZANARD.) SCHMITZ and *Lithophyllum racemus* (LAM.) FOSL. The biocoenosis of photophilic algae and the biocoenosis of coastal detritic bottoms were present.

- The area around the reef between Slatine and Arbanija (depth; 15 m; bottom: coarse sand; submarine freshwater springs; the biocoenosis of coarse sand and fine gravels affected by bottom currents). The fauna of the bottom : *Clausinella fasciata* (DA COSTA), *Pitar rude, Corbula gibba* (OLIVI), *Nucula nucleus* (L.), *Cardium* sp., *Tellina* sp., *Laevicardium oblongum* (CHEMNITZ), *Pecten jacobeaeus* (L.), *Modiolus barbatus* (L.), *Calyptraea chinensis* L., *Arhimediella triplicata* (BROCCHI), *Dentalium* sp., *Cladocora cespitosa, Holothuria tubulosa* GMELIN, *Ocnus planci, Astropecten irregularis, Psammechinus microtuberculatus* (BLAINV.), *Sphaerechinus granularis* LAM., *Phallusia mammilata* (CUV.), *Microcosmus sulcatus, Branchiostoma lanceolatum* (PALL.).

Zadar Channel (Fig. 6)

- Sajda shoal (13 August 1974; depth: 7 m; bottom: coarse sand and stone pebbles). Of

algae *Sargassum salicifolium* was dominant. The biocoenosis of coarse sands and fine gravel wave exposed.

Prokljan Lake (Fig. 3)

- Vukinac promontory towards the Sv. Mihovil promontory (8 August, 1973; depth 10-20 m; bottom: rocky-sandy-muddy). At 10 m bottom is completely covered by a dense "carpet" of the species: *Valonia macrophysa* KUTZ., at primarily rocky bottom and *Phyllophora nervosa* (DE CAUD.) GREV. on mobile bottom. At 20 m, the species *Rhodymenia ligulata* ZANARD. covers all the bottom through. Precoralline aspect of coralline biocoenosis and biocoenosis of photophilic algae.

Pelješac (Fig. 12)

- Bay of Mali Ston: Čeljen promontory (Usko): 1980, 1981. Rocky shores descend to 20 m at an angle of 30-35^0. They are covered by a thin sediment layer with bigger stone blocks in spots. Sandy-muddy sediment covers the bottom at 20-22 m which is the greatest depth of this area. Submarine freshwater springs reduce salinity of the entire area (mean salinity was 35.27‰ in 1980-1981). Water is very opaque what reduces transparency (mean Secchi disc transparency was 6.14 in 1981) and light penetration (>1% at the bottom throughout the area). The collonies of the species: *Lophogorgia ceratophyta* (L.) and *Paramuricea clavata* (RISSO).The following species are also numerous in this habitat: *Cerianthus membranaceus, Arca noae, Paracentrosus lividus, Halocynthia papillosa, Microcosmus sulcatus.* The shellfish *Pteria hirundo* (L.) is frequent on the branches of the collonies *Lophogorgia ceratophyta* and *Paramuricea clavata.* The biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis, an enclave of coralline biocoenosis and the biocoenosis of detritic more or less muddy bottoms are developed in this area.

Island Unije (Fig. 8)

-The cove near the small town of Unije (8 August, 1977). The bottom is sandy, depth 17 m. Biocoenosis of coastal detritic bottoms.

Island Sestrunj (Fig. 6)

- Opposite of the islet Tri sestrice (4 August, 1976; depth 0-30 m). Rocky coast descends steeply down to 2 m depth. The frequent algae are: *Dictyota dichotoma, Padina pavonia, Laurencia obtusa, Jania rubens* (L.) LAMOUR, *Cystoseira compressa, Phymatholithon lenormandi, Pseudolithophyllum expansum, Halimeda tuna,* and frequent animal species: *Arca noae, Arbacia lixula, Chondrilla nucula, Ircinia oros* (SCHM.), *Hippospongia communis.*

- Rocky bottom slopes very slightly between 2 and 4 m depth with stone piles of 1 to 1.5 m height and stones. *Padina pavonia, Laurencia obtusa, Dictyota dichotoma, Cystoseira adriatica, Phymatolithon lenormandi, Halimeda tuna, Peyssonnelia squamaria* are frequent algae and *Verongia aerophoba, Chondrilla nucula, Arbacia lixula, Arca noae, Barbatia barbata* L. are frequent animal species.

Going deeper, between 4 and 8 m, the bottom is still rocky, slightly sloping with stone piles and stones. Frequent algal species are: *Padina pavonia, Laurencia obtusa, Cystoseira adriatica, Cystoseira corniculata, Peyssonnelia polymorpha, Pseudolithophillum expansum, Udotea petiolata* and frequent animal species are: *Chondrilla nucula, Myriapora truncata, Porella cervicornis, Eunicella cavolini* (KOCH). The biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis are developed in this area. *Posidonia oceanica* occurs from 4 m in fissures and recesses of rocks filled with sediment. Bottom is sandy between 10 and 13 m, with the species *Posidonia oceanica.*

Islands Rivanj and Ugljan (Fig. 6)

-Veli Ždrelac (17 August, 1974; depth: 8 m). Sandy bottom with *Posidonia oceanica.*

Island Silba (Fig. 9)

- In the vicinity of the small town of Silba, Pocukmarak promontory (5 August, 1976). Rocky substrate with stone piles (up to 1 m high) and stones slightly slopes between the surface and 8 m depth. The species *Cystoseira barbata* and *Cystoseira adriatica* cover more than 80% of the surface down to 2.5 m depth.

The species: *Laurencia obtusa, Padina pavonia, Dictyota dichotoma, Chladophora* sp. (dominant), *Cystoseira adriatica, Wrangelia penicillata* C.AG. (SCHM.), *Lithothamnium fruticulosum* (KÜTZ.) FOSLIE, *Halimeda tuna, Udotea petiolata, Peyssonnelia squamaria, Peyssonnelia polimorpha, Arbacia lixula, Sphaerechinus granularis, Cladocora cespitosa, Chondrilla nucula, Petrosia ficiformis* are frequent between 2.5 and 8 m depth (the biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis). At depths exceeding 8 m stone piles are flatter and low. Sandy component with *Posidonia oceanica* extends with depth in relation to hard bottom. The patches of the species *Posidonia oceanica* occurs at 5 m depth already in the fissures of rocks filled with sedinment. Hard bottom between 10 and 20 m is dominated by *Cystoseira ercegovicii.* Of the rest of algae: *Cystoseira corniculata, Laurencia obtusa, Jania rubens, Rytiphloea tinctoria, Udotea petiolata, Halimeda tuna, Sargassum salicifolium, Sargassum hornschuchii* may be also found (the biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis). *Posidonia oceanica* dominates between 20 and 30 m. *Cystoseira adriatica, Cystosaeira corniculata, Cystoseira ercegovicii, Dictyota linearis, Sargassum hornschuchii* (dominance of the biocoenosis of meadows of *Posidonia oceanica*) may be recorded from rare hard substrate.

Island Olib (Fig. 9)

-In the vicinity of the cove South Slatina, Zubinin promontory (6 August, 1976). Both the bottom configuration and plant and animal species composition are very similar to those of Island Silba, Pocukmarak promontory.

Island Mljet (Fig. 13)

- Veliko jezero (15 June 1979; depth: 0-3 m: rocky-stony). The biocoenosis of photophilic algae. The "carpet" of algae, the basis of which is the alga *Valonia utricularis* (ROTH) C.AG. is particularly abundantly developed there. A large number of filamentous epyphitic forms are developed on this alga of which the species of genera: *Cladophora, Sphacelaria, Gelidiella, Griffithsia, Polysiphonia, Ceramium* and *Lophosiphonia* are dominant as well as the species of the groups of benthic diatoms and filamentous forms of cyanophiceae are dominant. It lies in the sheltered areas of the shores and is affected by intensive sedimentation. The species *Cystoseira adriatica* occurs at 6 m depth and covers by 100% the sandy bottom. Between 14 and 20 mobile bottom is covered by well represented algae: *Phymatolithon calcareum, Lithothamnium fruticulosum* and *Dasya baillouviana* (GMEL.) MONT. which is an epiphyte (particularly well developed) and for the most parts overgows these two lithothamnic algae.

Island Hvar (Fig. 14)

- Cliffs Lukavci (4 July, 1975; depth 54-62 m; bottom: lithothamnic). Coralline biocoenosis (coralline plateau). Of algae the species of genus *Lithothamnium* are dominant and followed in abundance by algal species *Peyssonnelia squamaria, Udotea petiolata, Halimeda tuna* and animal species: *Porella cervicornis, Myriapora truncata, Flustra securifrons* PALL., *Axinella damicornis, Frondipo-*

ra verrucosa (LAMOUR), *Eunicella singularis.*

- The outer side (promonotory) of the cove Pokrivenik (6 July, 1975; depth;0-20 m; coast configuration: slope of the coast beneath the sea from 30 to 35°. precoralline aspect of coralline biocoenosis is wonderfully developed between 10 and 20 m. Of animal species: *Acanthella acuta* (SCHM.), *Axinella polypoides* (SCHM.), *Spongia officinalis, Hippospongia communis, Petrosia ficiformis, Halocynthia papillosa, Eunicella cavolini, Porella cervicornis, Caryophyllia smithi* are frequent and of algae: *Halimeda tuna, Udotea petiolata, Cystoseira corniculata.* The biocoenosis of photophilic algae was found in photophilic part and in scyaphilic part the precoralline aspect of coralline biocoenosis, particularly well developed between 10 and 20 m depth.

- Cove Maslinica in the vicinity of Stari Grad (15July, 1972; depth: 15 m; bottom sandy; biocoenosis of coastal detritic bottoms)

- Shoal near Jerolim islets (7 July, 1975; depth: 11 m; bottom; rocky with patches of sand). *Peyssonnelia polymorpha* and *Posidonia oceanica* are developed on mobile bottom. The biocoenosis of photophilic algae, the biocoenosis of *Posidonia oceanica* meadows and the biocoenosis of detritic bottoms are present there.

- Outer part of the cove Stiniva (8 August, 1973, 5 July, 1975; depth:0-35 m; coast configuration: vertical cliff). From 15 m deeper coralline biocoenosis (lower horizon of littoral rocks) is well developed. The species: *Spongia officinalis, Eunicella singularis, Paramuricea clavata, Myriapora truncata, Sertella beaniana* (KING), *Porella cervicornis* are frequent and the species of genus *Axinella* of which *Axinella polypoides* is most numerous.

- The reef near the islet Zečevo (6 Julz, 1975; depth: 10-15 m; bottom: rocky). Of algae: *Cystoseira adriatica, Sargassum salicifolium* and *Sargassum hornschuchii* are frequent and of animal species: *Petrosia ficiformis, Chondrilla nucula, Caryophyllia smithi, Porella cervicornis, Myriapora truncata.* The biocoenosis of photophilic algae is well developed in photophilic part and precoralline aspect of coralline biocoenosis in the scyaphilic part.

- Zub od Zarače (7 July, 1975). Shore is rocky down to 10 m proceeding as as flat and rocky and with sand in places. The biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis are developed on rocky bottom and the biocoenosis of coastal detritic bottoms on mobile bottom.

Vis Island (Fig. 17)

- The cove in front of the rock Rogačić (8 July 1975; depth: 12-15 m; bottom: sandy: biocoenosis of coastal detritic bottoms).

- The area nera the cove Gradac (8 July 1975; depth: 70-85 m; bottom lithothamnic; coralline biocoenosis (coralline plateau). Of algae the species of genus *Lithothamnium* are dominant.

- The fissure near the cove Gradac (8 July 1975; depth: 0-15 m: coast configuration: the "pavement"* of 0.6 m width and then the vertical rock). Precoralline aspect of coralline biocoenosis is well developed already at 0.5 m depth. Of algal species four are dominant: *Pseudolitophyllum expansum, Halimeda tuna, Peyssonnelia rubra* and *Jania rubens* (L.) LAM., and of animal species: *Petrosia ficiformis, Hippospongia communis* and *Eunicella cavolini.* The biocoenosis of photophilic algae is well developed in photophilic part and pre-

* Some parts of the coast of the outer islandas has got developed the so called "pavement" the lower part of which is formed by *Litophyllum incrustans* and *Phymatolithon lenormandi* with *Lithophyllum tortuosum* coming at the surface in the form of tuber.

coralline aspect of coralline biocoenosis in the scyaphilic part.

-The fissure near the cove Smričevica (10 September, 1963; 10 July, 1975; depth: 0-15 m; coast configuration: "pavement" of 50 cm width and then the vertical rock. Precoralline aspect of coralline biocoenosis is well developed in the sheltered part from the surface itself. Dominant algae are: *Pseudolithophyllum expansum, Peyssonnelia rubra, Halimeda tuna, Padina pavonia, Dictyota linearis* (C. AG.) GREV, and dominant animal species are: *Eunicella cavolini, Porella cervicornis and Myriozoum truncatum.* The biocoenosis of photophilic algae is well developed in photophilic part and precoralline aspect of coralline biocoenosis in the scyaphilic part.

- Ploča shoal (9 July, 1975; depth 15 m; bottom: rocky - there is a reef in the area of sandy bottom). *Cystoseira corniculata* ssp. *laxior, Halimeda tuna, Udotea petiolata* are frequent algae with *Posidonia oceanica* occurring on mobile bottom. Animal species are: *Szchizobranchiella sanguinea, Porella cervicornis, Halocynthia papillosa* and *Myriapora truncata.* The biocoenosis of *Posidonia oceanica* meadows is developed on mobile substrate and precoralline aspect of coralline biocoensis is well developed on hard substrate.

Jabuka Island (Fig. 15)

- The cliff of Jabuka Island (16 September, 1987; depth: 0-40 m, bottom: vertical cliff: biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis, coralline biocoenosis). Scyaphilic elements of algal flora are dominant whereas photophilic forms are more rare. This markedly scyaphilic and monotonous settlement where *Peyssonnelia rubra, Peyssonnelia polymorpha, Halimeda tuna, Udotea petiolata* and a number of others prevail reaches 30, and in places even 40 m depth. Of zoological component: *Petrosia ficiformis, Ircinia variabilis* (SCHM.), *Ircinia fasciculata* (PALL:), *Chondrosia reniformis, Paramuricea clavata, Eunicella cavolini, Eunicella singularis, Caryophyllia smithi, Szchizobranchiella sanguinea, Myriapora truncata, Porella cervicornis, Hippodiplosia foliacea* ELL.&SOl., *Halocynthia papillosa* are particularly frequent.

Island Sušac (Fig. 16)

-Cliff of Sušac Island (17 September, 1986; depth: 0-30 m; bottom; vertical cliff). Substrate configuration and plant and animal settlement structure is similar to that on Jabuka cliff.

Surveys on trawling grounds:

Station 1 - 42°38'4 N, 18°02.2' E
42°37.3' N, 16°02.09' E
Fig. 1. (25 June, 1971; 23 April, 1972; depth: 106 m; bottom: sandy-muddy). Biocoenosis of detritic bottoms of the open sea.

Station 2 - 42°31'11 N, 16°23.35' E
43°31'11 N, 16°22.00' E
Fig. 2 (26 December 1968; 29 May, 1969; 29 October 1969; 23 May 1972; 8 June 1972; 19 June, 1973; 18 May, 1974; 5 June, 1974; 12 November, 1974;3 March, 1975; 13 August, 1976; depth: 40-30 m; bottom: mud). Biocoenosis of coastal terrigeneous muds. Bottom fauna: *Suberites domuncula* (OLIVI), *Tethya auranthium* (PALL.), *Alcyonium palmatum, Sternaspis scutata, Aphrodita aculeata, Laetmonice hystrix* (SAV.), *Macropipus depurator, Pilumnus hirtellus* (L.), *Turritella communis, Aporrhais pespelecani, Stichopus regalis, Holothuria tubulosa, Holothuria forskali* DELLE CHIAJE, *Ocnus planci, Marthasterias glacialis, Anseropoda placenta, Echinas-*

ter sepositus, Astropecten irregularis, Microcosmus sulcatus, Phallusia mammilata, Ascidia virginea (MÜLLER).

Station 3 - 43°29.2' N, 16°28.1' E
43°29.5' N, 16°26.5' E
Fig. 2 (20 Nov., 1972; 5 June, 1973; 18 May 1974; depth: 44 m; bottom: mud). Biocoenosis of coastal terrigeneous muds.

Station 4 - 43°41.8' N, 15°52.0' E
43°40.8' N, 15°52.7' E
Fig. 3 (11 August, 1973; 23 February 1974; depth: 40-45 m; bottom: sandy). Biocoenosis of coastal terrigeneous muds. Bottom fauna: *Geodia cydonium* (JAMESON), *Spongia officinalis, Hippospongia communis, Tethya aurantium, Verongia cavernicola* VACELET, *Ircinia muscarum* (SCHMIDT), *Ircinia oros, Ircinia spinulosa, Cliona celata* (GRANT), *Axinella cannabina, Axinella polypoides, Clathria coralloides* (OLIVI), *Alcyonium palmatum, Frondiporra verucosa, Porella cervicornis, Cellaria fistulosa, Stichopus regalis, Holothuria tubulosa, Holothuria forskali, Echinus acutus, Sphaerechinus granularis, Echinaster sepositus, Marthasterias glacialis, Anseropoda placenta, Ascidia mentula, Ascidia virginea, Microcosmus sulcatus, Phallusia mammilata.*

Station 5 - 44°04.4' N, 15°14.6' E
44°03.6' N, 15°15.8' E
Fig. 6 (14 August, 1974; depth: 33 m bottom: sandy-shelly). The biocoenosis of coastal terrigeneous muds. Dominant species: *Holothuria tubulosa* and *Holothuria forskali* and of algae *Codium bursa* (L.). Of other species: *Geodia cydonium, Ircinia muscarum, Suberites domuncula, Tethya aurantium, Cliona celata, Spongia officinalis, Hippospongia communis, Limacina inflata* (D'ORBIGNY), *Venus verrucosa, Echinus acutus, Echinaster sepositus, Astropecten aranciacus* (L.), *Anseropoda placenta, Phallusia mammilata, Ascidia mentula, Microcosmus sulcatus, Didemnum maculosum* (MILNE-EDW.).

Station 6 - 44°08' N, 15°11' E
44°09.4' N, 15°07.9' E
Fig. 6 (18 February 1975; depth: 40 m; bottom: sandy-shelly). Biocoenosis of coastal detritic bottoms. Bottom fauna: *Micale massa* (SCHMIDT), one of dominant species, *Tethya aurantium, Ircinia dendroides, Ircinia muscarum, Cliona celata, Clathria coralloides, Acanthella acuta, Raspailia viminalis* SCHMIDT, *Aequipecten opercularis* (L.), *Glossus humanus, Anomia ephippium* (L.), *Laetmonice hystrix, Alcyonium palmatum, Macropipus depurator, Pilmunus hirtellus, Holothuria forskali, Holothuria tubulosa, Ocnus planci, Stichopus regalis, Astropecten aranciacus, Marthasterias glacialis, Echinaster sepositus, Echinus acutus, Ophiura texturata* (one of dominant species).

Station 7 - 44°16.3' N, 15°02' E
44°18.7' N, 15°05' E
Fig. 5 (5 October 1974; 6 October 1974; 15 May, 1976; 5 April, 1977, depth : 60 m; Biocoenosis of muddy bottoms of the open sea.

Station 8 - 44°20.5' N, 14°59.3' E
44°22.3' N, 14°56.4' E
Fig. 5 (5 October 1974; 6 October 1974; 15 May, 1976; 5 April, 1977, depth : 62 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

Station 9 - 44°19.7' N, 15°14.1' E
44°17.5' N, 15°16.9' E

Fig. 5 (9 October 1974; 7 May, 1976; depth : 45 m; bottom: mud). Biocoenosis of coastal terrigeneous muds.

Station 10 - 45°12.6' N, 14°31' E
45°09.5' N, 14°29.5' E
Fig. 7 (5 August 1977; depth : 60 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

Station 11 - 45°17.8' N, 14°20.2' E
45°14.8' N, 14°19.0' E
Fig. 7 (6 August 1977; depth : 64 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

Station 12 - 45°17.8' N, 14°20.6' E
45°09.3' N, 14°23.4' E
Fig. 7 (5 August 1977; depth : 62 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

Station 13 - 45°06' N, 14°15' E
45°03.2' N, 14°17' E
Fig. 75 (6 August 1977; depth : 45 m; bottom: mud). Biocoenosis of coastal terrigeneous muds, *Turritella communis* facies.

Station 14 - 44°47.8' N, 14°02.8' E
44°50.8' N, 14°13.8' E
Fig. 7 (7 August 1977; depth : 62 m; bottom: sandy). Biocoenosis of detritic bottoms of the open sea.

Station 15 - 44°40.0' N, 14°08' E
44°43.0' N, 14°08' E
Fig. 8 (7 August 1977; depth : 62 m; bottom: sandy). Biocoenosis of detritic bottoms of the open sea.

Station 16 - 44°32.5' N, 14°09.6' E
44°32.6' N, 14°10' E
Fig. 8 (8 August 1977; depth : 50-55 m; bottom: sandy; facies: *Peyssonnelia polymorpha)*. Biocoenosis of detritic bottoms of the open sea.

Station 17 - 44°19.5' N, 14°28.0' E
44°21.0' N, 14°24.0' E
Fig. 8 (9 August 1977; depth : 65 m; bottom: sandy; Biocoenosis of detritic bottoms of the open sea.

Station 18 - 44°04.8' N, 15°07.0' E
44°05.8' N, 15°04.6' E
Fig. 6 (11 August 1977; depth: 55-60 m; bottom: sandy; Biocoenosis of coastal detritic bottoms.

Station 19 - 43°57.1' N, 15°16.2' E
43°58.8' N, 15°12.4' E
Fig. 6 (17 August 1974; depth: 65 m; bottom: sandy). Biocoenosis of coastal detritic bottoms. Bottom fauna: *Geodia cydonium, Tethya aurantium, Axinella damicornis, Axinella cannabina, Axinella polypoides, Verongia cavernicola, Spongia officinalis, Hippospongia communis, Cliona celata, Ircinia muscarum, Cacospongia scalaris* SCHMIDT, *Bubaris vermiculata, Chlatria coralloides, Pilumnus hirtellus, Porella cervicornis, Frondipora verrucosa, Cellaria fistulosa, Echinus acutus, Holothuria forskali, Holothuria tubulosa, Stichopus regalis, Ocnus planci, Marthasterias glacialis, Ascidia mentula, Ascidia virginea, Phallusia mammilata, Microcosmus sulcatus.*

Station 20 - 43°12.4' N, 16°20.2' E
43°14.1' N, 16°17.0' E
Fig. 14 (24 October 1969; 28. October,1969; 5 August, 1970; 23 August,

1972; 22 October, 1973; 27 April, 1974; 18 February, 1975; depth: 80 m; bottom: sandy. Biocoenosis of coastal detritic bottoms. Bottom fauna: *Spongia officinalis, Hippospongia communis, Tethya aurantium, Verongia cavernicola*, species of genus *Ircinia, Siphonochalina crassa* TOPSENT (numerous), *Suberites carnosum* (JOHN.) the most numerous, *Axinella damicornis, Axinella polypoides, Axinella verrucosa* SCHM., *Scaphander lignarius* (L.), *Dromia personata* (L.), *Pilumnus hirtellus, Pisa nodipes* LEACH, *Luidia ciliaris* PHIL. (56 specimens), *Echinaster sepositus, Anseropoda placenta, Cidaris cidaris, Echinus acutus, Chaetaster longipes* (RETZ.), *Ophiura texturata, Ophiothrix quinquemaculata* (DELLE CHIAJE) - settlement, *Eunicella singularis, Microcosmus sulcatus, Halocynthia papillosa, Phallusia mammilata, Ascidia virginea, Ascidia mentula, Pinna pectinata* (settlement).

Station 21 - 42°59.5' N, 16°19.7' E
42°57.4' N, 16°21' E
Fig. 17 (17 October 1968; 22 October,1969; 5 August, 1970; 4 August, 1972; 21 October, 1973; 13 April, 1974; 15 Nov., 1974; 19 February, 1975; depth: 104 m; bottom: sandy). Biocoenosis of detritic bottoms of the open sea with some elements of the biocoenosis of muddy bottoms of the open sea. Bottom fauna: *Rhizaxinella pyrifera* (DELLE CHIAJE), *Tethya aurantium, Thenea muricata, Verongia cavernicola, Suberites domuncula, Litocarpia myriophyllum* (settlement), *Funiculina quadrangularis, Alcyonium palmatum, Macropipus depurator, Dardanus arrosor* (HERBST), *Munida rugosa, Alpheus glaber* (OLIVI), *Stichopus regalis, Echinaster sepositus, Sphaerodiscus placenta* (MÜLLER & TROSCH), *Marthasterias glacialis, Astropecten irregularis, Chaetaster longipes, Cidaris cidaris, Echinus acutus, Centrostephanus longispinus* (PHIL.), *Luidia ciliaris, Ophiura texturata, Ophiothrix quinquemaculata, Diazona violacea* SAVIGNY, *Microcosmus sulcatus, Ascidia virginea.*

Station 22 - 43°26.5' N, 16°15' E
43°25.5' N, 16°21' E
Fig. 10 (21 June, 1968; 14 October 1980; depth : 60 m; bottom: mud). Biocoenosis of coastal terrigeneous muds.

Station 23 - 43°22' N, 16°13' E
43°18' N, 16°13' E
Fig. 10 (16 May 1964; 17 April, 1970; 6 July 1975: 16 September, 1978; 15 October, 1981; 10 May 1982; depth: 85 m; bottom: sandy). Biocoenosis of detritic bottoms of the open sea. Bottom fauna: *Geodia cydonium, Verongia cavernicola, Ircinia* sp., *Scaphander lignarius, Pinna pectinata, Stichopus regalis, Ocnus planci, Echinus acutus, Sphaerodiscus placenta, Marthasterias glacialis, Ophiacantha setosa* (RETZ.), *Astropecten irregularis.*

Station 24 - 43°07' N, 16°10' E
43°11.5' N, 16°09.5' E
Fig. 14 (21 April 1981; 10 June, 1982; 15 December 1983; depth: 80 m; bottom: sandy). Biocoenosis of detritic bottoms of the open sea.

Station 25 - 43°05.5' N, 16°48' E
43°07' N, 16°43.3' E
Fig. 14 (17 January, 1984; depth: 60 m; bottom: sandy). Biocoenosis of the coastal detritic bottoms. Bottom fauna: *Verongia cavernicola, Laetmonice hystrix, Lambrus massena* (ROUX), *Laevicardium oblongum* (CHEMNITZ), *Acantocardia echinata, Pecten jacobaeus* (L.), *Echinaster sepositus, Anseropoda placenta,*

Astropecten irregularis, Psammechinus microtuberculatus (BLAIN.), *Microcosmus sulcatus* and a large number of rock and other fragments, particularly of shellfish.

Station 26 - 42°43.2' N, 17°22.8' E
42°42.2' N, 17°27.2' E
Fig. 13 (11 March 1977;depth: 100 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

Station: Velebit Channel (northern Adriatic), between the small towns of Jurjevo and Lukovo Otočko (30 March, 1988; depth 75 m: bottom:mud). Biocoenosis of muddy bottoms of the open middle Adriatic and the area of islands of the northern Adriatic. There is a large number of submarine springs. Bottom fauna: *Thenea muricata* (BOWERB.), *Nephrops norvegicus* (L.), *Maia squinado* (HERBST.), *Marcropipus depurator, Munida rugosa, Gonoplax rhomboides* (L.), *Pontophilus spinosus* LEACH., *Glossus humanus, Galeodea echinophora* (L.), *Nucula sulcata* (BRONN.), *Acantocardia echinata, Turritella communis, Epitonium clathrus* (L.), *Sternaspis scutata, Aphrodita aculeata, Funiculina quadrangularis, Alcyonium plamatum, Astropecten irregularis, Marthasterias glacialis, Brissopsis lyrifera* (FORBES).

Stations of "PIPETA" Expedition, 1982-1983 (Fig. 18):

A(1): 45°18'00 N, 12°20'00 E
45°16'00 N, 12°21'00 E
(18 November, 1982; 1 July, 1983; depth: 20 m; bottom: sandy-muddy with lots of stones and submarine rocks; the area affected by Po River). Biocoenosis of fine muddy sands. Abundant algae are: *Gracilaria compressa* (C.AG.) GREV and *Ulva rigida.* Bottom fauna: *Suberites domuncula, Calliactis parasitica* (COUCH), *Squilla mantis* FABR., *Dromia personata, Homarus gamarus* (L.), *Inachus dorsettensis* (PENN.), *Carcinus mediterraneus* CZERNIAVSKY, *Liocarcinus vernalis* (RISSO), *Processa canaliculata, Aporrhais pespelecani, Murex brandaris, Hinia reticulata, Nucula nucleus* (L.), *Corbula gibba* (OLIVI), *Philine quadripartita* ASCANIUS, *Holothuria tubulosa, Ocnus planci, Astropecten irregularis, Ophiura albida* FORBES.

A(2): 45°18'00 N, 12°34'30 E
45°17'35 N, 12°35'72 E
(18 November, 1982; depth:20 m; bottom: coarse sand with lots of stones a n d submarine rocks). Biocoenosis of coarse sand and fine gravel affected by bottom currents. There is a lot of shelly material (40 to 50 kg per haul) made up mainly by: *Laevicardium oblongum, Acantocardia echinata, Glycimeris glycimeris, Murex brandaris, Truncullariopsis trunculus, Naticarius maculatus* ULYSSES, *Naticarius stercusmuscarum* (GMEL.), *Gibbula magus* (L.), *Fusinus rostratus* (OLIVI), *Aporrhais pespelecani.*

A(3): 45°22'48 N, 12°43'13 E
45°23'08 N, 12°47'31 E
(18 November, 1982; depth: 22 m; bottom: coarse sand with lots of stones and submarine rocks). Biocoenosis of coarse sand and fine gravel affected by bottom currents.

A(4): 45°19'00 N, 12°53'50 E
45°20'00 N, 12°57'50 E
(17 November, 1982; depth: 32 m; bottom: sandy-muddy-stony-rocky). Bioco-

enosis of detritic more or less muddy bottoms.
Bottom fauna: *Cliona viridis* (SCHM.), *Paguristes oculatus, Liocarcinus depurator, Turritella communis, Pinna pectinata, Laevicardium oblongum, Aequipecten opercularis, Ocnus planci, Echinus acutus, Schizaster canaliferus* (LAM.), *Astropecten irregularis, Anseropoda placenta, Ophiura texturata, Ophiothrix quinquemaculata, Phallusia mammilata, Microcosmus sulcatus.*

A(6): 45°29'27 N, 13°05'38 E
45°29'00 N, 13°03'72 E
(17 November, 1982; depth: 25 m; bottom: coarse sand with lots of stones and submarine rocks). Biocoenosis of coarse sands and fine gravel affected by bottom currents.

A(7): 45°20'00 N, 13°17'00 E
45°17'50 N, 13°12'00 E
(17 November, 1982; depth: 30-32 m). Biocoenosis of detritic more or less muddy bottoms.

A(8): 45°10'00 N, 13°01'00 E
45°07'22 N, 13°04'38 E
(19 November, 1982; depth: 34 m; bottom: sandy-muddy)Biocoenosis of detritic more or less muddy bottoms.

A(9): 45°21'00 N, 13°23'00 E
45°24'00 N, 13°25'30 E
(1 June, 1983; depth: 23-30 m). Biocoenosis of detritic more or less muddy bottoms, facies *Microcosmus sulcatus* (8000 to 9000 specimens of this species is obtained per haul). Bottom fauna: *Geodia cydonium, Spongia officinalis, Verongia cavernicola, Suberites domuncula, Laetmonice hystrix, Laevicardium oblongum, Aequipecten opercularis, Paguristes oculatus, Holothuria tubulosa, Ocnus planci, Anseropoda placenta, Astropecten aranciacus, Echinaster sepositus, Ophiothrix quinquemaculata, Microcosmus sulcatus.*

B(1): 45°00'00 N, 12°38'00 E
44°52'50 N, 13°33'00 E
(19 November, 1982; depth: 30 m). Biocoenosis of fine muddy sands. Bottom fauna: *Squilla mantis, Macropodia rostrata, Inachus dorsettensis, Gonoplax rhomboides, Liocarcinus depurator, Processa caniculata, Hinia reticulata, Turritella communis, Aporrhais pespelecani, Sphaeronassa mutabilis* (L.), *Naticarius stercusmuscarum, Nucula nucleus, Corbula gibba, Arca corbuloides* (MONT.), *Philine quadripartita, Ophiura albida.*

B(3): 45°04'00 N, 13°00'00 E
45°00'00 N, 13000'00 E
(19 November, 1982; depth:33 m): A boundary area between the biocoenosis of coastal terrigeneous muds and biocoenosis of detritic bottoms of the open sea (settlement of the species *Pinna pectinata*).

B(4): 45°00'00 N, 13°15'00 E
44°56'36 N, 13°80'00 E
(15 November, 1982; depth: 40 m, bottom: sandy-muddy). Biocoenosis of detritic bottoms of the open sea (settlement of the species *Pinna pectinata*).Bottom fauna: *Suberites carnosus, Cliona viridis, Macropodia rostrata, Inachus dorsettensis, Liocarcinus depurator, Aporrhais pespelecani, Turritella communis, Laevicardium oblongum*, the species of genera *Cardium* and *Chlamys*, *Aequipecten opercularis, Chione ovata* (PENN.), *Ocnus planci, Echinus acutus, Spatangus purpureus* O.F. MÜLLER, *Anseropoda placenta, Ophiura texturata.*

B(6): 44°32'00 N, 12°56'00 E
44°27'50 N, 12°55'00 E
(23 November, 1982; depth:40-42 m). Biocoenosis of detritic bottoms of the open sea (settlement of the species *Pinna pectinata*).

D(1): 43°53'00 N, 13°04'00 E
43°56'00 N, 12°59'00 E
(8 November, 1982; depth: 15 m). Biocoenosis of fine muddy sands.

D(6): 44°22'00 N, 14°01'00 E
44°24'00 N, 13°54'00 E
(29 April,1982; 12 November, 1982; depth: 56 m, bottom:coarse sand and numerous litotamnium pebbles). Coralline biocoenosis (coralline plateau). Bottom fauna: *Geodia cydonium,* the species of genus *Axinella,* the species of genus *Ircinia, Spongia officinalis, Hippospongia communis, Petrosia ficiformis, Lambrus massena, Pisa nodipes, Gibbula magus, Archimediella triplicata, Myriapora truncata, Porella cervicornis, Holothuria forskali, Echinus acutus, Anseropoda placenta, Aplidium conicum, Ascidia mentula, Botryllus schlosseri,* and of algae, the species of genus *Lithothamnium.*

E(7): 44°16'00 N, 14°33'00 E
44°18'00 N, 14°29'00 E
(31 May,1983; depth: 64 to 67 m; bottom: sand and numerous litotamnium pebbles).Coralline biocoenosis (lithotamnium pebbles made up more than 50% of net content).

F(1): 43°05'00 N, 13°55'50 E
42°58'00 N, 13°58'00 E
(4 December, 1982; depth 15 m). Biocoenosis offine muddy sands.

F(3): 43°16'50 N, 14°24'00 E
43°19'00 N, 14°21'50 E
(16 December,1982; depth: 84 m; bottom: sandy-muddy). Biocoenosis of detritic bottoms of the open sea.

I(4): 42°18'00 N, 16°49'50 E
42°21'00 N, 16°43'00 E
(6 December,1982; depth: 200-260 m; bottom: sandy mud). Biocoenosis of bathyal muds, facies of sandy and sandy-gravelly muds.

I(5): 42°24'00 N, 16°58'00 E
42°26'00 N, 16°53'00 E
(19 May,1982; 6 December, 1982; depth: 396-430 m; bottom: sandy mud). Biocoenosis of bathyal muds, facies of sandy and sandy-gravelly muds. Bottom fauna: *Amphianthus dohrnii* (V. KOCH), *Hormathia coronata* (GOSSE), *Macropipus tuberculatus* (ROUX), *Pagurus variabilis, Echinus melo* LAM., *Cidaris cidaris* (L.), *Terebratula vitrea* L. Of other frequent, but not so numerous species, the following were recorded: *Ranella gigantea* LAM., *Nephrops norvegicus, Parapenaeus longirostris* (H. LUCAS), *Gonoplax rhomboides, Scaphander lignarius* (L.), *Mesothuria intestinalis* (ASCANIUS & RATHKE), *Astropecten irregularis, Brisingella coronata* FISCHER, *Luidia sarsi* DÜBEN & KOREN and *Odontaster mediterraneus* MARENZELLER.

Stations of "HVAR" Expedition 1948/1949, the material from which contained living specimens of Prosobranchiata group (Fig. 19):

"H" 1 (depth: 33 m; bottom: sandy-muddy). Biocoenosis of detritic more or less muddy bottoms.

"H" 3 (depth: 32 m; bottom: sandy-muddy). Biocoenosis of detritic more or less muddy bottoms.

"H" 4 (depth: 36 m; bottom: sandy-muddy). Biocoenosis of detritic more or less muddy bottoms.

"H" 5 (depth: 50 m; bottom: sand). Biocoenosis of detritic bottoms of the open sea.

"H" 6 (depth: 60 m; bottom: sandy-muddy). Biocoenosis of detritic bottoms of the open sea.

"H" 8 (depth: 68 m; bottom: sand). Biocoenosis of detritic bottoms of the open sea.

"H" 11 (depth: 60 m; bottom: sand). Biocoenosis of detritic bottoms of the open sea.

"H" 15 (depth: 75 m; bottom: sandy-muddy). Biocoenosis of detritic bottoms of the open sea.

"H" 16 (depth: 68 m; bottom: sandy-muddy). Mixed bottoms.

"H" 18 (depth: 77 m; bottom: sand). Biocoenosis of detritic bottoms of the open sea.

"H" 20 (depth: 80 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 22 (depth: 75 m; bottom: sand). Biocoenosis of detritic bottoms of the open sea.

"H" 26 (depth: 75 m; bottom: sand). Biocoenosis of detritic bottoms of the open sea.

"H" 29 (depth: 93 m; bottom: sand). Biocoenosis of detritic bottoms of the open sea.

"H" 31 (depth: 95 m; bottom: sandy-muddy). Biocoenosis of detritic bottoms of the open sea.

"H" 33 (depth: 106 m; bottom: sand). Biocoenosis of detritic bottoms of the open sea.

"H" 39 (depth: 115 m; bottom: sandy-muddy). Mixed bottoms.

"H" 41 (depth: 130 m; bottom: sand). Biocoenosis of detritic bottoms of the open sea.

"H" 42 (depth: 132 m; bottom: sandy-muddy). Biocoenosis of detritic bottoms of the open sea.

"H" 43 (depth: 220 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 47 (depth: 199 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 48 (depth: 188 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 49 (depth: 240 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 52 (depth: 193 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 53 (depth: 181 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 55 (depth: 186 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 56 (depth: 190 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 57 (depth: 157 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 60 (depth: 210 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 61 (depth: 150 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 62 (depth: 157 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 66 (depth: 135 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 70 (depth: 110 m; bottom: sand). Biocoenosis of detritic bottoms of the open sea.

"H" 76 (depth: 111 m; bottom: sandy-muddy). Biocoenosis of detritic bottoms of the open sea.

"H" 80 (depth: 111 m; bottom: sandy-muddy). Biocoenosis of detritic bottoms of the open sea.

"H" 83 (depth: 37 m; bottom: mud). Biocoenosis of coastal terrigeneous muds.

"H" 86 (depth: 88 m; bottom: sand). Mixed bottoms.

"H" 87 (depth: 150 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 88 (depth: 124 m; bottom: sand). Biocoenosis of detritic bottoms of the open sea.

"H" 89 (depth: 154 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 92 (depth: 61 m; bottom: sand). Biocoenosis of detritic bottoms of the open sea.

"H" 97 (depth: 128 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 98 (depth: 106 m; bottom: sand). Biocoenosis of detritic bottoms of the open sea.

"H" 99 (depth: 174 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 101 (depth: 99 m; bottom: sandy-muddy). Mixed bottoms.

"H" 102 (depth: 130 m; bottom: muddy-sandy). Mixed bottoms.

"H" 103 (depth: 186 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 104 (depth: 128 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 110 (depth: 168 m; bottom: sand). Biocoenosis of detritic bottoms of the open sea.

"H" 118 (depth: 153 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 119 (depth: 155 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 136 (depth: 457 m; bottom: muddy-sandy). Mixed bottoms.

"H" 139 (depth: 40 m; bottom: mud). Biocoenosis of coastal terrigeneous muds.

"H" 141 (depth: 88 m; bottom: muddy-sandy). Mixed bottoms.

"H" 146 (depth: 118 m; bottom: mud). Biocoenosis of coastal terrigeneous muds.

"H" 156 (depth: 86 m; bottom: sandy-muddy). Biocoenosis of detritic bottoms of the open sea.

"H" 157 (depth: 30 m; bottom: mud). Biocoenosis of coastal terrigeneous muds.

"H" 164 (depth: 46 m; bottom: mud). Biocoenosis of coastal terrigeneous muds.

Personal studies at "HVAR" Expedition stations (Fig. 19):

"H" 40 (31 March, 1969; 1 November, 1970; depth: 181 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 43 (31 October, 1970; 26 August, 1972; depth: 220 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 44 (23 November, 1968; 31 March, 1969; 23 July, 1969; 1 November, 1970; depth: 220 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 46 (30 October, 1970; 27 August, 1972; depth: 216 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 47 (24 November, 1968; 19 July, 1970; 31 October, 1970; depth: 199 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 48 (23 November, 1968; 10 October, 1968; 30 March, 1969; 22 July 1969; 20 September, 1969; 18 July, 1970; 1 November, 1970; 25 August, 1972; depth: 188 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 50 (22 September, 1969; 14 July, 1970; 30 October, 1970; depth: 264 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 53 (24 November, 1968; 31 March, 1969; 20 September, 1969; 18 July, 1970; 25 August, 1972; depth: 181 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 54 (12 October, 1968; 23 November, 1968; 1 April, 1969; depth: 172 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 56 (23 November, 1969; 15 July, 1970; 30 October, 1970; 23 August, 1972; depth: 190 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 57 (24 November, 1968; 30 April, 1969; 21 September, 1969; 24 August 1972; depth: 157 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 61 (18 September, 1969; 10 July, 1970; 23 August, 1972; depth: 150 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 66 (25 November, 1968; 29 October, 1970; depth: 135 m; bottom: mud). Biocoenosis of muddy bottoms of the open sea.

"H" 67 (2 April, 1969; 19 September, 1969; 22 July, 1970; 29 Ocrtober, 1970; 24 August, 1972; depth: 127 m; bottom: sandy-muddy). Biocoenosis of detritic bottoms of the open sea with some elemnts of the biocoenosis of muddy bottoms of the open sea.

"H" 71 (25 November, 1968; 19 September, 1969; 29 October, 1970; depth: 125 m; bottom: sandy-muddy). Biocoenosis of detritic bottoms of the open sea with some elemnts of the biocoenosis of muddy bottoms of the open sea.

METHODS

Because of the objectives of this work and investigation goals, I worked on different biotopes of the northern, central and southern Adriatic, made use of the material of "HVAR" Expedition. The research covered coastal shallow and open deeper littoral or the bionomic steps of supralittoral, mediolittoral, infralittoral, circalittoral and bathyal of both hard and mobile substrates. To get a more complete image I also used the data from some stations of "PIPETA" Expedition (1982 and 1983) (area of investigations territorial and international waters).

Prosobranchiata group was studied in benthic plant and animal biocoenoses by two methods: 1) by SCUBA diving, that is direct collection and observations of qualitative-quantitative samples of benthic settlements; 2) by an indirect sampling method of sample collecting by Petersen grab, dredge and trawl net.

SCUBA divers carried out the observations and collected quantitative-qualitative samples of benthic settlements down to 30 m depth. Samples from mediolittoral and upper infralittoral, where settlements rapidly replace one another and are distributed mosaic-like, samples were collected more frequently and at smaller depth intervals. Depths greater than 30 m, where SCUBA divers could not work, were sampled by trawl nets, dredges and Petersen grab of 0.2 square metre size. Samples were collected more rarely and at greater depth intervals since the settlements were more homogeneous.

Qualitative-quantitative samples of benthic settlements were collected from the same surface areas. So the data obtained refer to the structure of settlements by species and abundance of individual species. The abundance of Prosobranchiata from the supralittoral and mediolittoral was expressed by the number per unit surface area as 1/16 sq m. When ever possible the same was done for infalittoral, so that

the abundance was expressed either per 1/16 sq m or per 1 sq m.

Bottom trawl data added to the data on the distribution and abundance of Prosobranchiata within individual biocoenoses. Material was collected by the method of "catch per unit area" at vessel speed of 3.0 to 3.5 Nm/hour*.

Dredge was used at hard and mobile bottoms where trawl could not be used. Dredge was hauled for 5 min accross the sea bottom at vessel speed of 2 Nm per hour. Collected material was preserved in 4% foramdehide solution or in 80% alcohol solution and definitively deterimed in the laboratory.

For some gastropod species, the data on the sites they were recorded from are considerably larger than given in this paper. I took into account only the living gastropod specimens for the authencity of the site they were recorded from.

Principal taxonomic classification was made after NORDSIECK (1968). Individual species were determined after the papers of: BUCQUOY, DAUTZENBERG & DOLLFUS (1882-1886), NORDSIECK (1968) and PARENZAN (1970) which were quite sufficient. Since they provide morphological descriptions of individual species I did not give them in the present paper. Benthic biocoenoses were determined and classified after PÉRÈS & PICARD (1964), PÉRÈS and GAMULIN-BRIDA (1973) and GAMULIN-BRIDA (1974).

RESULTS AND DISCUSSION

Ecological and zoogeographic data on individual species

Haliotis tuberculata LINNAEUS, 1758

Syn**: *Haliotis lamellosa* LAMARCK, 1822; *Haliotis parva* RISSO, 1826; *Haliotis marmorata* O. G. COSTA, 1829; *Haliotis glabra* O. G. COSTA, 1829; *Haliotis bistriata* O. G. COSTA, 1829

Previous reviews:
- Adriatic[1]: DANILO and SANDRI, 1856; GRUBE, 1861, 1864; HELLER, 1864; JEFFREYS, 1865; A. STOSSICH, 1865; BRUSINA, 1866, 1907; WEINKAUFF, 1868; M. STOSSICH; 1880; B.D.D.***, 1882-1886; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ZIMMERMANN, 1905-1906; ODHNER, 1914; VATOVA, 1928; COEN and VATOVA, 1933; COEN, 1937; HORVATH; 1963; RIEDL, 1963; STJEPČEVIĆ, 1967; GRUBIŠIĆ, 1967, 1982; STJEPČEVIĆ and PARENZAN, 1980.
- Mediterranean and Atlantic[2]: PHILIPPI, 1836, 1844; FORBES and HANLEY, 1848a; JEFFREYS, 1865; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878, 1884; B.D.D., 1882-1886; CARUS, 1889-1893; HIDALGO, 1917; PRIOLO, 1948; NORDSIECK, 1968; PARENZAN, 1970,; GRAHAM, 1971; DANCE, 1974; RIEDL, 1983.

Distribution: Atlantic (from Canary Islands in the north to Senegal in the south, accross Portugal, Cannaries and Azores), Mediterranean.

* The sites where trawl was used are shown in figures given in the Appendix. Arrows denote the towing direction and arrow lengths the path crossed.
[1]I gave all the authors who wrote on the Adriatic I could find in literature
[2]I gave only the most important authors for the Mediterranean and Atlantic
**Synonymy is limited to the most important authors
***B.D.D. - BUCQUEY, DAUTZENBERG, DOLLFUS

Results of studies:
Transects: DUBROVNIK AREA: transects 1 and 3 (depth 4-5 m, vertical rock), single specimens; SPLIT AREA: found at all 19 transects. At transect 9 (depth: 6-7 m, rocky bottom) 2 to 3 specimens * per sq m; ŠIBENIK AREA: found throughout the area. At transect 1 (depth: 1-2 m; bottom: rocky with a number of crevices and fissures), 6-7 s. per sq m; BIOGRAD AREA: found throughout the area. At transect 4 (depth: 0.5-5 m, bottom rocky with stones) 1 to 2 s. per sq m and 2 to 3 s. per sq m in places (predominantly on the bottom side of stones); ZADAR AREA: at transect 2 (depth: 0.2-0.5 m, bottom is a plate-like rock with stones), its abundance is 1 s. per sq m (predominantly on the bottom side of stones), and 2 to 3 s. per sq m in places. All the specimens were mainly big, 6 to 8 cm. At transect 3 (depth: 10 m, bottom sandy-shelly with a number of porous stones) this species is very frequent in stone crevices, with an average abundance of 2 to 3 s. per stone. It is interesting that only small specimens, of 1 to 3 cm, were found. VIR ISLAND AREA: found at all 12 transects on exclusivelly rocky or stony substrate, 0 to 1 s. per sq m, predominantly on the shaded side of rocks or on the bottom side of stones; KRK ISLAND AREA: distributed throughout the area. At transect 7 (depth: 1-35 m; bottom rocky down to 20 m and rocky-gravelly-sandy from 20-35 m) it was most abundant, 0-1 s. per sq m, down to 7 m depth. Single specimens could be found at 20 m depth. A large number of shells of this species was recorded from the sites where rocky bottoms transforms into rocky-gravelly sandy substrate. Between 20 and 35 m specimens not exceeding 1 to 3 cm could be found on loose stones. This species was also recorded from the fissures, on shaded rock parts or on the bottom side of stones at other transects.

Discussion: The species *Haliotis tuberculata* is a representative of solid substrate. It is distributed along rocky shores all along the Adriatic Sea. It is most abundant at hard bottoms down to 10 m depth**. Single specimens solely could be found on sheer rocks irrespective of the depth. It prefers places not directly illuminated (shaded rock parts or bottom side of stones) which is indicative of the fact that it is mainly sciaphilic. Specimens of 6 to 8 cm occur closer to the sea surface, their size decreases with depth. Only smaller specimens were recorded from depths exceeding 20 m. Its lower boundary of distribution is closely related to sea bed properties. Earlier authors also reported this species for the Adriatic, mentioning it as a species inhabiting smaller depths and being distributed on hard substrates. GRUBE (1864) found it to be frequent between 2 and 4 m. BRUSINA (1866) placed it among "commom" species and WIMMER (1883) reported it to be frequent on the stones down to 28 m. VATOVA (1928) and COEN and VATOVA (1933) found it in large numbers down to 25 m, on rocky shores and below stones, and rarely on rocky-sandy substrates. RIEDL (1963) described it as a hard substrate species of smaller depths. STJEPČEVIĆ (1967) reported it to occur on rocky shores, preferring bottom sides of stones or rocks, and to be stenohaline and stenothermal as to the salinity and temperature. GRUBIŠIĆ (1967, 1982) concluded that this species, confined to tidal zone, occurred in larger numbers at sites less exposed to wave action and along the stone ridges than on sheer rocks. The same author also stated that during the day it could be found below stones seeking for shelter, and that it creeps during the night. This lends support to the work of earlier authors stating that it is predominantly sciaphilic species. *Haliotis tuberculata* appears to be confined to the biocoenoses *** developed on hard substrates, from the sea surface downward. It also occurs in biocoenoses developed on mobile bottoms partly covered with bigger or smaller stones or limestone concretions. This species

*s. - specimen
**Table 1 presents approximately depth distribution of Prosobranchiata species worked out.
***Table 2 gives the list of all Prosobranchiata species recorded from individual benthic biocoenoses

was not recorded from stones scatterred on muddy bottoms. This speaks in favour of the belief that muddy bottom is a limiting factor of its distribution. Therefore, the depth at which biocoenosis of detritic more or less muddy bottoms continues as biocoenosis of muddy bottom is presumably the lower limit of its distribution.

Conclusion: Haliotis tuberculata is a hard substrate species. It is distributed throughout the Adriatic, with preference for the sites not directly illuminated. The biggest specimens occur closer to the sea surface and their size reduces with depth. It is distributed in the biocoenoses of hard botooms as well as in those of mobile sandy bottoms covered with stones or limestone concretions. The depth at which biocoenosis of detritic more or less muddy bottoms continues as biocoenosis of muddy bottom is presumably the lower limit of its distribution.

Emarginula huzardi PAYRAUDEAU, 1826

Syn: *Emarginula cusmischiana* BRUSINA, 1868

Previous reviews:
- Adriatic: DANILO and SANDRI, 1865; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; M. STOSSICH; 1880; B.D.D., 1882-1886; CARUS, 1889-1893; GRAEFFE, 1902; VATOVA, 1928; COEN and VATOVA, 1933; COEN, 1937; RIEDL, 1963; STJEPČEVIĆ and PARENZAN, 1980.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; CARUS, 1889-1893; PRIOLO, 1951; NORDSIECK, 1968; PARENZAN, 1970,; RIEDL, 1983.

Distribution: Mediterranean.

Results of studies:
Transects: DUBROVNIK AREA: transect 1 (depth 0.5 m, bottom: rocky and *Cystoseira stricta* v. *spicata*), single specimen in a rock crevice; MAKARSKA AREA: fissure near the small settlement Bratuš (depth: 5 m; bottom : vertical rock; precoralline aspect of coralline biocoenosis), 1 s.; SPLIT AREA: transect 18 (depth: 2 m, rocky bottom),1 s.; BIOGRAD AREA: transect 3 (depth: 7 m, bottom: stone blocks: of algae *Halimeda tuna* and *Udotea petiolata* are dominant; precoralline aspect of coralline biocoenosis) 1 s.; ZADAR AREA: transect 3 (depth: 10 m, bottom: sandy-shelly with a number of porous stones), 2 s. in stone fissures; VIR ISLAND AREA: transect 8 (depth: 5 m; bottom: rocky and *Sargassum salicifolium*), 1 s. Transect 6 (depth: 20 m; bottom: sandy with *Posidonia oceanica*), 1 s. in porous stones. Transect 9 (dredge; depth: 40 m; bottom: muddy-sandy and *Vidalia volubilis;* biocoenosis of detritic more or less muddy bottoms) 1 s. on the *Arca noae* shell; SESTRUNJ ISLAND AREA: opposite to the island Tri sestrice. Between 4 and 8 m bottom is rocky, slightly sloping with stone bulks and stones (biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis), 1 s. on stone bulk; ISLANDS RIVANJ and UGLJAN AREA: Veli Ždrelac (depth: 8 m; bottom: sandy and *Posidonia oceanica*), 1 s. on stone; VIS ISLAND AREA: the area around Gradac cove (depth: 70-85 m; bottom: lithothamnium; coralline biocoenosis), 2 s.; HVAR ISLAND AREA: outer side of Pokrivenik cove (depth: 15 m; bottom: rocky; precoralline aspect of coralline biocoenosis), 1 s.; SUŠAC ISLAND AREA: (depth: 30 m; bottom: rocky; coralline biocoenosis), 1 s. Trawl: station 4, Fig. 3 (depth: 40 - 45 m; bottom: sandy; Porifera group dominates; biocoenosis of coastal detritic bottoms), 1 s. Station 6, Fig. 6 (depth: 40 m; bottom: sandy-shelly; biomass of zoobenthic material high; biocoenosis of coastal detritic bottoms), 2 s. A single specimen found on *Glossus humanus* shell. Station 20, Fig. 14 (depth: 80 m; bottom: sandy; biocoenosis of detritic bottoms of the open sea), 1 s. on *Pinna*

pectinata shell; HVAR EXPEDITION: biocoenosis of detritic bottoms of the open sea: "H" 8 (depth: 68 m: bottom: sand), 1 s. "H" 11 (depth: 60 m; bottom: sand), 1 s. "H" 92 (depth: 61 m; bottom: sand), 1 s. "H" 98 (depth: 106 m; bottom: sand), 1 s.

Discussion: A STOSSICH (1865), HELLER (1864), M. STOSSICH (1880) and COEN and VATOVA (1933) reported *Emarginula huzardi* as very rare for the Adriatic, whereas RIEDL (1963) decribed it as common species on hard bottoms, particualrly on stones at smaller depths. I also believe that *Emarginula huzardi* is only apparently rare in the Adriatic, since it could hardly bee seen in its habitat. It is distributed on both hard and mobile bottoms throughout the Adriatic. It inhabits the elements of hard substrate and other sessile species of mobile bottoms. I recorded it from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and in coralline biocoenosis on hard bottoms and from the biocoenosis of coastal detritic bottom, biocoenosis of detritic more or less muddy bottoms and from biocoenosis of detritic bottoms of the open sea on mobile bottoms.

Conclusion: The species *Emarginula huzardi* occurs on both mobile and hard bottoms all along the Adriatic. It inhabits the elements of hard substrate and other sessile species of mobile bottoms. I recorded it from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis, coralline biocoenosis, biocoenosis of coastal detritic bottoms, biocoenosis of detritic more or less muddy bottoms and from biocoenosis of detritic bottoms of the open sea.

Emarginula cancellata PHILIPPI, 1836

Syn: *Emarginula sicula* GRAY, 1825; *Emarginula reticulata* RISSO, 1826; *Emarginula fissura* PAYRAUDEAU, 1826; *Emarginula rubra* O.G. COSTA, 1839; *Emarginula squamosa* ARADAS, 1846

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; HELLER, 1864; BRUSINA, 1866; WEINKAUFF, 1868; WIMMER, 1883; CARUS, 1889-1893; ZIMMERMANN, 1905-1906; COEN and VATOVA, 1933; COEN, 1937; RIEDL, 1963;
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878, 1884; B.D.D., 1882-1886; CARUS, 1889-1893; HIDALGO, 1917; PRIOLO, 1948; NORDSIECK, 1968; BOMBACE, 1970; PARENZAN, 1970,; GRAHAM, 1971; ABBOT, 1974; RIEDL, 1983.

Distribution: Atlantic (western coast of Europe; both sides of Florida to the Barbados Island), Mediterranean.

Results of studies:
Emarginula cancellata occurs in the same habitat types as *Emarginula huzardi.* It is hardly identifiable since it is very small (12 to 17 mm) and the colour of the shell is similar to the substrate.

Discussion: M. STOSSICH (1880) reported *Emarginula cancellata* as very rare species. COEN and VATOVA(1933) also decribed it as rare on rocky-detritic bottoms. WIMMER (1883) reported its records from 72 m depth whereas RIEDL (1963) decribed it as hard bottom species, particualrly on stones and inside them. It is pretty hard to say whether it is rare or common since it is not easily identifiable from the substrate it inhabits. That is why the records of this species are for the most part casual. As to the biocoenoses and habitats it is developen in, it behaves just like *Emarginula huzardi,* as I observed it.

Conclusion: Records of the species *Emarginula cancellata* are for the most part casual. As to the biocoenoses and habitats it is developen in, it behaves just like *Emarginula huzardi*, as I observed it.

Emarginula elongata O.G. COSTA, 1829

Syn: *Emarginula adriatica* O.G. COSTA, 1829

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; MONTEROSATO, 1878, 1884; M. STOSSICH, 1880; B.D.D., 1882-1886, CARUS, 1889-1893; GRAEFFE, 1902; ZIMMERMANN, 1905-1906; ODHNER, 1914; VATOVA, 1928; COEN and VATOVA, 1933; COEN, 1937; GAMULIN-BRIDA; 1962; RIEDL, 1963; STJEPČEVIĆ and PARENZAN, 1980.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878, 1884; B.D.D., 1882-1886; CARUS, 1889-1893; HIDALGO, 1917; PRIOLO, 1948; NORDSIECK, 1968; PARENZAN, 1970,; RIEDL, 1983.

Distribution: Atlantic (coastal area around Gibraltar to Cannary Islands), Mediterranean.

Results of studies:
Emarginula elongata occurs in the some habitats as two previous species. It is hardly identifiable since its is very small (10 to 18 mm), and the colour of the shell is similar to the substrate. Only single specimens were recorded.

Discussion: ZIMMERMANN (1905-1906), ODHNER (1914), VATOVA (1928); COEN and VATOVA (1933) reported *Emarginula elongata* from the area of Rovinj. GRUBE (1864) recorded it from the area of Kvarner, DANILO and SANDRI (1856) from Zadar area, GAMULIN-BRIDA (1962) from the central Adriatic channels and STJEPČEVIĆ and PARENZAN (1980) from Bay of Boka kotorska. A. STOSSICH (1865) decribed it as very rare in the northern Adriatic, attached to stones, and M. STOSSICH (1880) reported its large numbers from the southern Adrtiatic shallow areas. RIEDL (1963) found it on hard bottoms and stones in the northern Adriatic and HELLER (1864) in the meadows of marine phanerogams in the central and southern Adriatic. As I found it it is developed in the same biocoenoses and habitats and occurs in identical numbers as the previous two species.

Conclusion: As I found it it is developed in the same biocoenoses and habitats and occurs in identical numbers as the previous two species.

Diodora italica (DEFRANCE, 1820)

Syn: *Fissurella italica* DEFRANCE, 1820; *Fissurella neglecta* DESHAYES, 1830; *Fissurella mediterranea* SOWERBY, 1835; *Glyphis italica* HIDALGO, 1917
Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; MONTEROSATO, 1878, 1884; M. STOSSICH; 1880; B.D.D., 1882-1886; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ODHNER, 1914; VATOVA, 1928; COEN and VATOVA, 1933; COEN, 1937; ŽUPANOVIĆ, 1961; GAMULIN-BRIDA, 1962, 1967b; RIEDL, 1963, 1983; GAMULIN-BRIDA *et al.*, 1968; ZAVODNIK, 1971; TAVIANI, 1978, 1980; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
- Mediterranean: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878, 1884; B.D.D., 1882-1886; CARUS, 1889-1893; HIDALGO, 1917; PRIOLO, 1951; NORDSIECK, 1968; PARENZAN, 1970; RIEDL, 1983.

Distribution: Mediterranean.

Results of studies:
Transects: DUBROVNIK AREA: Daksa Is-

land (depth 1 m, sample 1/16 sq m: *Cystoseira compressa*; biocoenosis of photophilic algae), 1 s. on rock. SPLIT AREA: transect 13 (depth: 5 m; sample 1/16 sq m: *Cystoseira barbata*; biocoenosis of photophilic algae), 1 s. on a rock; ŠIBENIK AREA: transect 3 (depth: 2 m; bottom: rocky-stony; biocoenosis of photophilic algae), 1 s. on the species *Lemintina arenaria*; BIOGRAD AREA: transect 3 (depth: 5 m, bottom: gravelly-sandy, criss-crossed by smaller submarine rocks protruding from mobile bottom; biocoenosis of coarse sands and fine gravells affected by bottom currents; biocoenosis of photophilic algae) 1 s. on the species *Hippospongia communis* on a submarine rock; VIR ISLAND AREA: transect 4 (depth: 1-6 m; bottom: sandy with rock protrusions and stones; biocoenosis of fine uniform sands and biocoenosis of photophilic algae). Nine specimens were collected from rock protrusions and stones; JABUKA ISLAND AREA: (depth: 25 m: bottom: rock; sample from a surface of 1/16 sq m; coralline biocoenosis), 1 s.; VIS ISLAND AREA: a fissure near Gradac cove (depth: 1 m; bottom: vertical rock; precoralline aspect of coralline biocoenosis), 1 s.; HVAR ISLAND AREA: outer side of Pokrivenik cove (depth: 10 m; bottom: rocky; precoralline aspect of coralline biocoenosis), 1 s. Dredge: BIOGRAD AREA: transect 3 (depth 10 m; bottom; coarse sand with stones), 2 s.; ZADAR AREA: transect 2 (depth 15 m; bottom: sandy with *Posidonia oceanica,* stones and rocks), 1 s., Transect 3 (depth: 30 m; bottom: sandy-muddy and *Vidalia volubilis*); bottom fauna well represented; biocoenosis of detritic more or less muddy bottoms), 2 s.; VIR ISLAND AREA: transect 9 (depth: 30 m; bottom: sand; and *Lythophyllum racemus*; bottom fauna abundant), 3 s. Trawl: station 2, Fig. 2 (depth: 30 - 40 m; bottom: mud; biocoenosis of coastal terrigeneous muds), 2 s. About one to two tons of zoobenthic material is caught per hour haul. Station 4, Fig. 3 (depth: 40-45 m; bottom: sandy; biocoenosis of coastal detritic bottoms), 32 s. About one ton of zoobenthic material is caught per hour haul with Porifera group dominance). Station 5, Fig. 6 (depth: 33 m; bottom: sandy-shelly; biocoenosis of coastal detritic bottoms), 5 s. Two tons of zoobenthic material are caught per hour haul with the dominance of the species *Holothuria tubulosa* and *Holothuria forskali*, and of algae *Codium bursa*. Station 6, Fig. 6 (depth: 40 m; bottom: sandy-shelly; biocoenosis of coastal detritic bottoms), 18 s. Half a ton of zoobenthic material was caught per hour haul. Settlement of the species *Ophiura texturata*. Station 19, Fig. 6 (depth: 55 m; bottom: sandy; biocoenosis of coastal detritic bottoms), 10 s. Half-an-hour (30 min) haul gave more than a ton of zoobenthic material. Porifera group dominated. Species composition is alike that at station 19; "HVAR" EXPEDITION: "H" 3 (depth: 32 m: bottom: sandy-muddy; biocoenosis of detritic more or less muddy bottoms), 3 s., "H" 5 (depth: 50 m; bottom: sand; biocoenosis of detritic bottoms of the open sea), 2 s.,"H" 4 (depth: 36 m; bottom: sandy-muddy; biocoenosis of detritic more or less muddy bottoms), 2 s., "H" 16 (depth: 68 m; bottom: sandy-muddy: mixed bottoms), 2 s. "H" 83 (depth: 37 m; bottom: mud; biocoenosis of coastal terrigeneous muds), 1 s., "H" 141 (depth: 88 m; bottom: muddy-sandy; mixed bottoms), 3 s., "H" 156 (depth: 86 m; bottom: sandy-muddy; biocoenosis of detritic bottoms of the open sea), 2 s.

Discussion: VATOVA (1928) and COEN and VATOVA (1933) reported *Diodora italica* from the stones in shoals and frequently on rocks on detritic bottoms, coralline areas and sponges in the area of Rovinj. A. STOSSICH (1865) decribed it as very frequent on stones at small depths in the northern Adriatic, and HELLER (1864) on stones of the middle and southern Adriatic, and M. STOSSICH (1880) reported its presence on the stones at medium depth throughout the Adriatic. After RIEDL (1963) *Diodora italica* was not rare on hard bottoms at 10 m depth. GAMULIN-BRIDA (1962) recorded it from the mid-Adriatic channels and in the 1967b reported it for the biocoenosis of detritic more or less muddy bottoms (depth: 32 to 35 m) and for the biocoenosis of coastal terrigeneous muds, f.* of viscous muds

* f.- facies

(depth: 30 to 33 m) of the surroundings of Rovinj. ZAVODNIK (1971) recorded it from the coastal detritic bottom community at 35 m depth. This author reported it as a species the ecological distribution of which was still poorly known. As I found it, *Diodora italica* occurs on both hard and mobile bottoms. It inhabits the elements of hard substrate and a large number of sessile species of soft bottom on mobile substrates, first of all the groups Porifera, Tentaculata and Tunicata. It uses the surfaces of these organisms as a substrate on which it moves and retains. Therefore, higher the biomass of these groups in an area the number of this species specimens is higher. Survey of the "Hvar" Expedition material and my personal observations showed 88 m to be the greatest depth at which it was recorded. I recorded it from the biocoenosis of photophilic algae, biocoenosis of coarse sands and fine gravel affected by bottom currents, biocoenosis of fine uniform sands, biocoenosis of the meadows of *Posidonia oceanica,* biocoenosis of coastal detritic bottoms, biocoenosis of coastal terrigeneous muds, biocoenosis of detritic more or less muddy bottoms, biocoenosis of detritic bottoms of the open sea, precoralline aspect of coralline biocoenosis, coralline biocoenosis and mixed bottoms.

Conclusion: The species *Diodora italica* occurs on both hard and mobile bottoms. It inhabits the elements of hard substrate and a large number of sessile species of soft bottoms on mobile substrates. The greatest depth I recorded it from was 88 m. I recorded it from the biocoenosis of photophilic algae, biocoenosis of coarse sands and fine gravel affected by bottom currents, biocoenosis of fine uniform sands, biocoenosis of the meadows of *Posidonia oceanica*, biocoenosis of coastal detritic bottoms, biocoenosis of coastal terrigeneous muds, biocoenosis of detritic more or less muddy bottoms, biocoenosis of detritic bottoms of the open sea, precoralline aspect of coralline biocoenosis, coralline biocoenosis and mixed bottoms.

Diodora graeca (LINNAEUS, 1767)

Syn: *Patella graeca* LINNAEUS, 1767; *Patella reticulata* DONOVAN, 1803; *Fissurella graeca* LAMARCK, 1822; *Fisurella mamillata* RISSO, 1826; *Fissurella corrugata* O.G. COSTA, 1839; *Fisurella dominicana* O.G. COSTA, 1839; *Fissurella recurvata* O.G. COSTA, 1839; *Fisurella occitanica* RÉCLUZ, 1843; *Comoria montaguana* LEACH, 1852; *Glyphis graeca* HIDALGO, 1917

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; MONTEROSATO, 1878, 1884; M. STOSSICH; 1880; B.D.D., 1882-1886; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ODHNER, 1914; ZIMMERMANN, 1905-1906; VATOVA, 1928, 1949; COEN and VATOVA, 1933; COEN, 1937; GAMULIN-BRIDA, 1962, 1967b; HORVATH, 1963; RIEDL, 1963, 1983; STJEPČEVIĆ, 1967; ZAVODNIK, 1967a, 1971; GAMULIN-BRIDA *et al.*, 1968; TAVIANI, 1978, 1980; VIO *et al.*, 1979; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; JEFFREYS, 1865; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878, 1884; B.D.D., 1882-1886; CARUS, 1889-1893; HIDALGO, 1917; FORBES and HANLEY, 1948a; PRIOLO, 1951; NORDSIECK, 1968; BOMBACE, 1970; PARENZAN, 1970; RIEDL, 1983.

Distribution: Atlantic (from Orkney islands to Gibraltar), Mediterranean.

Results of studies:
During my study I recorded *Diodora graeca* very frequently together with *Diodora italica* in the study area (both species are distributed in the same habitat). On mobile bottoms its numbers depend, in the first place, on the biomass

of the groups Porifera, Tentaculata and Tunicata. I recorded the largest number of individuals of this species from station 18, Fig. 6 (depth; 55-60 m; bottom: sandy; biocoenosis of coastal detritic bottoms), 23 s. The greatest depth I recorded it at was 111 m at station "H" 76 (bottom: sandy-muddy; biocoenosis of detritic bottoms of the open sea).

Discussion: VATOVA (1928) and COEN and VATOVA (1933) recorded *Diodora graeca* from the rocks on detritic bottoms, coralline areas and sponges in the area of Rovinj. HELLER (1864) reported it as frequent between algae on hard substrates. After RIEDL (1963) *Diodora graeca* was not rare on stones, sponges and ascidians. GAMULIN-BRIDA (1962) recorded it from the mid-Adriatic channels and in the 1967b reported it for the biocoenosis of detritic more or less muddy bottoms (depth: 30 to 39 m) and for the biocoenosis of coastal terrigeneous muds, f. of viscous muds (depth: 30 to 33 m), biocoenosis of marine phanerogams (depth: 15 to 20 m) of the surroundings of Rovinj. ZAVODNIK (1967a) recorded it from the phytal and in 1971 from the coastal detritic bottom community at 35 m depth. This author reported it as a species the ecological distribution of which was still poorly known. STJEPČEVIĆ (1967) recorded it from rocky shores, attached to a rock, reef or stone and very frequently in recesses and fissures of rocks throughout the Bays of Boka kotorska, Herceg Novi and Tivat, whereas HORVAT (1963) assigned it to the gastropod group which crawl along the substrate (not attached) with its broad feet. JEFFREYS (1865) reported it as frequent on oyster shells, adult shellfishes and rocks, from the low tide level down to 90 m. As to the biocoenoses and habitats it is developed in, as I myself observed, this species is identical to the species *Diodora italica.*

Conclusion: As to the biocoenoses and habitats it is developed in, as I myself observed, this species is identical to the species *Diodora italica.*

Diodora gibberula (LAMARCK, 1822)

Syn: *Fissurella gibberula* LAMARCK, 1822; *Fisurella minuta* O.G. COSTA, 1829; *Fissurella gibba* PHILIPPI, 1836; *Fisurella philippiana* DUNKER, 1846; *Glyphis gibberula* HIDALGO, 1917

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; MONTEROSATO, 1878, 1884; M. STOSSICH; 1880; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; COEN and VATOVA, 1933; COEN, 1937; ZEI, 1955; RIEDL, 1963, 1983; STJEPČEVIĆ, 1967; GAMULIN-BRIDA *et al.*, 1968; VIO *et al.*, 1979; STJEPČEVIĆ and PARENZAN, 1980.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878, 1884; B.D.D., 1882-1886; CARUS, 1889-1893; HIDALGO, 1917; PRIOLO, 1951; RIEDL, 1983; NORDSIECK, 1968; PARENZAN, 1970; BOMBACE, 1970.

Distribution: Atlantic (coasts of England, France, Spain, Portugal, Cannary Islands to Guinea), Mediterranean.

Results of studies:
Transects: DUBROVNIK AREA: transect 4 (sample of *Cystoseira adriatica* from an area of 1/16 sq m; depth 1 m, bottom: rocky), 1 s. on a rock. MAKARSKA AREA: At 10 m depth, on rocky bottom (biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis), 2 s. SPLIT AREA: specimens of this species were recorded from transects 4, 9, 16 and 18 (depth: 0.2 to 5 m, bottom: rocky; biocoenosis of photophilic algae and poorly developed precoralline aspect of coralline biocoenosis); ŠIBENIK AREA: transect 2 (depth: 0.5 m, bottom: rocky; sample of *Cystoseira crinitophylla* from an area of 1/16 sq m), 1 s. on a rock. Transect 3 (depth: 2 m), 1 s. on *Hippo-*

spongia communis; ZADAR AREA: transect 3 (depth: 1 m, bottom: rocky) 1 s.; VIR ISLAND AREA: transect 3 (depth: 2 m; bottom: plate rock with smaller and bigger stones), 2 s. on the bottom side of stones. Transect 5 (depth: 1 m: bottom: sandy with *Cystoseira compressa*), 1 s. Transect 6 (depth: 5 m; bottom: rocks and stones) 1 s. on the bottom side of a stone. Transect 10 (depth: 2 m; bottom: rocky; sample of *Cystoseira barbata* from an area of 1/16 sq m), 1 s. KRK ISLAND AREA: transect 10 (depth:0.5 m; bottom: rocky), 1 s. VIS ISLAND AREA: a fissure near Gradac cove (depth: 10 m; bottom : vertical rock; precoralline aspect of coralline biocoenosis), 1 s.; HVAR ISLAND AREA: outer side of Stiniva cove (depth: 20 m; bottom: vertical rock; coralline biocoenosis), 1 s.; JABUKA ISLAND AREA: (depth: 25 m; bottom: vertical rock; coralline biocoenosis), 1 s. Dredge: ŠIBENIK AREA: transect IV (depth: 20 m; bottom: sandy; biocoenosis of coastal detritic bottoms), single specimens could be found on *Arca noae* shells; ZADAR AREA: transect 3(depth; 20 m; bottom: sand with shells and stones and well developed *Posidonia oceanica*), 1 s. on *Arca noae* shell and 1 s. in porous stones. Transect 1 (depth: 30 m; bottom: muddy-sandy with stones and *Vidalia volubilis*; biocoenosis of detritic more or less muddy bottoms), 1 s. on a stone; VIR ISLAND AREA: transect 7 (depth: 15 m; bottom: sand with lots of shelly material; biocoenosis of coastal detritic bottoms), 1 s. on *Laevicardium oblongum* shells. Transect 11 (depth: 20 m; bottom: muddy-sandy with *Vidalia volubilis*), 1 s.; VIS ISLAND AREA: the area around Gradac cove (depth: 70-85 m; bottom: lithothamnium; coralline biocoenosis), 1 s. Trawl: in the area of trawling I recorded several specimens of *Diodora gibberula* at stations 4, 5, 6 and 19 (see *Diodora italica*). It is hard to say anything about its numbers since it is too small (8-16 mm) and hardly identifiable from a large biomass of zoobenthic material; "HVAR" EXPEDITION: station "H" 3 (depth: 32 m; bottom: sandy-muddy; biocoenosis of detritic more or less muddy bottoms) 1 s. on the shell of *Pecten jacobeus*.

Discussion: A.STOSSICH (1865) and M: STOSSICH (1880) reported *Diadora gibbberula* as rare in the Adriatic. HELLER (1864) and COEN and VATOVA (1933) recorded *Diodora gibberula* from rocky and rocky-detritic bottoms, also believing it to be rare. ZEI (1955) reported it as most frequent in the infralittoral where it prefers to live below stones. STJEPČEVIĆ (1967) recorded small numbers of this species from rocky shores, frequently below stones, among sponges and in some cases among algae in Bay of Boka kotorska. After his records this author believes that this species is developed in the coastal zone at depths between 0.8-1.5 m. RIEDL (1963) described it as common species of rocky shores, frequent below stones, among sponges and sinascidians. After my own observations I agree with the authors who believe it to be common Adriatic species. It is distributed throughout the Adriatic. On mobile bottoms it inhabits the elemnts of hard substrate (stones, shells of mollusks) as well as many other sessile species of soft bottoms the surface of which it uses as a substrate at which it moves and lives. I recorded it from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and coralline biocoenosis on hard bottoms and from the biocoenosis of marine phanerogams, biocoenosis of coastal detritic bottoms and biocoenosis of detritic more or less muddy bottoms on mobile substrates.

Conclusion: Diodora gibberula occurs on both hard and mobile bottoms. On mobile bottoms it inhabits the elemnts of hard substrate (stones, shells of mollusks) as well as many other sessile species of soft bottoms the surface of which it uses as a substrate at which it moves and lives. I recorded it from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and coralline biocoenosis on hard bottoms and from the biocoenosis of marine phanerogams, biocoenosis of coastal detritic bottoms and biocoenosis of detritic more or less muddy bottoms on mobile substrates.

Pattela caerulea LINNAEUS, 1767

Syn: *Patella scutellaris* BLAINVILLE,, 1825; *Patella fragilis* PHILIPPI, 1836

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1861; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866, 1907; WEINKAUFF, 1868; M. STOSSICH; 1890; B.D.D., 1882-1886; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; COEN and VATOVA, 1933; COEN, 1937; ZEI, 1955; HORVATH, 1963; RIEDL, 1963, 1983; GAMULIN-BRIDA, 1967a, 1974; GRUBIŠIĆ, 1967, 1982; STJEPČEVIĆ, 1967; ZAVODNIK, 1967a, ŠIMUNOVIĆ, 1970; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878, 1884; B.D.D., 1882-1886; CARUS, 1889-1893; HIDALGO, 1917; PRIOLO, 1951; NORDSIECK, 1968; PARENZAN, 1970; POWEL, 1973; DANCE, 1974; RIEDL, 1983.

Distribution: Atlantic (Portugal, Cannary Islands and Azores and Madeira), Mediterranean.

Results of studies:
Transects: DUBROVNIK AREA: found at all four transects (single specimens). MAKARSKA AREA: Globally, here the rocky shore descends steeply to 15 m depth. This type of steep shores is not inhabited by this species. Up to 4 s. per 1/16 sq m could be found in places (microlocalities), immediatelly below the sea surface in small fissures or plateau-like shore protrusions. SPLIT AREA: different abundance of this species was recorded from all the transects dependently on shore configuration; ŠIBENIK AREA: the largest numbers recorded from transect 1 (area of Zlarin Island) where it stretches as a continuous belt with the 6 to 7 s. per 1/16 sq m abundance down to 1 m depth. It is interesting that there is a large number of small submarine springs in this area. Its abundance was 2 to 3 s. per 1/16 sq m at transects 2 and 3. BIOGRAD AREA: its abundance was 2 to 3 s. per 1/16 sq m at transect 2 and 0 to 1 s. at transect 4; ZADAR AREA: transect 2 (depth: 0.5 m, bottom: rocky plates) occurs rather continuously with abundance of 5 to 6 s. per 1/16 sq m; Specimens found in the vicinity of domestic sewage outfall were markedly big. Its abundance was 1 to 2 s. per 1/16 sq m at transects 1 and 3; VIR ISLAND AREA: its abundance was predominantly 3 to 4 s. per 1/16 sq m throughout the study area; KRK ISLAND AREA: Its abundance was 2 to 3 s. per 1/16 sq m at transect 3, 3 to 4 s. at transects 5 and 10, from 4-5 s. at transects 2 and 9, from 5-6 s. (on rocky plates) at transect 6, 7 and 8, 7-8 s. at transects 1 (rocky plates), 11-12 s. at transect 4 (on rocky plates, as well).

Discussion: The species *Patella caerulea* is distributed on hard bottoms throughout the Adriatic. M. STOSSICH (1890) reported *Patella caerulea* as common throughout the Adriatic and WIMMER (1883) as a species distributed between 0.5 and 2 m. STJEPČEVIĆ (1967), in addition to reporting it as common, mentioned that it did not descend below 2.5 m in Bay of Boka kotorska. GRUBIŠIĆ (1967) found it to be distributed on rocky shores, tidal zone, prefering less sloping shores and better sheltered areas avoiding turbid and less saline waters all along the coastal area. RIEDL (1963) also described it as common species in tidal zone and on rocky shores. As distinct from GRUBIŠIĆ (1967), this author reported its presence in town ports. ZEI (1955) believed it to be more frequent on exposed shores than on the shelterd ones. GAMULIN-BRIDA (1974) suggested it to be a characteritic species of the biocoenosis of photophilic algae, and as to its vertical distribution this author reported it from the infralittoral. ZAVODNIK (1967a) recorded it from phytal of the wider area of Rovinj and reported its vertical distribution to be exclusivelly connected with infralittoral. At the same time we can take it to be the species marking the boundary between medio- and infalittoral.

As distinct from the species *Patella aspera* and *Patella rustica*, which are better represented on more exposed localities than on the sheltered ones, *Patella caerulea* is almost equally present at both these locality types. The numbers of this species depend on the shore configuration. It occurs in highest numbers on flat shores of smoother surfaces (rocky plates). As a rule it does not inhabit steep localities on the coast. I also believe that turbid and less saline waters are not limiting factors of its distribution, but, on the contrary, it could be well represented in these areas (once again affected by shore configuration). Its individuals are mainly very well developed (predominantly big specimens).

Conclusion: Patella caerulea occurs on hard bottoms throughout the Adriatic. It is characteristic of the biocoenosis of photophilic algae. It is the species which marks the boundary between medio- and infalittoral which it mainly inhabits. The numbers of this species depend on the shore configuration and not on the locality exposure. It occurs in highest numbers on flat shores of smoother surfaces (rocky plates). Turbid and less saline waters are not limiting factors of its distribution.

Patella aspera LAMARCK, 1819

Syn: *Patella athletica,* FORBES, 1853

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; M. STOSSICH; 1880; GRAEFFE, 1902; VATOVA, 1928; COEN, 1937; GAMULIN-BRIDA, 1967a, 1974; ŠIMUNOVIĆ, 1970; RADIĆ, 1982; RIEDL; 1983;
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878, 1884; B.D.D., 1882-1886; HIDALGO, 1917; PRIOLO, 1951; NORDSIECK, 1968; PARENZAN, 1970; RIEDL, 1983.

Distribution: Atlantic (coast of England, France, Spain and Portugal), Mediterranean.

Results of studies:
Transects: DUBROVNIK AREA: found at all four transects. The highest numbers at transect 4 where up to 12 specimens were recorded per 1/16 sq m in places; MAKARSKA AREA: its abundance here was from 1 to 2 s. per 1/16 sq m . The rocky shore descends steeply to 15 m depth; SPLIT AREA: it was recorded from all the transects. Its numbers varied from 1-2 specimens (t. 10, 11, 12, 13) up to maximum 12-15 and 15-20 (t. 9 and 14); ŠIBENIK AREA: the abundance of 20 to 25 s. per 1/16 sq m was recorded from transect 1, 3 to 4 s. at transect 2 and 10 to 12 specimens at transect 3; BIOGRAD AREA: its abundance per 1/16 sq m was slightly higher at transect 2 (3 to 4 s.) than at transects 1, 3 and 4 (2 to 3 s.); ZADAR AREA: the abundance of 4 to 5 speciemens per 1/16 sq m was recorded from transect 1, 0 to 1 s. per 1/16 sq m at transect 2, and 3 to 4 s. at transect 3; VIR ISLAND AREA: its abundance was 7 to 9 s. per 1/16 sq m at transects 1, 2, 7 and 8, 10 to 12 s. at transect 5, 5 to 6 specimens at transect 6, 3 to 4 s. at transects 3 and 10, 2 to 3 s. at transect 11 and 1 to 2 s. at transects 4 and 12; KRK ISLAND AREA: its abundance was 7 to 9 s. per 1/16 sq m at transect 6, 6 to 7 s. at transects 1, 2, 3, 4, 5, 8 and 9, 3 to 4 s. at transects 7 and 10; HVAR ISLAND AREA: Zub od Zaraće and Smričevica cove: 4 to 5 specimens per 1/16 sq m ; VIS ISLAND AREA: a recess with the "pavement" near Gradac cove, 15 to 17 specimens per 1/16 sq m.

Discussion: The species *Patella aspera* is the representative of hard substrates. It is distributed on rocky shores throughout the Adriatic. A. STOSSICH (1865) reported *Patella aspera* attached to rocks. GAMULIN-BRIDA (1967a, 1974) mentioned it as a mediolittoral species and characteristic of the biocoenosis of the lower littoral rocks, and RIEDL (1963) described it

as common species on rocky eulittoral. During my studies I noticed that on exposed localities it was most abundant in lower mediolittoral in places where melobesis alga *Phymatolithon lenormandii* (ARECH.)FOSL., as a limestone formation, covers the shore parts of small slope angle. It occurred in small numbers elsewhere. Some measurements of exposed localities showed that *Patella aspera* reaches the upshore height of 30 cm above the sea level. The height it reaches on sheltered localities does not exceed 10 cm. *Patella aspera,* the vertical distribution of which is somewhere between that of *Patella caerulea* and *Patella rustica,* may be considered as a species well adapted to the environment between mainly dry area inhabited by *Patella rustica* and constantly submersed zone inhabited by *Patella caerulea.*

Conclusion: Patella aspera occurs on rocky parts of the mediolittoral throughout the Adriatic. It is best represented in exposed localities of the lower mediolittoral in places where melobesis alga *Phymatolithon lenormandii* covers the shore parts of small slope angle. It reaches 30 cm above the sea level at exposed localities and 10 cm at sheltered localities. Its vertical distribution is somewhere between mainly dry area (of the coast) and constantly submersed zone.

Patella rustica LINNAEUS, 1767

Syn: *Patella granularis* SCHRÖTER, 1784; *Patella lusitanica* GMELIN, 1790; *Patella punctata* LAMARCK, 1819

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; MONTEROSATO, 1878, 1884; M. STOSSICH, 1880; B.D.D., 1882-1886; GRAEFFE, 1902; ZIMMERMANN, 1905-1906; KRUMBACH, 1918; VATOVA, 1928; COEN and VATOVA, 1933; COEN, 1937; ZEI, 1955; RIEDL, 1963, 1983; GAMULIN-BRIDA, 1967a, 1974; STJEPČEVIĆ, 1967; ŠIMUNOVIĆ, 1970; POWEL, 1973; STJEPČEVIĆ and PARENZAN, 1980.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878, 1884; B.D.D., 1882-1886; HIDALGO, 1917; PRIOLO, 1951; NORDSIECK, 1968; PARENZAN, 1970; POWEL, 1973; RIEDL, 1983.

Distribution: Atlantic (southwestern coast of France, Portugal, Madeira), Mediterranean.

Results of studies:
Transects: DUBROVNIK AREA: *Patella rustica* is characteristic of the entire area of the biocoenosis of upper mediolittoral rocks but it is not evenly distributed. From 12 to 15 s. per 1/16 sq m may be found in places at mildly exposed localities (t. 4). It occurs in larger numbers at very exposed localities (t. 1, 2, 3). Up to 30 s. could be recorded per 1/16 sq m; SPLIT AREA: it was recorded from all the transects. It was more abundant at transects 1 through 4 and 6 through 9 and on 13 and 16 than on the rest of the transects (t. 10, 11, 12, 14, 17, 18, 19); ŠIBENIK AREA: it was more abundant at transect 1 (15 to 20 s. per 1/16 sq m) than on the transects 2 and 3 (5 to 7 s. per 1/16 sq m); BIOGRAD AREA: from 1 to 2 specimens were recorded from transects 1 and 3, 0 to 1 s. per 1/16 sq m at transects 2 and 4. The coast is rocky and not steep (small slope angle) at studied transects. It relatively soon and at small depths continues as gravelly-sandy substrate frequently criss-crossed by smaller submarine rocks protruding from mobile gravelly bottom and providing the conditions for the development of smaller oases of animal benthic communities of hard substrate; ZADAR AREA: single specimens were recorded from all three transects. The shore is low and made of rocks reaching 1 m depth and of stone blocks on gravelly-sandy bottom; VIR ISLAND AREA: its abundance

was 3 to 4 s. per 1/16 sq m at transects 8 and 11, and only single specimens could be found on the remaining ten transects; KRK ISLAND AREA: from 5 to 6 specimens were recorded only from some places at transect 6 and 3 to 4 s. per 1/16 sq m at transect 9 (Glavotok cape). Its abundance was 1 to 2 s. per 1/16 sq m at other transects; HVAR ISLAND AREA: Zub od Zaraće: 18 to 20 specimens per 1/16 sq m ; VIS ISLAND AREA: 7 to 9 s. per 1/16 sq m in the fissure near Gradac and Smričevica coves.

Discussion: The species *Patella rustica* is a typical represntative of rocky shores. It is distributed on rocky shores throughout the Adriatic. VATOVA (1928) reported *Patella rustica* as common along the rocky shores, and GAMULIN-BRIDA (1967a, 1974) mentioned it as characteristic of the biocoenosis of the upper mediolittoral rocks. During my own studies I observed that it was most numerous in the upper mediolittoral, distributed in the medium and upper mediolittoral and in the lowest (initial) part of supralittoral. GAMULIN-BRIDA (1967a, 1974) also reported it as medio and supralittoral species. As to its vertical distribution, some measurements at exposed localities showed that it could reach 70 cm above the sea level. Its abundance is affected by the indentation of rocky shores, its wave exposure and angle of the slope. Greater the rocky shore indentation and wave exposure the abundance of this species is higher. ZEI (1955) also found it to be most frequent at exposed shores. Literature on the Adriatic somewhere mentions this species as rare for some areas. So A. STOSSICH (1865) reported it rare in the area of Brijuni. I think that this is due to the poorly indented and sheltered rocky coast. I also observed that *Patella rustica* formed groups at defined places of rocky shores whereas it was more rare in some other areas. It prefers a part of the coast with a defined slope angle, which means the places where waves hit against the shore and does not overflow it. It is worth mentioning that red alga *Catenella repens* (LIGHTFOOT) BATTERS is well developed in many places where *Patella rustica* occurs in great numbers. On the basis of their distribution it may be stated that *Patella rustica* shows settlement preferences for coastal localities not under direct illumination that is the places of greater slope angle.

Conclusion: Patella rustica is a typical represntative of rocky shores. It occurs on rocky shores throughout Adriatic. It is best represented in the upper mediolittoral but it also inhabits medium and upper mediolittoral and the lowest (initial) part of supralittoral. It reaches up to 70 cm above the sea level at exposed localities. Its abundance is affected by the indentation of the rocky shores, exposure and shore slope angle.

Calliostoma conulum (LINNAEUS, 1767)

Syn: *Trochus conulus* LINNAEUS, 1767; *Trochus lucidus* RISSO, 1826; *Zizyphinus conulus* BRUSINA, 1866

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1861, 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; MONTEROSATO, 1878, 1884; B.D.D., 1882-1886; CARUS, 1889-1893; GRAEFFE, 1902; VATOVA, 1928; COEN and VATOVA, 1933; COEN, 1937; GAMULN-BRIDA, 1962, 1967b, 1974; RIEDL, 1963; STJEPČEVIĆ, 1967; ZAVODNIK, 1967a; GAMULIN-BRIDA, *et al.*, 1968; VIO, *et al.*, 1979; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; FORBES and HANLEY, 1848a; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878, 1884; B.D.D., 1882-1886; HIDALGO, 1917; PRIOLO, 1951; NORDSIECK, 1968; PARENZAN, 1970; DANCE, 1974; RIEDL, 1983.

Distribution: Atlantic (Cannary Islands, Azores, Madeira), Mediterranean.

Results of studies:
Transects: MAKARSKA AREA: western entrance to the port (depth: 3 m; bottom: rocky), 1 s.; SPLIT AREA: Kaštela Bay, along the Čiovo Island coast, near the stone-pit (depth: 12 m, bottom: sandy with *Posidonia oceanica*), 2 s.; ŠIBENIK AREA: transect 3 (depth: 2 m, bottom: rocky-stony) on *Cystoseira discors* (sample of 1/16 sq m), 1 s.; BIOGRAD AREA: transect 1 (depth: 5 m; bottom; sandy with stones), 1 s. Transect 2 (depth: 4-7 m; bottom: stone bulks with a large number of sheltered crevices and rich plant material), 2 s. (biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis); ZADAR AREA: transect 2 (depth: 15 m, bottom: sandy with stones and *Posidonia oceanica*), 7 s.; VIR ISLAND AREA: transect 6 (depth: 20 m; bottom: sandy with *Posidonia oceanica*), 9 s. Transect 8 (depth: 15 m; bottom: sandy with *Posidonia oceanica*), 26 s. Transect 9 (depth: 20-30 m; bottom: sandy with *Posidonia oceanica*), 12 s. SESTRUNJ ISLAND AREA: opposite to the island Tri sestrice. Between 4 and 8 m bottom is rocky, slightly sloping with stone bulks and stones (biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis), 7 s.; ISLANDS RIVANJ and UGLJAN: Veli Ždrelac (depth: 8 m; bottom: sandy and *Posidonia oceanica*), 20 s.; ZADAR CHANNEL AREA: Sajda shoal (depth: 7 m; bottom: coarse sand and pebbles; biocoenosis of coarse sands and fine gravels, wave exposed), 9 s.; VIS ISLAND AREA: shoal Ploča (depth: 15 m; bottom: rocky - a reef in the area of sandy bottom). The biocoenosis of *Posidonia oceanica* meadows is developed on mobile bottom and precoralline aspect of coralline biocoenosis on hard substrate), 17 s. were recorded; HVAR ISLAND AREA: reef near Zečevo Island (depth: 10-15 m; bottom: rocky). The biocoenosis of photophilic algae is developed in photophilic part and precoralline aspect of coralline biocoenosis in scyaphilic part; 11 specimens were recorded. HVAR ISLAND AREA: shoal near Jerolim (depth: 11 m; bottom: rocky with patches of sandy substrate). The biocoenoses of photophilic algae, of *Posidonia oceanica* and of coastal detritic bottoms are developed. Eight specimens were recorded. Lukavci cliffs (depth: 54-62 m; bottom is lithothamnium, coralline biocoenosis), 11 specimens. SILBA ISLAND AREA: near the small town of Silba: Pocukmarak cape. Substrate is rocky, very slightly sloping with stone bulks (up to 1 m high) and stones from surface to 8 m depth (biocoenosis of photophilic algaea and precoralline aspect of coralline biocoenosis), 5 s.

Discussion: GRUBE (1861, 1864) recorded the species *Calliostoma conulum* from the areas of Trieste, Cres and Mali Lošinj. GRAEFFE (1902) also reported it from the area of Trieste. A.STOSSICH (1865) reported *Calliostoma conulum* as rare in the northern Adriatic, recording it from offshore bottoms (not great depths). M. STOSSICH (1880) reported it, however, as rather numerous at greater depths throughout the Adriatic. HELLER (1864) also believed it to be frequent on muddy bottoms, between 18 and 37 m in the middle and southern Adriatic. COEN and VATOVA (1933) recorded only single specimens on detritic bryozoan bottoms near Rovinj. GAMULIN-BRIDA (1967b) reported it for the biocoenosis of detritic more or less muddy bottoms between 30 and 50 m in the area of Rovinj. In her paper of 1974 this autor described *Calliostoma conulum* as not fully ecologocally defined species. STJEPČEVIĆ (1967) recorded it from hard substrate shores overgrown by algae, in small numbers frequently down to 10 m. This author recorded it also from the muddy-sandy bottoms, in parts overgrown by marine phanerogams (*Zostera)* between 5 and 10 m in Bay of Kotor. ZAVODNIK (1967a) reported it for the phytal of Rovinj area. RIEDL (1963) described single specimens on soft and secondarily stiffened substrates. After my own observations it inhabits both the hard and mobile bottoms. On mobile bottoms it occurs on the elements of hard substrate or the sites where plant component is well represented like is the case of *Posidonia oceanica* the leaves of which provide a substrate for its movement. Down to 10

m *Calliostoma conulum* occurs in larger numbers that her relative species *Calliostoma zizyphinus*. I recorded it from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis, coralline biocoenosis, biocoenosis of *Posidonia oceanica,* biocoenosis of coarse sand and fine gravels wave exposed, biocoenosis of coastal detritic bottoms and biocoenosis of detritic more or less muddy bottoms.

Conclusion: Calliostoma conulum occurs on both hard and mobile bottoms. On mobile bottoms it inhabits the elements of hard substrate or sites where plant component is well developed. Down to 10 m *Calliostoma conulum* occurs in larger numbers than her relative species *Calliostoma zizyphinus*. I recorded it from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis, coralline biocoenosis, biocoenosis of *Posidonia oceanica*, biocoenosis of coarse sand and fine gravels wave exposed, biocoenosis of coastal detritic bottoms and biocoenosis of detritic more or less muddy bottoms.

Calliostoma zizyphinus (LINNAEUS, 1767)

Syn: *Trochus zyziphinus* LINNAEUS, 1767

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; MONTEROSATO, 1878, 1884; M. STOSSICH, 1880; B.D.D., 1882-1886; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; COEN and VATOVA, 1933; COEN, 1937; RIEDL, 1963; GAMULN-BRIDA, 1967b; STJEPČEVIĆ, 1967; GAMULIN-BRIDA, *et al.*, 1968; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; FORBES and HANLEY, 1848a; JEFFREYS, 1865; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878, 1884; B.D.D., 1882-1886; CARUS, 1889-1893; HIDALGO, 1917; PRIOLO, 1951; NORDSIECK, 1968; PARENZAN, 1970; GRAHAM, 1971; ABBOT, 1974; DANCE, 1974, RIEDL, 1983.

Distribution: Atlantic (from the area of Finmark in the north of Norway, across Great Britain, France, Spain and Portugal to the Moroccan coast, including Cannary Islands, Azores, Madeira), Mediterranean.

Results of studies:
Transects: ZADAR AREA: transect 1 (depth: 10 m, bottom: sandy, criss-crossed with smaller and bigger flat rocks and stone blocks), 2 s.; DUBROVNIK AREA: Koločep Island: nortwestern part (depth: 45-50 m; bottom: lithothamnium; coralline biocoenosis), 5 s.; VIR ISLAND AREA: transect 7 (depth: 15 m; bottom: sandy with stones). Of species *Posidonia oceanica* and *Sargassum hornschuchii* are dominant (biocoenosis of *Posidonia oceanica* and precoralline aspect of coralline biocoenosis), 8 s. Transect 8 (depth: 15 m; bottom: sandy with *Posidonia oceanica*), 4 s. Transect 9 (depth: 20 m; bottom: sandy with stones and *Posidonia oceanica*), 23 s. SILBA ISLAND AREA: near the small town of Silba: Pocukmarak cape. Stone bulks are flat and low below 8 m depth. Sand component is better developed with depth. Between 10 and 20 m *Cystoseira ercegovicii* (biocoenosis of photophilic algaea and precoralline aspect of coralline biocoenosis) is dominant on hard substrate; 46 s. of *Calliostoma zizyphinus* were recorded from hard substrate. Between 20 and 30 m *Posidonia oceanica* is well developed and 32 specimens were found among the leaves of its well developed settlements. The distribution of the species *Calliostoma zizyphinus* is similar around Olib Island (near the cove Južna Slatina and Zubinin cape). HVAR ISLAND AREA: shoal near Jerolim (depth: 11 m; bottom: rocky with patches of sandy substrate). The biocoenosis of photophilic algae, of *Posidonia oceanica* and of coastal detritic bottoms are developed.

Twelve specimens were recorded on the species *Peyssonnelia polymorpha*; HVAR ISLAND AREA: the outer side of the (cape) Pokrivenik cove (depth: 15 m; bottom: rocky; precoralline aspect of coralline biocoenosis). Eleven specimesn were recorded. Trawl: station 19, Fig. 6 (depth: 65 m; bottom: sandy; biocoenosis of coastal detritic bottoms), 52 s. The zoobenthic material biomass was very high in this area (a 30 min haul gave more than a ton material). It should be mentioned that the largest number of individuals of *Calliostoma zizyphinus* were found with the species *Cellaria fistulosa*, very well represented there; "HVAR" EXPEDITION: "H" 1 (depth; 33m; bottom: sandy-muddy; biocoenosis of detritic more or less muddy bottoms), 1 s. "H" 8 (depth: 68 m; bottom: sand; biocoenosis of detritic bottoms of the open sea), 1 s. "H" 18 (depth: 77m; bottom: sand; biocoenosis of detritic bottoms of the open sea), 5 s. "H" 15(depth: 75m; bottom: sand; biocoenosis of detritic bottoms of the open sea), 2 s. "H" 26(depth: 75m; bottom: sand; biocoenosis of detritic bottoms of the open sea), 1 s. "H" 33(depth: 106m; bottom: sand; biocoenosis of detritic bottoms of the open sea), 1 s.

Discussion: GRAEFFE (1902) recorded the species *Calliostoma zizyphinus* from the areas of Trieste, and HELLER (1864) from the area of Lastovo Island. There is a number of reports for this species for the area of Rovinj. So A.STOSSICH (1865) reported *Calliostoma zizyphinus* as numerous on sandy bottoms and greater depths, whereas, on the contrary COEN and VATOVA (1933) found it to be rare on detritic bottoms. WIMMER (1883) reported its records among algae between 3 and 6 m and on sponges at 28 m, and GAMULIN-BRIDA (1967b) reported it for the biocoenosis of detritic more or less muddy bottoms between 37 and 41 m. M. STOSSICH (1880) described it as occurring in small numbers in the northern and middle Adriatic. RIEDL (1963) thought it to be common but not frequent and distributed on soft and secondarily stiffened bottoms. STJEPČEVIĆ (1967) recorded it below stones and among algae in the Bay of Boka kotorska, predominantly on hard bottoms between 1 and 15 m among *Cystoseira*. After my own observations it inhabits both the hard and mobile bottoms. It occurs on mobile bottoms where the elements of hard substrate are present or on sites where zoobenthic material biomass is high or plant component well represented like is the case of *Posidonia oceanica* the leaves of which provide a substrate for *Calliostoma zizyphinus* movement. Down to 10 m and deeper *Calliostoma zizyphinus* occurs in largest numbers. The greatest depth I recorded it from was 106 m. I recorded it from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis, coralline biocoenosis, biocoenosis of *Posidonia oceanica,* biocoenosis of coastal detritic bottoms, biocoenosis of detritic more or less muddy bottoms and biocoenosis of detritic bottoms of the open sea.

Conclusion: Calliostoma zizyphinus occurs on both hard and mobile bottoms. I believe that on mobile bottoms it inhabits the elemnts of hard substrate or sites where zoobenthic material biomass is high and plant component well developed. Down to 10 m and deeper *Calliostoma zizyphinus* occurs in largest numbers. The greatest depth I recorded it from was 106 m.I recorded it from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis, coralline biocoenosis, biocoenosis of *Posidonia oceanica*, biocoenosis of coastal detritic bottoms, biocoenosis of detritic more or less muddy bottoms and biocoenosis of detritic bottoms of the open sea.

Calliostoma granulatum (BORN, 1778)

Syn: *Trochus granulatus* BORN, 1778; *Trochus papillosus* DA COSTA, 1779, *Trochus fragilis* PULTENEY, 1799; *Trochus tenuis* MONTAGU, 1803; *Zizyphinus granulatus* BRUSINA, 1866

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; B.D.D., 1882-1886; CARUS, 1889-1893; GRAEFFE, 1902; COEN and VATOVA, 1933; COEN, 1937; TAVIANI, 1980, RADIĆ, 1982.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; FORBES and HANLEY, 1848a; JEFFREYS, 1865; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878, 1884; B.D.D., 1882-1886; CARUS, 1889-1893; HIDALGO, 1917; PRIOLO, 1951; NORDSIECK, 1968; PARENZAN, 1970; GRAHAM, 1971; DANCE, 1974, RIEDL, 1983.

Distribution: Atlantic (coast of Portugal, Spain, France, southern coast of England and Ireland, Madeira and Cannary Islands), Mediterranean.

Results of studies:
Trawl: station 19, Fig. 6 (depth: 65 m; bottom; sandy; biocoenosis of coastal detritic bottoms; benthic biomass relatively high), 2 s. Station 20, Fig. 14 (depth: 80 m; bottom: sandy; biocoenosis of detritic bottoms of the open sea; benthic biomass relatively high), 3 s. Sation 21, Fig. 17(depth: 104m; bottom: sandy; biocoenosis of detritic bottoms of the open sea), 2 s. Station 23, Fig. 10 (depth: 85 m; bottom: sandy; biocoenosis of detritic bottoms of the open sea; benthic biomass relatively high), 2 s.; "HVAR" EXPEDITION: biocoenosis of detritic bottoms of the open sea: "H" 6 (depth; 60 m; bottom: sandy), 2 s. "H" 8 (depth; 68m; bottom: sand), 1 s. "H" 18 (depth; 77 m; bottom: sand), 1 s. "H" 22 (depth; 75 m; bottom: sand), 2 s. "H" 33 (depth; 106 m; bottom: sand), 1 s. "H" 41 (depth: 130 m; bottom: sand), 2 s. "H" 67 (depth: 127 m; bottom: sandy-muddy), 2 s. "H" 80 (depth: 111 m; bottom: sandy-muddy), 2 s. "H" 88 (depth; 124 m; bottom: sand), 2 s. "H" 92 (depth: 61 m; bottom: sand), 1 s. "H" 98 (depth: 106 m; bottom: sand), 2 s. "H" 110 (depth: 168 m; bottom: sand), 38 s., mixed bottoms. "H" 39 (depth; 115 m; bottom: sandy-muddy), 2 s. "H" 101 (depth: 99 m; bottom: sandy-muddy), 2 s. "H" 102 (depth: 130 m; bottom: sandy-muddy), 8 s.

Discussion: A. STOSSICH (1865) and M. STOSSICH (1880) believed it rare in the Adriatic and inhabiting greater depths. HELLER (1864) recorded the species *Calliostoma granulatum* from the bottoms covered by algae (middle Adriatic), and COEN and VATOVA (1933) recorded it from detritic bryozoan bottom in the vicinity of Rovinj. After RIEDL (1983) it occurs on primarily and secondarily stiffened substrates at depths exceeding 10 m. On the contrary, GRAHAM (1971) stated that it did not occur on the rocky part of littoral but on the sandy bottoms. As I found it *Calliostoma granulatum* is the species of sandy and sandy-muddy bottoms, where it is more frequent at sites where epifauna is rather abundant. After my own observations and the observations of some earlier authors *Calliostoma granulatum* presumably prefers deeper areas in its vertical distribution. I recorded it from the biocoenosis of coastal detritic bottoms, biocoenosis of detritic bottoms of the open sea and after the biocoenological map of the Adriatic (PÉRÈS and GAMULIN-BRIDA, 1973) from mixed bottoms.

Conclusion: Calliostoma granulatum occurs on sandy and sandy muddy bottoms. It prefers deeper areas in its vertical distribution. I recorded it from the biocoenosis of coastal detritic bottoms, biocoenosis of detritic bottoms of the open sea and from mixed bottoms.

Gibbula magus (LINNAEUS, 1767)

Syn: *Trochus magus* LINNAEUS, 1767; *Trochus tuberculatus* DA COSTA, 1779
Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866;

WEINKAUFF, 1868; MONTEROSATO, 1844, 1878; B.D.D., 1882-1886; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ZIMMERMANN, 1905-1906; ODHNER, 1914; VATOVA, 1928, 1949; COEN and VATOVA, 1933; COEN, 1937; GAMULIN-BRIDA, 1962, 1967b; RIEDL, 1963; STJEPČEVIĆ, 1967; KARAMAN and GAMULIN-BRIDA, 1970; STJEPČEVIĆ and PARENZAN, 1980; TAVIANI, 1980; RADIĆ, 1982.
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; FORBES and HANLEY, 1848a; JEFFREYS, 1865; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1844, 1878; B.D.D., 1882-1886; CARUS, 1889-1893; HIDALGO, 1917; PRIOLO, 1951; NORDSIECK, 1968; PARENZAN, 1970; GRAHAM, 1971; RIEDL, 1983.

Distribution: Atlantic (Zetland Archipelago, Great Britain, Ireland, soutwestern part of Swedish coast, Channel Islands, France, Spain, Portugal, Senegal, Azores and Cannary Islands and islands of Madeira), Mediterranean.

Results of studies:
Transects: DUBROVNIK AREA: Island Koločep: north-western part (depth 45-50 m, bottom: lithothamnium; coralline biocoenosis), 3 s.; ŠIBENIK AREA: transect IV (depth: 5 m; coast is rocky, steeply sloping, in places covered with bigger and smaller stones; biocoenosis of photophilic algae), 1 s.; VIR ISLAND AREA: transect 7 (depth: 15-20 m; bottom: sandy-muddy and *Posidonia oceanica*), 1 s. Transect 8 (depth: 40 m; bottom: muddy-sandy and *Vidalia volubilis*; biocoenosis of detritic more or less muddy bottoms), 3 s. Transect 9 (depth: 15 m; bottom: sandy-muddy and *Posidonia oceanica*), 1 s. Transect 10 (depth: 35-40 m; bottom: muddy-sandy and *Vidalia volubilis),* 1 s. KRK ISLAND AREA: transect 5 (depth: 30 m; bottom: muddy-sandy and *Vidalia volubilis),* 1 s.; ZADAR CHANNEL: Sajda shoal (depth: 7 m; bottom: coarse sand and pebbles; biocoenosis of coarse sands and fine gravel, wave exposed), 2 s. VIS ISLAND AREA: Ploča shoal (depth: 15 m; bottom: rocky situated in sandy bottom area; precoralline aspect of coralline biocoenosis), 3 s. found on rocky bottom; HVAR ISLAND AREA: shoal near Jerolim (depth: 11 m; bottom: rocky with sand patches), 3 s. were found on *Peyssonnelia polymorpha* (biocoenosis of coastal detritic bottoms). Zub od Zarače (depth: 10 m; bottom rocky, flatted, with sandy patches). A single specimen was found at the basis of a rock in sand. Trawl: "HVAR" EXPEDITION: "H" 3 (depth: 32 m; bottom: sandy-muddy; biocoenosis of detritic more or less muddy bottoms), 2 s. "H" 4 (depth: 36 m; bottom: sandy-muddy; biocoenosis of detritic more or less muddy bottoms), 3 s. "PIPETA" EXPEDITION: north-western part of the northern Adriatic. The number of specimens per hour haul at stations: A(2):depth: 20m, 160 -170 s.; A(3): depth: 20m, 150-160 s.;A (6): depth: 25 m, 1100-1150 s. Bottom of all three stations: coarse sand with a number of stones and submarine rocks. There is a lot of shelly material (40-50 kg per haul). The stations are situated in an area of formed biocoenosis of coarse sands and fine gravel affected by bottom currents. Station D(6): depth: 56 m. About 15 to 20 specimens were obtained per an hour haul. Bottom: coarse sand with a number of bigger and smaller lithothamnium pebbles (coralline biocoenosis).

Discussion: The species *Gibbula magus* is distributed on both hard and mobile substrate all along the Adriatic coast. GRAEFFE (1902) reported it for the area of Trieste, WIMMER (1883) and ODHNER (1914) for the area of Rovinj. VATOVA (1928) reported it frequent on sites with mud and rocky bottom near Rovinj, and much more rare on detritic bottoms. COEN and VATOVA (1933) found it to be frequent on muddy bottoms and considerably less frequent on rocky and detritic bottoms with coralline elements or on sandy bottoms of the same area. GRUBE (1864) reported it from the area of Mali Lošinj, and GAMULIN-BRIDA (1967b) from the biocoenosis of detritic more or less muddy bottoms, between 33 and

41 m in the area of Rovinj. M. STOSSICH (1880) believed it to occur in very small numbers in the Adriatic. A. STOSSICH (1865), as well, reported it to be rare in deep northern Adriatic waters. HELLER (1864), on the contrary, described it as frequent on bottoms overgrown by algae, between 37 and 73 m. GAMULIN-BRIDA (1962) recorded it from the mid-Adriatic channels and STJEPČEVIĆ (1967) from diiferent substrates between 3 and 15 m throughout the Bay of Boka kotorska. This author, however, believed that this species was most frequent on rocky and gravely bottoms where up to 6 s. per sq m could be found. RIEDL (1963) stated that this species was common and frequent at all the bottoms at depths exceeding 10 m. As my own studies show, *Gibbula magus* inhabits different types of both hard and mobile substrates. I recorded single specimens down to 10 m depth. It mainly occurs below 10 m. The greatest depth I recorded it from was 56 m. I believe that coarse sand with hard bottom elements is an optimum habitat for *Gibbula magus* distribution, apart from the fact that it may be found on different mobile and hard bottom types. I recorded it from the biocoenosis of photophilic algae, biocoenosis of *Posidonia oceanica* meadows, biocoenosis of coastal detritic bottoms, biocoenosis of detritic more or less muddy bottoms, biocoenosis of coarse sands and fine gravel wave exposed, biocoenosis of coarse sands and fine gravel affected by bottom currents, precoralline aspect of coralline biocoenosis and coralline biocoenosis.

Conclusion: Gibbula magus inhabits both hard and mobile bottoms all along the Adriatic coast. Coarse sand with hard bottom elements is an optimum habitat for *Gibbula magus* distribution. I recorded it from the biocoenosis of photophilic algae, biocoenosis of *Posidonia oceanica* meadows, biocoenosis of coastal detritic bottoms, biocoenosis of detritic more or less muddy bottoms, biocoenosis of coarse sands and fine gravel wave exposed, biocoenosis of coarse sands and fine gravel affected by bottom currents, precoralline aspect of coralline biocoenosis and coralline biocoenosis.

Gibbula adansoni (PAYRAUDEU, 1862)

Syn: *Trochus adansonii* PAYRAUDEAU, 1826; *Trochus varians* DESHAYES, 1832; *Trochus adriaticus* PHILIPPI, 1836;

Previous reviews:
- Adriatic: HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866, 1872; WEINKAUFF, 1868; M. STOSSICH, 1880; B.D.D., 1882-1886; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902, VATOVA, 1928; COEN and VATOVA, 1933; COEN, 1937; HORVATH, 1963; RIEDL, 1963; GAMULIN-BRIDA, 1967a, 1974; ZAVODNIK, 1967a; VIO *et al.*, 1979; RADIĆ, 1982.
Mediterranean: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878, 1884; B.D.D., 1882-1886; CARUS, 1889-1893; HIDALGO, 1917; PRIOLO, 1951; NORDSIECK, 1968; PARENZAN, 1970; RIEDL, 1983.

Distribution: Mediterranean.

Results of studies:
I found the specimens of *Gibbula adansoni* in the material collected from an area of 1/16 sq m from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and coralline biocoenosis and the samples of algae (*Ulva rigida, Cystoseira barbata, Cystoseira adriatica, Cystoseira stricta* var. *spicata, Cystoseira corniculata, Cystoseira corniculata* ssp. *laxior, Cystoseira ercegovicii, Cystoseira compressa, Cystoseira crinita, Sargassum salicifolium, Sargassum hornschuchi*) of the areas of Dubrovnik, Makarska, Split, Biograd, Šibenik, Zadar, Vir Island, Krk Island, Sestrunj Island, Silba Island, Hvar Island and Vis Island. The number of specimens varied from one sample to another and is primarily affected by the degree of shore exposure, algal abundance and depth. This species was most numerous in sheltered areas of the coast, calm water down to 0.5 m depth where samples frequently con-

tained from 5 to 20 specimens. Samples with a larger number of individuals were more rare. The highest number was recorded near Dubrovnik. A total of 179 specimens was counted from the sample of *Ulva rigida* collected from 0.2 m depth in well sheltered part of the shore. Its numbers are very small in exposed areas. The number of individuals also decreses with depth so that mainly single specimens may be found between 10 and 15 m. Sediment collected by grab from a number of localities (Split area: between 10 and 30 m with developed biocoenosis of *Posidonia oceanica* meadows; Šibenik area: at 26 m on sandy bottom with *Posidonia oceanica*; Vir island area, t. 6, depth: 6 m, sand and the species *Cymodocea nodosa*; Krk Island area: t. 5, depth: 30 m, sand) showed several shelly residues of the species *Gibbula adansoni*.

Discussion: The species *Gibbula adansoni* belongs to a group of abundant gastropods in the Adriatic Sea. It is distributed all along the eastern Adriatic coast. GRAEFFE (1902) reported it for the area of Trieste. A. STOSSICH (1865), M. STOSSICH (1880), WIMMER (1883) and COEN and VATOVA (1933) reported it as numerous in the shoals between algae in the area of Rovinj. RIEDL (1963) and ZAVODNIK (1967a) found it frequent in phytal and VATOVA (1928) recorded it on rocky shores down to 25 m. BRUSINA (1872) recorded it from the vicinity of Hvar Island and Dubrovnik and HORVATH (1963) among algae on rocky bottoms near Split. GAMULIN-BRIDA (1967a, 1974) described it as characteristic of the biocoenosis of photophilic algae developed in the biocoenosis of muddy sands of sheltered shores. As my own studies show, *Gibbula adansoni* inhabits hard substrates overgrown by algae, and only shelly residues can be found in sediment. Rare living specimens found on leaves of marine phanerogams, originate from upper layers wherefrom they were carried by mechanical wave action or sea currents. The number of individuals is markedly reduced with depth increase and shore exposure to waves. I recorded it from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and coralline biocoenosis.

Conclusion: The species *Gibbula adansoni* belongs to a group of abundant gastropods in the Adriatic Sea. It is distributed all along the eastern Adriatic coast. It inhabits hard substrates overgrown by algae. It prefers for its distribution shallower, calm and more sheltered areas on the shore. I recorded it from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and coralline biocoenosis.

Gibbula divaricata (LINNAEUS, 1767)

Syn: *Trochus divaricatus* LINNAEUS, 1767; *Gibbulastra divaricata* MONTEROSATO, 1884

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1861, 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; MONTEROSATO, 1878, 1884; M. STOSSICH, 1880; B.D.D., 1882-1886; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902, VATOVA, 1928; COEN and VATOVA, 1933; COEN, 1937; ZEI, 1955; HORVATH, 1963; RIEDL, 1963; STJEPČEVIĆ, 1967; ZAVODNIK, 1967a; ŠIMUNOVIĆ, 1970; VIO *et al.*, 1979; RADIĆ, 1982; STJEPČEVIĆ and PARENZAN, 1980;
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878, 1884; B.D.D., 1882-1886; CARUS, 1889-1893; HIDALGO, 1917; PRIOLO, 1951; NORDSIECK, 1968; RIEDL, 1983.

Distribution: Atlantic (coast of Spain and Portugal), Mediterranean.

Results of studies:
Transects: DUBROVNIK AREA: at transect 4 on the flattened part of the coast in the tidal

zone, 2 to 3 s. per 1/16 sq m (only in places); SPLIT AREA: at transects 1, 2, 3, 5, 7, 10, 11, 12, 14, 15, 16, 17, 18 and 19 common species (in the tidal zone, on stones and low rocks); ŠIBENIK AREA; transect 1 (mainland side) on low rocks down to 1 m depth, 3 to 4 s. and 15-16 s. between mobile rocks at a part of the coast protected from waves. Transect 2 (mainland side) 6 to 7 s. per 1/16 sq m (coast low and rocky). Transect 3 (mainland side) 7 to 8 s. on low rocks and 30 to 35 s. between mobile stones on thin sediment layer (coast low and rocky and the whole transect very shallow); BIOGRAD AREA: common at all four transects. At transect 4 occurs in somewhat larger numbers than at other transects. It is rather uniformly distributed down to 1 m depth and 10 to 12 s. per sq m were recorded. Large number of shells occupied by crabs could be found deeper than 1 m. Coast at study transects is rocky with slight slope (small slope angle); ZADAR AREA: at transect 1 on stone blocks, 11-12 s. per 1/16 sq m. Transect 2, on low rocks 12-15 s. and 40-45 s. per 1/16 sq m among mobile stones (coastal edge in form of marly plates mildly slopes down to 8-9 m depth. Smaller stone blocks, heaps of mobile stones and rocks, of which some protrude through the sea surface occur just at the sea surface. Its abundance at transect 3 is very alike that at transect 2 (rocky, flat shore made of rocks discending down to 1 m depth. They run in several parallel series between which small sheltered shallow pools occur and are in permanent contact with the sea. At the rock feet flatter stone bottom is formed stretching to approximately 5-6 m depth); VIR ISLAND AREA: common throughout the area (coast is rocky for the main part, slightly sloping and soon stretching on as mobile sandy bottom); KRK ISLAND AREA: common at transects 1, 2, 3, 4, 5, 8 and 10. Its abundance is 6 to 7 specimens on low rocks, whereas more than 40 s. per 1/16 sq m may be found among mobile stones at some trasnects (coast is rocky, slightly sloping and rather soon transforming into mobile sandy bottom).

Discussion: The species *Gibbula divaricata* is markedly a representative of solid substrate. It is distributed on rocky and stony shores all along the Adriatic Sea. It inhabits flattened and low parts of the coast (small slope angle) of rather calm and sheltered areas. Such a shore type is frequently liable to rather rapid sedimentation due to the reduced free flow of the sea. This species does not inhabit more steep areas directly wave exposed. It is most abundant at rocky bottoms down to 1 m depth below which it becomes rather rare and a large number of empty shells, now inhabited by crustaceans, could be found. It is more abundant among stones than on rocky bottoms. *Gibbula divaricata* is a mediolittoral and the uppermost infralittoral species distributed in the biocoenosis of mediolittoral rocks and biocoenosis of photophilic algae. A large number of authors reported it for the Adriatic. GRUBE (1861, 1864) reported it for the area of Cres Island; DANILO and SANDRI (1856) for the area of Zadar; GRAEFFE (1902) for Trieste; ZAVODNIK (1967a) for phytal of the vicinity of Rovinj; WIMMER (1883) along the coast among algae at 1 to 3 m depth (close to Rovinj); VATOVA (1928) reported it from the rocky shores and tidal zone of the area of Rovinj; HORVATH (1963) from rocks and stones of the tidal zone near Split; STJEPČEVIĆ (1967) between 2.5 and 5 m depths on hard substrate overgrown by algae in Bay of Boka kotorska where it occurred in small numbers; COEN and VATOVA (1933) reported it rare on rocky-detritic bottoms and particularly frequent along the shores on algaea between 1 and 3 m; RIEDL (1963) reported it common and frequent among algae and below and among stones of rocky littoral at very small depths. ZEI (1955) stated that *Gibbula divaricata* was distributed all over the emersion zone, on rocks, in fissures on and below stones on both exposed and sheltered shores, even though more frequent in sheltered areas. This author also reported that it protects itself from dessication by following the sea level so that it is most frequent immediately below the sea surface.

Conclusion: The species *Gibbula divaricata* is a representative of hard substrate. It is distributed along the rocky and stony shores all along the Adriatic. It inhabits flattened and low parts of the coast (small slope angle) of rather calm and sheltered areas. Such a shore type is frequently liable to rather rapid sedimentation due to the reduced free flow of the sea. This species does not inhabit the more steep areas directly wave exposed. It is most abundant at rocky bottoms down to 1 m depth below which it becomes rather rare and a large number of empty shells, now inhabited by crustaceans, could be found. It is more abundant among stones than on rocky bottoms. *Gibbula divaricata* is a mediolittoral and the uppermost infralittoral species distributed in the biocoenosis of mediolittoral rocks and biocoenosis of photophilic algae.

Monodonta turbinata (BORN, 1780)

Syn.: *Trochus turbinatus* BORN, 1780; *Trochus tessellatus* GMELIN, 1790; *Monodonta fragaroides* LAMARCK, 1822; *Monodonta tessellata* RISSO, 1826; *Monodonta olivieri* PAYRAUDEAU, 1826; *Caragolus turbinatus* MONTEROSATO, 1884

Previous reviews:
- Adriatic: NARDO, 1847; DANILO and SANDRI, 1856; GRUBE, 1861, 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866, 1907; WEINKAUFF, 1868; MONTEROSATO, 1878, 1884; M. STOSSICH, 1880; B.D.D., 1882-1886; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ZIMMERMANN, 1905-1906; VATOVA, 1928, 1949; COEN and VATOVA, 1933; COEN, 1937; ZEI, 1955; HORVATH, 1963; RIEDL, 1963; GAMULIN-BRIDA, 1967a, 1974; GRUBIŠIĆ, 1967, 1982; STJEPČEVIĆ, 1967; ŠIMUNOVIĆ, 1970; VIO *et al.*, 1979; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878, 1884; B.D.D., 1882-1886; CARUS, 1889-1893; HIDALGO, 1917; PRIOLO, 1952; NORDSIECK, 1968; PARENZAN, 1970; DANCE, 1974; RIEDL, 1983.

Distribution: Atlantic (coast of Spain and Portugal, Cannary Islands), Mediterranean.

Results of studies:
Transects: DUBROVNIK AREA: at transect 4 (slightly exposed locality) it most freqeuntly inhabits the shore fissures at the mediolittoral step. Up to 10 s. per 1/16 sq m were found in places. Single specimens occurred at transects 1, 2 and 3 due to their strong exposure and rather steep rocks; MAKARSKA AREA: 2 to 3 s. per 1/16 sq m in places in the mediolittoral; SPLIT AREA: recorded from all the transects but it was considerably rarer at transects 9, 10, 11, 12, 16, 17, 18 and 19 (the number of individuals ranged from 0-1 to 2-3 s. per 1/16 sq m) than on other transects; ŠIBENIK AREA; common and fairly numerous throughout the area. At transect 1 on the shores not directly exposed to wave action its abundance was 6 to 7 s. per 1/16 sq m. At transect 2 (the area of Zlarin Island) I found the batches of 7-8 s. per 1/16 sq m in shore fissures during early morning hours. It is interesting that at transect 3 the largest number of specimens recorded were empty shells occupied by crabs of familiy Paguridae at already 0.3 m depth; BIOGRAD AREA: well represented throughout the area. VIR ISLAND AREA: at transects 1 and 2 occurs on the rocks, 2 to 3 s. per 1/16 sq m in the mediolittoral zone. At transect 3 from 3 to 4 s. on mediolittoral rocks, and 20-25 specimens (juveniles) among mobile stones per 1/16 sq m in the sheltered shore areas (depth: to 0.1 m). At transect 8, 2 to 3 specimens on mediolittoral rocks, and 12 to 15 s. (juv.) per 1/16 sq m among mobile stones. At transect 10, 35-40 s. (juv.) per 1/16 sq m on mobile stones (depth: to 0.1 m). KRK ISLAND AREA: at transect 1, 6-7 s. (juv.) among mobile stones, and 1 to 2 s.

per 1/16 sq m on the rocks along the shoreline. At transect 2 batches of 5 to 6 specimens on the rocks, along the shoreline. At transect 3 batches of 6 to 7 s. per 1/16 sq m on rocks. At transect 10, 2 to 3 specimens on mediolittoral rocks and 15-20 s. (juv.) per 1/16 sq m on mobile stones (depth: to 0.1 m). Its distribution is very similar on other transects.

Discussion: The species *Monodonta turbinata* belongs among better represented species in the Adriatic Sea. It is a representative of solid substrate. It is distributed on the rocky and stony shores all along the Adriatic Sea. It shows settlement preferences for rather calm and sheltered habitats. Its vertical distribution stretches down to the infralittoral, and the greatest abundance of its adults was recorded from the mediolittoral step just above the sea surface. As distinct from adult specimens, the abundance of juveniles, the morphology of which considerably differs from the adults, is greatest in the shallow part of the sea (depth: down to 0.1 m) in sheltered and flattened shore parts covered by mobile stones. Its abundance is very high there and it may amount up to 40 s. per 1/16 sq m. Studying the Adriatic gastropods BRUSINA (1907) found that morphology of juvenile animals differrent considerably from that of adults. It is also interesting that the number of specimens of the species *Monodonta turbinata* suddenly reduces with the slightest depth increase, so that a large number of empty shells, occupied by crabs, may be found at already 0.3 m depth. At exposed localities, during the early morning "calm" their abundance is higher in mediolittoral step. In summer during the day's heats it withdraws down to the infralittoral, its abundance being reduced in the mediolittoral. The specimens which remain in the mediolittoral, could be mainly found in mediolittoral pools and crevices where water was retained. During wave splashing on the shore this species is very rare in the mediolittoral its abundance being reduced to 0 to 1 s. per 1/16 sq m in fissures sheltered from the waves. It is well represented in sheltered localities both in mediolittoral and at the beginning of infralittoral. As indicated by the papers of many authors this species is rather numerous and well represented on hard substrates in the tidal zone all along the Adriatic. NARDO (1847) reported it from the area of Venice, GRUBE (1861) for Trieste and Cres Island, HORVATH (1963) for the area of Split and STJEPČEVIĆ (1967) for Bay of Boka kotorska. VATOVA (1928) recorded it along the rocky shores in the tidal zone. ZEI (1955) reported its distribution throughout the emersion zone in the northern Adriatic. This author believed that it was more abundant in fissures than on rocks and stones and very rare below stones. He recorded it from both exposed and sheltered localities more frequently from the sheltered ones and found that it protects itself from dessication by following the sea level so that it is most frequent immediately below the sea surface. GRUBIŠIĆ (1967) reported its distribution on rocky shores and stone piles in sites of low and high tide alternations all along the Adriatic. The same author stated that the settlements of this species were denser at sites where the shore is rather slaty and better overgrown and that during the day it found shelter in fissures and crevices. With the sunset it leaves its shelters and crawls on the stones in search of dwarf algae on which it feeds. This author believed that it evades steep shores and freshed water. As to its biocoenology GAMULIN-BRIDA (1974) reported its preference for the biocoenosis of lower mediolittoral rocks. I believe that settlement preferences of adults and juveniles of this species are quite different. Namely, adult specimens primarily inhabit miediolittoral of rocky shores as distinct from juveniles which inhabit loose stones in the surface part of infralittoral.

Conclusion: The species *Monodonta turbinata* belongs among better represented species in the Adriatic Sea. It is distributed on the rocky and stony shores all along the Adriatic Sea. It preferently inhabits rather calm and sheltered places. The morphology of juveniles considerably differs from that of adults. In its vertical distribution it occurs in the mediolittoral and infralittoral. The number of specimens of the species

Monodonta turbinata suddenly reduces with the slightest depth increase, so that a large number of empty shells, occupied by crabs, may be found at already 0.3 m depth. Adult specimens primarily inhabit mediolittoral of rocky shores as distinct from juveniles which inhabit loose stones in the surface part of infralittoral.

Monodonta articulata LAMARCK, 1822

Syn.: *Trochus draparnaudii* PAYRAUDEAU, 1826; *Trochus articulatus* DESHAYES, 843; *Caragolus articulatus* MONTEROSATO, 1844

Previous reviews:
- Adriatic: PHILIPPI, 1844; DANILO and SANDRI, 1856; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; MONTEROSATO, 1878, 1884; M. STOSSICH, 1880; B.D.D., 1882-1886; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; VATOVA, 1928; COEN and VATOVA, 1933; COEN, 1937; HORVATH, 1963; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878, 1884; B.D.D., 1882-1886; HIDALGO, 1917; PRIOLO, 1952; NORDSIECK, 1968; PARENZAN, 1970; RIEDL, 1983.

Distribution: Atlantic (coast of Spain and Portugal), Mediterranean.

Results of studies:
I recorded *Monodonta articulata* mainly together with *Monodonta turbinata.* Its abundance was 1 to 2, rarely 3 s. per 1/16 sq m in a number of localities both on the coast of the mainland and on islands. The number of specimens suddenly reduces with the depth increase and the number of empty shells, occupied by crabs, suddenly increases like in *Monodonta turbinata.*

Discussion: Monodonta articulata belongs to frequent gastropod species in the Adriatic. It is distributed on rocky and stony shores of the mediolittoral and in the uppermost infralittoral. As compared with *Monodonta turbinata* the species *Monodonta articulata* inhabits slightly lower positions on the shore in its vertical distribution. It may be said to prefer the edge of lower mediolittoral and the shallowest part of infralittoral, that is predominantly submerged or permanently submerged zones. It is frequent in sheltered shore parts. With depth the number of its specimens is suddenly reduced and the number of empty shells, occupied by crabs, increased. WIMMER (1833) reported it among algae between 1 and 3 m depth in the area of Rovinj. A. STOSSICH (1865) and M. STOSSICH (1880) reported it numerous on stones and rocks in the northern and central Adriatic. HORVATH (1963) reported it from the zone of the lowest tide and below that level in the area of Split and STJEPČEVIĆ and PARENZAN (1980) for Boka kotorska Bay.

Conclusion: Monodonta articulata belongs to frequent gastropod species in the Adriatic. It is frequent in sheltered shore parts. It is distributed on rocky and stony shores of the mediolittoral and in the uppermost infralittoral. It may be said to prefer the edge of lower mediolittoral and the shallowest part of infralittoral. It occurs in the biocoenosis of lower mediolittoral rocks and the biocoenosis of photophilic algae.

Jujubinus striatus (LINNEAUS, 1767)

Syn.: *Trochus striatus* LINNAEUS, 1767; *Trochus parvus* DA COSTA, 1779; *Trochus conicus* DONOVAN, 1803;

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1861; HELLER, 1864; JEFFREYS,

1865; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; B.D.D., 1882-1886; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ZIMMEREMANN, 1905-1906; VATOVA, 1928, COEN, 1937; RIEDL, 1963; STJEPČEVIĆ, 1967; ZAVODNIK; 1967a; TAVIANI; 1978; VIO *et al.*, 1979; STJEPČEVIĆ and PARENZAN, 1980.
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; FORBES and HANLEY; 1848a; ARADAS and BENOIT, 1870; JEFFREYS; 1865; WEINKAUFF, 1868; MONTEROSATO, 1878; B.D.D., 1882-1886; HIDALGO, 1917; PRIOLO, 1952; NORDSIECK, 1968; PARENZAN, 1970; RIEDL, 1983.

Distribution: Atlantic (south coast of England, Channel Islands, France, Spain, Portugal, Madeira, Cannary Islands and Azores), Mediterranean.

Results of studies:
Transects: MAKARSKA AREA: western entrance to the port; at 7 to 10 m the bottom is rocky. In the sample of *Cystoseira corniculata* from the area of 1/16 sq m, 12 specimens were counted. Bottom is muddy at 50 m depth and I found shelly residues of the species (5 shells) in the grab sample of the sediment; SPLIT AREA: frequent in the biocoenosis of photophilic algae. The biocoenosis of the meadows of *Posidonia oceanica* is distributed between 10 and 30 m. About 20 and 30, specimens were obtained on several occasions; BIOGRAD AREA: it is most abundant in the area of *Cystoseira barbata* (t. 2; depth: 0.5 m; 11 s. and t. 4; depth: 0.5 m; 9 s. per 1/16 sq m). It is frequent on stone blocks at transect 3 (depth: 5 to 7 m; biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis); ŠIBENIK AREA: transect 3 (depth: 2 m; *Cystoseira ercegovicii*), 15 s. per 1/16 sq m. Transect 3 (grab; depth: 40 m; bottom: muddy) sediment contained only shell residues (6 shells); VIR ISLAND AREA: transect 1 (depth: 5 m; *Cystoseira ercegovicii*), 9 s. per 1/16 sq m. Transect 8 (depth: 5 m; bottom: rocky and *Sargassum salicifolium*), 3 s. per 1/16 sq m. Transect 10 (depth: 1 m; bottom: rocky and *Cystoseira crinitophylla)*, 11 s. Transect 6 (depth: 6 m; bottom: sandy and *Cymodocea nodosa*), 2 s. Transect 8 (depth: 15 m; bottom: sand and *Posidonia oceanica*), 34 s; KRK ISLAND AREA: shelly residues on muddy bottoms (depth: 30-40 m); SESTRUNJ ISLAND AREA: opposite the island Tri sestrice. Between 4 and 8 m bottom is rocky, slightly sloping with stone bulks and stones (biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis). The specimens of *Jujubinus striatus* were frequent on stone bulks, stones and algae; VIS ISLAND AREA: Ploča shoal (depth: 15 m; bottom: rocky - a reef in the area of sandy bottom). The sample of *Cystoseira corniculata* from area of 1/16 sq m contained 3 specimens. Cove Gradac area (dredge; depth: 70-85 m; bottom: lithothamnium; coralline biocoenosis), 2 s.; HVAR ISLAND AREA: reef near Zečevo Island (depth: 10 to 15 m; bottom: rocky). Of algae *Cystoseira adriatica, Sargassum salicifolium* and *Sargassum hornschuchi* are frequent (biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis). The sample of *Sargassum hornschuchi* contained 5 specimens and the sample of *Cystoseira adriatica* 8 specimens; SILBA ISLAND AREA: Pocukmarak cape (depth: 2.5 m; bottom: hard; dominance of the algae: *Cystoseira barbata* and *Cystoseira adriatica*; biocoenosis of photophilic alagae). *Cystoseira adriatica* sample contained 14 specimens, whereas 54 specimens were found at 10 m depth (dredge; bottom: hard; dominance of *Cystoseira ercegovicii*, biocoenosis of photophilic algae), KOLOČEP ISLAND AREA: northwestern side (dredge; depth: 45-50 m; bottom; lithothamnium; coralline biocoenosis), 2 s.

Discussion: GRAEFFE (1902) recorded the species *Jujubinus striatus* from the area of Trieste. It was reported for the area of Rovinj by: WIMMER (1883) among algae at 3-4 m depth, VATOVA (1928) among the algae along shore, ZAVODNIK (1967a) in phytal. M.

STOSSICH (1880) described it as numerous in the Adriatic, at medium depths on stones and algae, HELLER (1864) as frequent down to 3.5 m depth in the central and southern Adriatic, RIEDL (1963) as common and very frequent among algae (*Cystoseira* genus), on the rocky shores of the northern Adriatic and STJEPČEVIĆ (1967) among stones at 5-20 m depth on the rocky shores of Bay of Herceg Novi. My observations showed this species to be frequent and rather numerous Adriatic gastropod. It is distributed all along the eastern Adriatic coast. It inhabits the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and coralline biocoenosis on hard substrate overgrown by algae. Some specimens were recorded below 80 m depth. It is frequent on mobile substrate (sometimes occurring in large numbers) in the biocoenosis of meadows of marine phanerogams. Muddy bottoms appear to be limiting factors of its distribution (grab samples frequently contained several shells).

Conclusion: Jujubinus striatus is frequent Adriatic species. It inhabits the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and coralline biocoenosis on hard substrate overgrown by algae. It is frequent on mobile substrate (sometimes occurring in large numbers) in the biocoenosis of meadows of marine phanerogams. Muddy bottoms appear to be limiting factors of its distribution.

Jujubinus exasperatus (PENNANT, 1777)

Syn.: *Trochus exasperatus* PENNANT, 1777; *Trochus exiguus* PULTENEY, 1799; *Trochus crenulatus* BROCCHI, 1814; *Trochis pyramidatus* LAMARC, 1822; *Zizyphinus crenulatus* BRUSINA, 1866; *Calliostoma exasperatum* DAUTZENBERG & FISCHER, 1906.

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; B.D.D., 1882-1886; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; COEN and VATOVA, 1933; COEN, 1937; RIEDL, 1963; ZAVODNIK, 1967a; TAVIANI; 1978; VIO *et al.*, 1979; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.

Mediterranean and Atlantic: PHILIPPI, 1836, 1844; JEFFREYS, 1865; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; 1884; B.D.D., 1882-1886; CARUS, 1889-1893; HIDALGO, 1917; PRIOLO, 1952; NORDSIECK, 1968; BOMBACE, 1970; PARENZAN, 1970; RIEDL, 1983.

Distribution: Atlantic (southern coast of England, Channel Islands, France, Spain, Portugal, Morocco, Madeira, Cannary Islands and Azores), Mediterranean.

Results of studies:
This species was considerably more poorly represented than the preceding species in the algal samples collected from 1/16 sq m, in the biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis as well as in the material collected from coralline biocoenosis and biocoenosis of meadows of marine phanerogams. The same applies to the shells in sediment .

Discussion: GRAFFE (1902) recorded the species *Jujubinus exasperatus* from the area of Trieste. WIMMER (1883) described it as frequent among algae between 2 and 4 m depth near Rovinj. RIEDL (1963), as well, believed it to be common and very frequent among algae (*Cystoseira* genus) on the rocky shores of the northern Adriatic. ZAVODNIK (1967a) reported it for the phytal of the vicinity of Rovinj. GRUBE (1864) mentioned it for the area of Lošinj, STJEPČEVIĆ and PARENZAN (1980) for Bay of Boka kotorska and HELLER (1864) for the central and southern Adriatic. COEN and VATOVA (1933) reported it as

rare on muddy and detritic bottoms. As I found it this species inhabits the same habitat types as the preceding species, even though its number of specimens is much smaller.

Conclusion: The species *Jujubinus exasperatus* inhabits the same habitat types as the preceding species, even though its of specimens is much smaller

Clanculus cruciatus (LINNAEUS, 1767)

Syn.: *Trochus cruciatus* LINNAEUS, 1767; *Monodonta vieillotii* PAYRAUDEAU, 1862; *Trochus mediterraneus* WOOD, 1829; *Trochus vieillotii* DESHAYES, 1832; *Clanculus vieillotii* BRUSINA, 1866; *Clanculopsis cruciata* DAUTZENBERG, 1833.

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; M: STOSSICH, 1880; B.D.D., 1882-1886; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; VATOVA; 1928; COEN and VATOVA, 1933; COEN, 1937; RIEDL, 1963; VIO *et al.*, 1979; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878, 1884; B.D.D., 1882-1886; CARUS, 1889-1893; PRIOLO, 1951; NORDSIECK, 1968; PARENZAN, 1970; RIEDL, 1983.

Distribution: Atlantic (Cape Verde Islands), Mediterranean.

Results of studies:
Transects: MAKARSKA AREA: western entrance to the port (depth: 7m; bottom: rocky), 3 s., depth : 30 m (bottom: muddy-sandy and *Vidalia volubilis*), shelly residues; ŠIBENIK AREA; transect 3 (depth: 2 m; bottom: rocky-stony), *Cystoseira ercegovicii* (sample from 1/16 sq m), 2 s.; BIOGRAD AREA: transect 1 (depth: 5 m; bottom: sandy with stones), 2 s. below stones. Transect 2 (depth: 4-7 m; bottom: stone bulks with a lot of shaded fissures rich in plant material), 38 specimens collected (biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis); ZADAR AREA: transect 2 (depth: 15 m; bottom: sandy with stones and *Posidonia oceanica*), 2 s.; VIR ISLAND AREA: transect 1 (depth: 5 m; bottom: rocky and *Cystoseira ercegovicii*), 3 s. per 1/16 sq m. Transect 6 (depth: 0.5 m), 2 s. Transect 7 (depth: 4 m; bottom: rocky and *Sargassum salicifolium*), 8 specimens. Transect 8 (depth: 30 m; bottom: sand and *Posidonia oceanica*), shelly residues. Transect 9 (depth: 35 m; bottom: muddy-sandy), shelly residues. Transect 11 (depth: 25 m: bottom: muddy-sandy with *Vidalia volubilis*), shelly residues; KRK ISLAND AREA: Čuf cape (shoal), 1 s. below the stone. Transect 3 (depth: 20 m; bottom: sandy-muddy with *Vidalia volubilis*), shelly residues. Transect 8 (depth: 30 m; bottom: muddy-sandy with the residues of the species *Vidalia volubilis*), shelly residues; SESTRUNJ ISLAND AREA: (opposite the island Tri sestrice). Between 4 and 8 m bottom is rocky, slightly sloping with stone bulks and stones (the biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis). It is more frequent and numerous on rocks and among stones; SILBA ISLAND AREA: (Pocukmarak cape). From surface to 8 m depth the substrate is rocky, slightly sloping with stone bulks (up to 1m high) and stones. A total of 46 specimens were collected; HVAR ISLAND AREA: reef near Zečevo Island (depth: 10-15 m; bottom: rocky). Seven specimens were collected. Lukavci cliffs (depth: 54-62 m; bottom: lithothamnium; coralline biocoenosis), 5 specimens; VIS ISLAND AREA: near Gradac cove (depth: 70-85 m; bottom: lithothamnium), coralline biocoenosis (coralline plateau), 2 specimens.

Discussion: GRAEFFE (1902) recorded the species *Clanculus cruciatus* from the area of Trieste, VATOVA (1928) and COEN and VA-

TOVA (1933) as rare on the stones, muddy and detritic bottoms along the coast near Rovinj, whereas RIEDL (1963) mentioned it as common on stones and among algae. HELLER (1864) believed it to be fairly frequent in the central and southern Adriatic, and M. STOSSICH (1880) to be fairly numerous all along the Adriatic coast. STJEPČEVIĆ and PARENZAN (1980) reported it for Bay of Boka kotorska. As I found it and as available data show, the species *Clanculus cruciatus* is a frequent Adriatic species. It prefers shaded parts occurring in large numbers on lot of localities. Up to 10 shells could be found in sediment samples obtained by grab. With respect to the bottom type* the species *Clanculus cruciatus* inhabits hard bottoms, whereas it could be found on mobile bottom but only at places where there is at least an element of hard substrate. I recorded it from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis, coralline biocoenosis and biocoenosis of the meadows of *Posidonia oceanica* where some elements of hard substrate were present.

Conclusion: Clanculus cruciatus is a hard substrate representative. It is frequent Adriatic species, occuring in large numbers on lot of localities. It inhabits the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis, coralline biocoenoosis and biocoenosis of meadows of marine phanerogams in sites where some elements of hard substrate are present.

Clanculus corallinus (GMELIN, 1790)

Syn.: *Trochus corallinus* GMELIN, 1790; *Trochus pharaonius* OLIVI, 1792; *Trochus roseus* VON SALIS, 1793; *Monodonta couturi* PAYRAUDEAU, 1826; *Otavia corallina* RISSO, 1826; *Trochus couturi* BLAINVILLE, 1830; *Mondonta carollina* PHILIPPI, 1844; *Trochus multigranus* PHILIPPI, 1848

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; MONTEROSATO, 1878, 1884; M. STOSSICH, 1880; B.D.D., 1882-1886; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; VATOVA; 1928; COEN and VATOVA, 1933; COEN, 1937; RIEDL, 1963; STJEPČEVIĆ, 1967; RADIĆ, 1982.
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; MONTEROSATO, 1878, 1884; ARADAS and BENOIT, 1870; B.D.D., 1882-1886; CARUS, 1889-1893; PRIOLO, 1952; NORDSIECK, 1968; PARENZAN, 1970; RIEDL, 1983.

Distribution: Atlantic (Senegal), Mediterranean.

Results of studies:
This species was considerably more poorly represented than the preceding species in the algal samples collected from 1/16 sq m in the biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis as well as in the material collected from coralline biocoenosis. The same applies to the shells in sediment .

*ERCEGOVIĆ (1960 a,b, 1964, 1966) distinguished four types of Adriatic bottoms: rocky, lithothamnium-shelly, sandy and clayey-silty. He reported that the Adriatic algal vegetation was densest on compact rocky and lithothamnium-shelly bottoms, whereas some elements of vegetation occurred in only well shaded areas on mobile bottoms. He believed that the reduction and impoverishment in vegetation on some bottoms was due, in the first place, to the lack of hard, particularly stone, substrate. I hold that, as to the number of species and habitat type, Prosobranchiata group is very similar to algal group. The highest number of gastropod species inhabits hard substrate, considerably smaller number sandy bottom and the lowest number muddy bottoms. Like in the algal group, missing of hard substrate may be the main cause of reduction in the number of species on mobile bottoms.

Discussion: GRAEFFE (1902) recorded *Clanculus corallinus* from the area of Trieste, WIMMER (1883) on mud (12-20 m) and A. STOSSICH (1865) and COEN and VATOVA (1933) on sponges around Rovinj. M. STOSSICH (1880) found it to occur in small numbers at medium depths in the Adriatic, and RIEDL (1963) reported it as common on stones and among algae, more frequent at secondarily stiffened bottoms at depths exceeding 10 m. STJEPČEVIĆ (1967) reported single specimens from Boka kotorska Bay which he found on stones and rocks overgrown by algae between 8 and 23 m depths. He also stated that this species inhabited depth of even 200 m in the open parts of the central and northern Adriatic*. As I found it, their species inhabits the same habitats as the preceding species only the number of its specimens is considerably lower.

Conclusion: Clanculus corallinus inhabits the same habitats as the preceding species only the number of its specimens is considerably lower.

Astraea rugosa (LINNAEUS, 1767)

Syn.: *Turbo rugosus* LINNAEUS, 1787; *Trochus solaris* BROCCHI, 1814; *Trochus rugosus* PHILIPPI, 1836; *Pachypoma rugosa* CHENU, 1859; *Bolma rugosa* BRUSINA, 1866

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1861, 1864; HELLER, 1864; A. STOSSICH, 1865; WEINKAUFF, 1868; M. STOSSICH, 1880; B.D.D., 1882-1886; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ZIMMERMANN, 1905-1906; ODHNER, 1914; COEN and VATOVA, 1933; COEN, 1937; RIEDL, 1963; GAMULIN-BRIDA, 1967a,b; STJEPČEVIĆ, 1967; GAMULIN-BRIDA *et al.*, 1968; TAVIANI, 1980; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; CARUS, 1889-1893; PRIOLO, 1952; NORDSIECK, 1968; PARENZAN, 1970; BOMBACE, 1970; DANCE, 1974; RIEDL, 1983.

Distribution: Atlantic (Cannary Islands, Madeira, coasts of Portugal, Spain, France), Mediterranean.

Results of studies:
Transects: ŠIBENIK AREA: transect 1 (depth: 30 m; bottom: sandy and *Posidonia oceanica*), 2 s. Transect 3 (depth: 20 m; bottom: sandy and *Posidonia oceanica*), 2 s. VIR ISLAND AREA: transect 7 (depth: 40 m; bottom: muddy-sandy and *Vidalia volubilis*), 3 s. Transect 8 (depth: 25-35 m; bottom: sandy-muddy with *Posidonia oceanica* and *Vidalia volubilis*), 1s.; KRK ISLAND AREA: trasnect 5(depth: 30 m; bottom: muddy-sandy and *Vidalia volubilis*), 1 s.; DUBROVNIK AREA: between the island Koločep and the mainland (depth: 25-35 m; *Vidalia volubilis* made up 80% of the dredge sample), 2 s.; VIS ISLAND AREA: fissure near Gradac cove (depth: 72-85 m; bottom: lithothamnium), 4 s. Ploča shoal (depth: 15 m; bottom: reef in an area of sandy bottom). Two specimens found on the reef; HVAR ISLAND AREA: reef near island Zečevo (depth:10-15 m), 5 s. Lukavci cliffs (depth: 54-62 m; bottom: lithothamnium), 3 s.; "PIPETA" EXPEDITION: A(9): 6 Nm off Novigrad towards Umag (depth: 28-30 m; biocoenosis of detritic more or less muddy bottoms, *Microcosmus sulcatus* facies). On the average 12 specimens of *Astrea rugosa* were
found by an hour haul of bottom trawl. Station E(7): 4.5 Nm off Premuda Island (depth: 64-67 m; bottom: sandy with lithothmnium pebbles; corlline biocoenosis). On the average 7 specimens of *Astrea rugosa* would be found by an

* I really do not know to which part of the northern Adriatic the author referred (Šimunović)

hour net haul. The species *Holothuria forskali* occurred in greatest numbers.

Discussion: Astrea rugosa inhabits both hard and mobile substrate. GRUBE (1861) reported it as numerous in the area of Trieste. It was reported for the area of Rovinj by: ODHNER (1914), ZIMMERMANN (1905-1906), WIMMER (1883). GAMULIN-BRIDA (1967a) described this species in the biocoenosis of detritic more or less muddy bottoms (depth:10-37 m) and in the biocoenosis of coastal terrigeneous muds f. viscous muds (depth: 33-35 m) near Rovinj. The same author recorded it between 10 and 15 m on submarine reefs west of Vis Island. M: STOSSICH (1880) reported it as numerous throughout the Adriatic, HELLER (1864) as frequent in the central and southern Adriatic on coarse sands and in marine meadows and A. STOSSICH (1865) as numerous in the northern Adriatic on calcified substrates. COEN and VATOVA (1933) described it as numerous on rocky bottom overgrown by algae but also as the species which can occur at greater depths, on detritic and rocky detritic bottoms inhabited by the species *Arca noae*. STJEPČEVIĆ (1967) recorded several specimens between 15 and 30 m on hard substrate overgrown by algae in Bay of Boka kotorska and a large number of juvenile specimens in Herceg Novi Bay. RIEDL (1963) reported it as common but not frequent on hard bottoms between phytal and great depths. After my own research, the species *Astrea rugosa* could be found on both mobile and hard bottoms (sandy-muddy and muddy-sandy). I recorded no living specimen from coastal terrigeneous muds and muds of the open sea. The greatest depth I found it at was 85 m. I believe that it is a common Adriatic species not occurring in large numbers as reported by some above mentioned authors. I recorded it from the biocoenosis of *Posidonia oceanica* meadows, biocoenosis of detritic more or less muddy bottoms, precoralline aspect of coralline biocoenosis and coralline biocoenosis.

Conclusion: The species *Astrea rugosa* could be found on both mobile and hard bottoms. I believe that it is a common Adriatic species not occurring in large numbers as reported by some above mentioned authors. I recorded it from the biocoenosis of *Posidonia oceanica* meadows, biocoenosis of detritic more or less muddy bottoms, precoralline aspect of coralline biocoenosis and coralline biocoenosis.

Littorina neritoides (LINNAEUS, 1767)

Syn.: *Turbo neritoides* LINNAEUS, 1767; *Turbo saxatilis* OLIVI, 1792; *Helix petraea* MONTAGU, 1803; *Turbo caerulescens* LAMARC, 1822; *Littorina basterotii* PAYRAUDEAU, 1826; *Rissoa elegans* RISSO, 1826; *Turbo petraeus* BLAINVILLE, 1830; *Littorina caerulescens* LAMARC, 1843

Previous reviews:
- Adriatic: OLIVI, 1792; GRUBE, 1861, 1864; HELLER, 1864; JEFFREYS, 1865; BRUSINA, 1865; A. STOSSICH, 1865; WEINKAUFF, 1868; M. STOSSICH, 1880; B.D.D., 1882-1886; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ZIMMERMANN, 1905-1906; VATOVA, 1928; COEN and VATOVA, 1933; COEN, 1937; ZEI, 1955; HORVAT, 1963; RIEDL, 1963; GAMULIN-BRIDA, 1967a, 1974; STJEPČEVIĆ, 1967; ŠIMUNOVIĆ, 1970; VIO *et al.*, 1979; RADIĆ, 1982.
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; FORBES and HAINLEY, 1848b; JEFFREYS, 1865; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; CARUS, 1889-1893; NORDSIECK, 1968; PARENZAN, 1970; RIEDL, 1983.

Distribution: Atlantic (from the coast of Norway, accross Zetland Islands, England, Ireland, Helgoland Island, Germany, Portugal, Spain, France to Morocco, with Cannary Islands, Azores and Madeira I.), Mediterranean.

Results of studies:
DUBROVNIK AREA: at transect 1 its abundance was 2 to 3 s. per 1/16 sq m. It could reach 4 m above the sea level (rocks are steep and relatively smooth). At transect 2 the coast is erroded and full of fissures. Single specimens could be found at even 14 m height. Up to 20-25 specimens were found in fissures 20 to 30 cm long and 3 to 4 cm wide at 5 m height. At transect 3, its abundance was 10-12 s. per 1/16 sq m at 2 m height. At transect 4 it reached 1.5 m height; MAKARSKA AREA: western entrance to the port: most numerous in the mediolittoral pools (220-230 s. per 1/16 sq m); SPLIT AREA; recorded from all 19 transects. It occurred in greatest numbers on eroded rocks of smaller slope angle (25-35^0) and in mediolittoral pools. So at transect 6, 315 specimens per 1/16 sq m were counted in a mediolittoral pool; 227 specimens at 1 m heigh and 32 s. per 1/16 sq m at 1.5 m. At transect 11, 145 s. per 1/16 sq m were counted at 0.5 m height, and 120 specimens in lower supralittoral (height: 1 m) at transect 13. The situation is similar on other transects as to the numbers of individuals and dependent on exposure, height, slope and physical structure of microbiotope; ŠIBENIK AREA: *Littorina neritoides* was well represented all over the ŠIBENIK Channel. At transect 2 (a side of Zlarin Island) it was particularly numerous in lower supralittoral where it occurs with an uninterrupted abundance of 110 to 120 s. per 1/16 sq m. Its abundance was still greater, 180-190 s. per 1/16 sq in supralittoral pools. Transect 1 (a side of Zlarin Island) its abundance was 145-155 s. per 1/16 sq m in mediolittoral pools and 7-10 specimens on surrounding mediolittoral rocks. The lower supralittoral pools showed from 35 to 45 specimens whereas 12 to 15 s. per 1/16 sq m on surrounding rocks. At trasnect 3 (side of Drvenik Island) the fissures of eroded rocks of upper mediolittoral and lower supralittoral are abundantly inhabited by this species. I found no specimen of *Littorina neritoides* in ŠIBENIK Bay, which is a single area along the Adriatic coast wherefrom I did not record this species on rocky shores. BIOGRAD AREA: well represented all over the area; ZADAR AREA: well represented all over the area; VIR ISLAND AREA: common and frequent at all 12 transects. Numbers of this species on individual transects depends on the shore exposure, height, slope and physical structure of microbiotope; KRK ISLAND AREA: as to the numbers of this species, the situation is very similar to the other parts of the Adriatic coast (it occurs in highest numbers in mediolittoral pools and lower supralittoral of exposed shores). It is interesting to notice that all along the Adriatic coast the specimens found on rocks and in mediolittoral pools were smaller, darker in colour and going towards supralittoral bigger and markedly grey.

Disscussion: The species *Littorina neritoides* is markedly a representative of rocky shores. It is one of the most abundant gastropods along the eastern Adriatic coast. It is most numerous in mediolittoral pools and in lower supralittoral, being more and more rare going up towards the upper limits of the step. It occurs in higher numbers on less steep than on steep rocks of exposed shores whereas only single specimens can be found on vertical rocks. It abundance is also greater on exposed than on sheltered shores. I recorded it from as high a point as 14 m above the sea level on exposed shores. With respect to the physical structure of microbiotope the configuration of the shore appears to be very important both for its distribution and abundance. It is most abundant in places which are very rough and full of fissures and pits, where it finds shelter from the waves which can wash this small gastropod away from the shore. It is interesting to notice that all along the Adriatic coast the specimens found on rocks and in mediolittoral pools were smaller and of darker colour and bigger and markedly grey going towards supralittoral. It is distributed in the biocoenoses of medio and supralittoral rocks. The data of a large number of authors describing *Littorina neritoides* in the Adriatic are mainly complementary. ZEI (1955) reported for the area of Rovinj that this species was distributed up to 2 m above the sea level and

most numerous in the uppermost part of the emersion zone. The same author found it to be more frequent in exposed than in sheltered area, on less steep rocky sites where the waves pour along the rocks and slowly flow back. This author also found only single specimens on vertical rocks and below stones. STJEPČEVIĆ (1967) reported it numerous in Bay of Boka kotorska, stating that rocks turned south were better inhabited by *Littorina neritoides* than rocks turned north and that the number of species in the outer part of the bay exceeded that in the inner part. GAMULIN-BRIDA (1967a) reported that *Littorina neritoides* was distributed on solid substrate all along the Adriatic coast, including islands and that it was characteristic of the biocoenosis of supralittoral rocks.

Conclusion: Littorina neritoides is markedly a representative of rocky shores. It occurs in highest numbers in mediolittoral pools and in lower supralittoral. It is more abundant on less steep than on steep rocks of exposed shores and occurs in higher numbers on exposed than on sheltered shores. Its distribution and abundance are partly affected by the shore configuration. The highest point it reaches upshore is 14 m. The specimens found on rocks and in mediolittoral pools were smaller and of darker colour and bigger and markedly grey going towards supralittoral. It is distributed in the biocoenoses of medio and supralittoral rocks.

Alvania cimex (LINNAEUS, 1767)

Syn.: *Turbo cimex* LINNAEUS, 1767; *Turbo calathiscus* MONTAGU, 1808; *Alvania europea* RISSO, 1826; *Alvania freminvillea* RISSO, 1826

Previous reviews:

- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1861, 1864; HELLER, 1864; BRUSINA, 1865; A. STOSSICH, 1865; WEINKAUFF, 1868; B.D.D., 1882-1886; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; VATOVA, 1928; COEN and VATOVA, 1933; COEN, 1937; HORVATH, 1963; RIEDL, 1963; ZAVODNIK, 1967a; TAVIANI, 1978, 1980; VIO *et al.*, 1979; STJEPČEVIĆ and PARENZAN, 1980.

Mediterranean and Atlantic: PHILIPPI, 1836, 1844; FORBES and HAINLEY, 1848b; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878, 1884; B.D.D., 1882-1886; CARUS, 1889-1893; PRIOLO, 1953; NORDSIECK, 1968; PARENZAN, 1970; RIEDL, 1983.

Distribution: Atlantic (southern coast of England, southern, eastern and western coast of Ireland, southern coast of Spain, Azores), Mediterranean.

Results of studies:

I recorded the specimens of *Alvania cimex* in samples of the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and in samples of algae (*Cystoseira barbata, Cystoseira adriatica, Cystoseira stricta* var. *spicata, Cystoseira corniculata, Cystoseira corniculata* ssp. *laxior, Cystoseira ercegovicii, Cystoseira compressa, Sargassum salicifolium, Sargassum hornsuchi*) collected from a surface area of 1/16 sq m all over the study area (Dubrovnik, Makarska, Split, Biograd, Šibenik, Zadar, Vir Island, Krk Island, Sestrunj Island, Silba Island, Hvar Island, Vis Island). The number of specimens varied from one sample to another and is primarily dependent on the level of shore exposure, richness of algae and depth. The highest numbers were recorded from sheltered shore parts, in calm water where frequently 20, 30 and 40 specimens were found on an area of 1/16 sq m. Samples with a larger number of individuals were rarer such as on transect 2 (BIOGRAD AREA) where the sample of *Cystoseira barbata* (depth: 0.5 m) counted 93 specimens. The number of individuals suddenly decreases on exposed areas. So, for example, the samples of the species *Cystoseira stricta* var. *spicata* contained single or a very small number of specimens. The number of individuals diminishes with depth, as well. Mate-

rial collected from 20 m depth (solid substrate) contained single specimens. Sediment obtained by grab from a number of localities (SPLIT AREA: between 10 and 30 m with developed *Posidonia oceanica*; ŠIBENIK AREA: at 26 m bottom is sandy with *Posidonia oceanica* and *Vidalia volubilis*; VIR ISLAND AREA: t. 6, depth: 5 m, sand with *Cymodocea nodosa,* and at 38 m sand with lithothamnium pebbles; KRK ISLAND AREA: t. 5, depth: 30 m, sand) was rich in shell residues of species of genera *Alvania* and *Rissoa.*

Discussion: Alvania cimex belongs to the group of the most abundant gastropods in the Adriatic Sea. It is distributed all along the eastern Adriatic coast. GRAEFFE (1902) recorded it from the area of Trieste. A. STOSSICH (1865) described it as numerous on sandy bottoms of the northern Adriatic. COEN and VATOVA (1933) also reported its as numerous on sandy bottoms in the vicinity of Rovinj, and RIEDL (1963) held it in general an abundant species on the shores where algae are well developed. BRUSINA (1866) mentioned *Alvania cimex* as numerous throughout Dalmatia. HORVATH (1963) recorded it as an inhabitant of algae, living either on or among them on rocky bottoms. It was reported from Bay of Boka kotorska (southern Adriatic) by STJEPČEVIĆ and PARENZAN (1980). As I found it, all or almost all species of *Alvania* genus inhabit the same habitat type. They live on hard substrate overgrown by algae, and numerous shell residues in sediment as well as rare living specimens on the leaves of marine phanerogams, originate from upper sea water layers and were brought there by mechanical wave activity or by currents. FORBES and HANLEY (1848b) reported the record of only dead specimens (shells) of *Alvania cimex* in the material collected by dredge at 27 m depth (coast of England). It is most numerous in sheltered parts of the shore and in calm water. The number of specimens markedly drops with depth and shore exposure. Like other species of genera *Alvania* and *Rissoa* I recorded it from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and coralline biocoenosis.

Conclusion: The species *Alvania cimex* belongs to the group of the most abundant gastropods in the Adriatic Sea. It is distributed all along the eastern Adriatic coast. It lives on hard substrate overgrown by algae. Mobile substrate (sand, mud) is a limiting factor of this species distribution. I recorded it from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and coralline biocoenosis.

Alvania montagui (PAYRAUDEAU, 1826)

Syn.: *Rissoa montagui* PAYRAUDEAU, 1826; *Alvania sardea* RISSO, 1826; *Rissoa montacuti* JEFFREYS, 1884; *Rissoa cimex* SCACCHI, 1836; *Rissoa europea* PETIT, 1852; *Alvania calathiscus* H. & A. ADAMS, 1858; *Acinus cimex* MONTEROSATO, 1884; *Turbona cimex* NORDSIECK, 1972

Previous reviews:
- Adriatic: GRUBE, 1861, HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; VATOVA, 1928; COEN and VATOVA, 1933; COEN, 1937; RIEDL, 1963; ZAVODNIK, 1967a; TAVIANI, 1978, 1980; VIO *et al.*, 1979;
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878, 1884; B.D.D., 1882-1886; CARUS, 1889-1893; PRIOLO, 1953; NORDSIECK, 1968; PARENZAN, 1970; RIEDL, 1983.

Distribution: Atlantic (Madeira I., southern coast of of Spain), Mediterranean.

Results of studies:
I recorded specimens of *Alvania montagui*

from precoralline aspect of coralline biocoenosis, coralline biocoenosis and biocoenosis of photophilic algae. Like *Alvania cimex* it was most abundant in sheltered parts of the shore, in the uppermost part of infralittoral where the samples of algae from an area of 1/16 sq m frequently contained 20, 30, 40 and even more than 50 specimens. Samples with a large number of individuals were rather rare such as the sample of *Cystoseira barbata* (depth: 1 m) from transect 6 (VIR ISDLAND: cove Radnjača) which contained 106 individuals of this species. The number of individuals markedly declines with depth and greater shore exposure. A grab sediment samples (depth: 6-30 m) contained only shells of *Alvania montagui.*

Duscussion: The numbers of *Alvania montagui* were higher in sheltered places of the uppermost littoral part. The number of individuals markedly declines with depth and greater shore exposure. A grab sediment samples (depth: 6-30 m) contained only shells of *Alvania montagui.* GRAEFFE (1902) recorded this species from the area of Trieste. WIMMER (1883) described it as frequent among algae (the area of Rovinj) between 2 and 4 m. A. STOSSICH (1865) and COEN and VATOVA (1933) reported large numbers of this species on algae in the area of Rovinj. ZAVODNIK (1967a) recorded a large number of this species (Rovinj area) from calm water (sheltered areas) and particularity in sites with intensive sedimentation. RIEDL (1983) reported it as species occurring on the rock ridges among algae. M. STOSSICH (1880) reported it from both the northern and central Adriatic, and HELLER (1864) as frequent on sandy bottoms of the southern Adriatic.

Conclusion: Numbers of *Alvania montagui* are highest in sheltered places of the uppermost littoral part. Mobile bottoms are limiting factor of its distribution.

Rissoa variabilis (MÜHLFELD, 1824)

Syn.: *Helix variabilis* MÜHLFELD, 1824; *Rissoa costata* DESMAREST, 1814; *Turbo rissoanus* DELLE CHIAJE, 1829

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; MONTEROSATO, 1878, 1884; M. STOSSICH, 1880; B.D.D., 1882-1886; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; VATOVA, 1928; COEN and VATOVA, 1933; COEN, 1937; HORVATH, 1963; RIEDL, 1963; GAMULIN-BRIDA, 1967a, b and 1974; ZAVODNIK, 1967a, 1971; ; GAMULIN-BRIDA *et al.*, 1968; VIO *et al.*, 1979; RADIĆ, 1982.
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878, 1884; B.D.D., 1882-1886; CARUS, 1889-1893; PRIOLO, 1954; NORDSIECK, 1968; PARENZAN, 1970; RIEDL, 1983.

Distribution: Atlantic (coasts of of Spain and Portugal), Mediterranean.

Results of studies:
I recorded specimens of *Rissoa variabilis* from precoralline aspect of coralline biocoenosis, coralline biocoenosis and biocoenosis of photophilic algae and in samples of algae collected from an area of 1/16 sq m. It was most abundant in sheltered parts of the shore, in calm water where frequently 30, 40 and even 50 specimens would be found. Its largest number was recorded from island Silba (Pocukmarak cape). A total of 122 specimens were counted in a sample of *Cystoseira barbata*, and 114 specimens in a *Cystoseira adriatica* sample (rocky substrate, slightly sloping, 80% covered by mentioned algae). With depth and shore exposure the number of specimens is evidently smaller and, as a rule, this species occurs in small numbers. Sediment obtained by grab from a number of localities (depth: from 6 to 30

m) was rich in shell residues of species of genera *Alvania* and *Rissoa.*

Discussion: The species *Rissoa variabilis* belongs to the group of most abundant gastropods in the Adriatic. It is distributed all along the eastern Adriatic coast. GRAEFFE (1902) recorded it from the area of Trieste. A. STOSSICH (1865) descibed it as numerous on sandy bottoms of the northern Adriatic, and COEN and VATOVA (1933) as numerous on algae, at 2-4 m depth in the port of Rovinj. GAMULIN-BRIDA (1967a,b and 1974) recorded it from the biocoenosis of photophilic algae, biocoenosis of meadows of *Posidonia oceanica* and other marine phanerogams, believing it to be characteristic of the biocoenosis of photophilic algae. RIEDL (1963) also mentioned it as common and very frequent among algae (*Cystoseira, Laurencia, Cladophora*) and in marine phanerogams at small depths. ZAVODNIK (1967, 1971a) recorded it from a mixed community of sandy bottom (island Dvije sestrice near Rovinj - depth: 9 m), at station with rich floral component (*Cymodocea nodosa, Cystoseira adriatica, Cystoseira barbata, Cystoseira ercegovicii, Udotea desfontaini, Halimeda tuna*). The same author found it in the phytal in the vicinity of Rovinj and reported it as an exclusive species of the biocoenosis of photophilic algae. ZAVODNIK (1967a) stated that gastropods were rather rare in the exposed area of the island Banjole (vicinity of Rovinj) whereas some species occur in continuation and in large numbers in calm waters particularly those with intensive sedimentation. This author mentioned *Rissoa variabilis* along with some other species. BRUSINA (1866) reported it as frequent in the areas of Zadar, Hvar and Dubrovnik, and HORVATH (1963) as a species living on algae or among algae and on stones in the area of Split. After my own observations *Rissoa variabilis* is preferentially the species of the biocoenosis of photophilic algae, and large numbers of shell residues in sediments as well as rare living specimens found on the leaves of marine phanerogams come from the upper layers and were brought down by mechanical wave action or by sea currents. Mobile substrate (sand and mud) are limiting factors of its distribution. It prefers rather calm and sheltered parts of the shore. Its numbers are abruptly reduced with depth and shore exposure.

Conclusion: The species *Rissoa variabilis* belongs to the group of most abundant gastropods in the Adriatic. It is distributed all along the eastern Adriatic coast. It is preferentially the species of the biocoenosis of photoiphilic algae, and large numbers of shell residues in sediments as well as rare living specimens found on the leaves of marine phanerogams come from the upper layers and were brought down by mechanical wave action or by sea currents. Mobile substrate (sand and mud) are limiting factors of its distribution. It is most abundant on sheltered parts of the shore.

Rissoa violacea DESMAREST, 1814

Syn.: *Rissoa tricolor* RISSO, 1826; *Turbo mavers* BRUSINA, 1870; *Persephona violacea* MONTEROSATO, 1884

Previous reviews:
- Adriatic: HELLER, 1864; A. STOSSICH, 1865; JEFFREYS, 1867; BRUSINA, 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; B.D.D., 1882-1886; CARUS, 1889-1893; GRAEFFE, 1902; COEN, 1937.
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; JEFFREYS, 1867; WEINKAUFF, 1868; MONTEROSATO, 1878, 1884; B.D.D., 1882-1886; CARUS, 1889-1893; PRIOLO, 1954; NORDSIECK, 1968; PARENZAN, 1970; RIEDL, 1983.

Distribution: Atlantic (Zetland Islands, coasts of Norway, Great Britain, France, Spain and Portugal), Mediterranean.

Results of studies:
I recorded, as a rule, from 1 to 10 specimens of the species *Rissoa violacea* in algal samples collected from an area of 1/16 sq m. The samples with 5 specimens were more frequent than those with 5 to 10 specimens. Material collected from 20 m depth (solid substrate) contained single rare specimens of this species.

Discussion: The samples of algae with 5 specimens were more frequent than those with 5 to 10 specimens of this species. It belongs to the group of common and frequent Adriatic gastropods but compared to some other species of the genus *Rissoa* (*Rissoa variabilis, Rissoa ventricosa*) it was far less numerous. GRAEFFE (1902) recorded it from the area of Trieste. HELLER (1864) reported it for the area of central Adriatic, and M. STOSSICH (1880) for the northern and central Adriatic. A. STOSSICH (1865) described it as very rare at greater depth (northern Adriatic) and RIEDL (1963) reported it as locally common on algae present in the upper sublittoral.

Conclusion: I recorded, as a rule, from 1 to 10 specimens of the species *Rissoa violacea* in algal samples collected from an area of 1/16 sq m.

Rissoa splendida EICHWALD, 1830

Previous reviews:
- Adriatic: PHILIPPI, 1844; DANILO and SANDRI, 1856; BRUSINA, 1866; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; M. STOSSICH, 1880; CARUS, 1889-1893; GRAEFFE, 1902; COEN; 1937; ZAVODNIK, 1967a; NORDSIECK, 1968; VIO *et al.*, 1979; STJEPČEVIĆ and PARENZAN, 1980.
Mediterranean: WEINKAUFF, 1868; ARADAS and BENOIT, 1870; CARUS, 1889-1893; NORDSIECK, 1968; PARENZAN, 1970.

Distribution: Mediterranean.

Results of studies:
I recorded specimens of *Rissoa splendida* from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and coralline biocoenosis. It was most abundant in calm water of sheltered parts of the shore where the samples of algae from an area of 1/16 sq m frequently contained from 15 to 40 specimens. Samples with more than 40 individuals were rather rare. They were found in decreasing number with the increasing depth and, as a rule, it occurs in small numbers. Mobile substrate (sand, mud) is a limiting factor of its survival.

Discussion: The species *Rissoa splendida* belongs to the group of common and frequent gastropods along the eastern Adriatic coast. It is most abundant in sheltered parts of the shore where the samples of algae from an area of 1/16 sq m frequently contained from 15 to 40 specimens. They were found in decreasing number with the increasing depth and as a rule it occurs in small numbers. GRAEFFE (1902) recorded it from the area of Trieste. ZAVODNIK (1967a) reported it for the phytal in the area of Rovinj; DANILO and SANDRI (1856) for the area of Zadar and STJEPČEVIĆ and PARENZAN (1980) for Bay of Boka kotorska.

Conclusion: The samples of algae from the study area frequently contained from 15 to 40 specimens of *Rissoa splendida.*

Rissoa decorata PHILIPPI, 1846

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; BRUSINA, 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; B.D.D., 1882-1886; CARUS, 1889-1893; GRAEFFE, 1902; ZAVODNIK, 1967a; NORDSIECK, 1968; VIO *et al.*, 1979.
Mediterranean and Atlantic: PHILIPPI, 1844;

FORBES and HANLEY, 1848b; JEFFREYS, 1867; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878, 1884; B.D.D., 1882-1886; CARUS, 1889-1893; HIDALGO, 1917; NORDSIECK, 1968; PARENZAN, 1970; GRAHAM, 1971.

Distribution: Atlantic (Great Britain, France, Spain), Mediterranean.

Results of studies:
I recorded specimens of *Rissoa decorata* from precoralline aspect of coralline biocoenosis, coralline biocoenosis and biocoenosis of photophilic algae. After available data it is very similar to *Rissoa violacea* as to the number of specimens. Samples, as a rule, contained from 1 to 10 specimens. The samples with 5 specimens were more frequent than those with 5 to 10 specimens.

Discussion: After available data *Rissoa decorata* is very similar to *Rissoa violacea* as to the number of specimens. The samples of algae with 5 specimens were more frequent than those with 5 to 10 specimens of this species. GRAEFFE (1902) recorded it from the area of Trieste. ZAVODNIK (1967a) reported it for the phytal in the area of Rovinj; DANILO and SANDRI (1856) for the area of Zadar, M. STOSSICH (1880) for the Hvar Island. BRUSINA (1866) reported it as frequent in the Adriatic and throughout the Mediterranean.

Conclusion: I recorded, as a rule, from 1 to 10 specimens of the species *Rissoa decorata* in algal samples collected from an area of 1/16 sq m.

Rissoa auriscalpium (LINNAEUS, 1767)

Syn.: *Turbo auriscalpium* LINNAEUS, 1767; *Rissoa acuta* DESMAREST, 1814; *Zippora drumondi* LEACH, 1852; *Zippora auriscalpium* MONTEROSATO, 1884; *Goniostoma auriscalpium* NORDSIECK, 1972

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; BRUSINA, 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; B.D.D., 1882-1886; CARUS, 1889-1893; GRAEFFE, 1902; COEN, 1937.
Mediterranean: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878, 1884; B.D.D., 1882-1886; CARUS, 1889-1893; PRIOLO, 1954; NORDSIECK, 1968; PARENZAN, 1970.

Distribution: Mediterranean.

Results of studies:
I recorded, as a rule, small number of specimens of Rissoa auriscalpium from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and coralline biocoenosis collected from an area of 1/16 sq m. The samples mostly contained from 1 to 4 specimens. The samples with 1 and 2 specimens were more frequent than those with 3 and 4 specimens. I recorded the largest number of individuals in the sample of *Cystoseira barbata* (depth: 1 m) collected near Pocukmarak cape on Silba Island where 5 specimens were counted per an area of 1/16 sq m.

Discussion: I recorded, as a rule, from 1 to 4 specimens of *Rissoa auriscalpium* from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and coralline biocoenosis collected from an area of 1/16 sq m. I recorded 5 individuals only in the sample of *Cystoseira barbata* (depth: 1 m) collected near Pocukmarak cape on Silba Island.

Conclusion: The samples of algae mostly contained from 1 to 4 specimens of the species *Rissoa auriscalpium.*

Rissoa lineolata MICHAUD, 1832

Syn.: *Rissostomia lineolata* NORDSIECK, 1972

Previous reviews:
- Adriatic: GRUBE, 1864; BRUSINA, 1866; GRAEFFE, 1902; COEN and VATOVA, 1933; COEN; 1937; ZAVODNIK, 1967a; NORDSIECK, 1968.
Mediterranean: PHILIPPI, 1844; WEINKAUFF, 1868; MONTEROSATO, 1878; B.D.D., 1882-1886; PRIOLO, 1954; NORDSIECK, 1968; PARENZAN, 1970; RIEDL, 1963.

Distribution: Mediterranean.

Results of studies:
I recorded specimens of Rissoa lineolata from precoralline aspect of coralline biocoenosis, coralline biocoenosis and biocoenosis of photophilic algae. After collected data it is very similar to *Rissoa auriscalpium* as to the number of specimens. Samples, as a rule, contained from 1 to 5 specimens. The samples with 1 and 2 specimens were more frequent than those with 3, 4 and 5 specimens.

Discussion: Samples of algae, as a rule, contained from 1 to 5 specimens. The samples with 1 and 2 specimens were more frequent than those with 3, 4 and 5 specimens. GRAEFFE (1902) recorded it from the area of Trieste. COEN and VATOVA (1933) and ZAVODNIK (1967a) reported it for the vicinity of Rovinj. BRUSINA (1866) described it as much rarer than *Rissoa decorata*, and RIEDL (1963) reported it as common but not frequent at rock ridges and among present algae.

Conclusion: Material and samples collected from an area of 1/16 sq m. I recorded, as a rule, a small number of specimens of *Rissoa lineolata.*

Archimediella triplicata (BROCCHI, 1814)

Syn.: *Turbo triplicatus* BROCCHI, 1814; *Turbo duplicata* SANDRI, 1856; *Turbo turbona* MONTEROSATO, 1876

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; HELLER, 1864; BRUSINA, 1865; WEINKAUFF, 1868; M. STOSSICH, 1880; B.D.D., 1882-1886; CARUS, 1889-1893; VATOVA, 1928; COEN, 1937; RIEDL, 1963; GAMULIN-BRIDA *et al.*, 1968; SABELLI and SPADA, 1978; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; MONTEROSATO, 1878; B.D.D., 1882-1886; CARUS, 1889-1893; PRIOLO, 1955; NORDSIECK, 1968; BOMBACE, 1970; PARENZAN, 1970; SABELLI and SPADA, 1978; RIEDL, 1983.

Distribution: Atlantic (Cannary Islands and coast of Spain), Mediterranean.

Results of studies:
SPLIT AREA: transect 8 (depth: 15 m; bottom: sand and Posidonia oceanica; biocoenosis of the meadows of Posidonia oceanica), 3 s. Transect 13 (depth: 15m; bottom: sand and *Posidonia oceanica*) 2 s. Kaštela Bay: reef between Slatine and Arbanija (depth: 15 m; bottom: coarse sand; submarine fresh water springs; biocoenosis of coarse sands and fine gravels affected by bottom currents), 5 s; ŠIBENIK AREA: transect 3 (depth: 20 m; bottom: sandy with *Posidonia oceanica*), 1 s. Transect 2 (depth: 30 m; bottom: sandy; biocoenosis of coastal detritic bottoms), 3 s. Transect 1 (depth: 30 m; bottom: sandy: biocoenosis of coastal detritic bottoms), 1 s. Transect III (depth: 30 m; bottom: sandy; biocoenosis of coastal detritic bottoms), 2 s. Transect IV (depth: 40 m; biocoenosis of detritic more or less muddy bottoms), 1 s; Island Zlarin: position: vicinity of Veli Vrh (depth: 35

m; bottom: sand with a number of shelly residues; the species *Lythophyllum solutum* made up 50% of dredge sample), 11 s; BIOGRAD AREA: Transect 1 (depth: 15 m; bottom: sandy; biocoenosis of coastal detritic bottoms), 3 s. Transect 2 (depth: 15 m; bottom: sandy; biocoenosis of coastal detritic bottoms), 1 s. Transect 3 (depth: 12 m; bottom: coarse sand with gravel; biocoenosis of coarse sands and fine gravels affected by bottom currents), 4 s; ZADAR AREA: transect 3 (depth: 15 m; bottom: sandy and *Posidonia oceanica*), 2 s. At 20 m bottoms is sandy (biocoenosis of coastal detritic bottoms), 1 s. VIR ISLAND AREA: transect 7 (depth: 20 m; bottom: sandy with *Posidonia oceanica*), 3 s. Transect 8 (depth: 15 m; bottom: sandy with *Posidonia oceanica*), 7 s. Transect 9 (depth: 20 m; bottom: sandy with *Posidonia oceanica*), 5 s.; SESTRUNJ ISLAND AREA: depth: 25 m; bottom: sandy with *Posidonia oceanica*), 1 s. Trawl: station 4, Fig. 3 (depth: 40-45 m; bottom: sandy; biocoenosis of coastal detritic bottoms), 7 s. Station 5, Fig. 6 (depth: 33 m; bottom: sandy-shelly; biocoenosis of coastal detritic bottoms), 3 s. Station 6, Fig. 6 (depth: 40 m; bottom: sandy-shelly; biocoenosis of detritic bottoms of the open sea), 2 s. Station 16, Fig. 8 (depth: 50-55 m; bottom: sandy - facies of *Peysonnelia polymorpha*; biocoenosis of coastal detritic bottoms), 9 s. Station 17, Fig. 8 (depth: 65 m; bottom: sandy; dominance of Porifera group; biocoenosis of detritic bottoms of the open sea), 6 s. Station 18, Fig. 6 (depth: 55-60 m; bottom: sandy; biocoenosis of coastal detritic bottoms), 2 s. Station 19, Fig. 6 (depth: 65 m; bottom: sandy; biocoenosis of coastal detritic bottoms), 4 s. Station 25, Fig. 14 (depth: 60 m; bottom: sandy; biocoenosis of coastal detritic bottoms), 1 s. "HVAR" EXPEDITION: "H" 1 (depth: 33 m; bottom: sandy-muddy), biocoenosis of detritic more or less muddy bottoms. "H" 3 (depth: 32 m; bottom: sandy-muddy), biocoenosis of detritic more or less muddy bottoms. "H" 4 (depth: 36 m; bottom: sandy-muddy), biocoenosis of detritic more or less muddy bottoms. "H" 5 (depth: 50 m; bottom: sand), biocoenosis of detritic bottoms of the open sea. "H" 11 (depth: 60 m; bottom: sand), biocoenosis of detritic bottoms of the open sea. H"92" (depth: 61 m; bottom: sand), biocoenosis of detritic bottoms of the open sea. I recorded some living specimens in the material collected from the stations of the "HVAR" Expedition.

Discussion: Archimediella triplicata is a representative of mobile bottoms. M. STOSSICH (1880) reported it as numerous on muddy bottoms in the areas of Zadar, Hvar, Korčula, Lastovo and Dubrovnik. On the contrary, BRUSINA (1907) held it rare in the same areas in which M. STOSSICH reported it as numerous. STJEPČEVIĆ and PARENZAN (1980) recorded it from Bay of Boka kotorska. RIEDL (1963) described it as frequent on all the mobile bottoms, and GAMULIN-BRIDA (1974) as a characteristic species of coastal detritic bottoms. I recorded this species from the biocoenosis of *Posidonia oceanica* meadows, biocoenosis of coarse sands and fine gravels affected by bottom currents, biocoenosis of coastal detritic bottoms, biocoenosis of detritic more or less muddy bottoms and biocoenosis of detritic bottoms of the open sea. As distinct from the species *Turitella communis* which forms large number of facies on muddy bottoms, *Archimediella triplicata* occurs in small numbers on detritic bottoms so that I did not find its facies in any of mentioned biocoenoses.

Conclusion: Archimediella triplicata is a representative of mobile bottoms. I recorded this species from the biocoenosis of *Posidonia oceanica* meadows, biocoenosis of coarse sands and fine gravels affected by bottom currents, biocoenosis of coastal detritic bottoms, biocoenosis of detritic more or less muddy bottoms and biocoenosis of detritic bottoms of the open sea, where he occurs in small numbers.

Turritella communis RISSO, 1826

Syn.: *Turbo ungulinus* MÜLLER, 1776; *Turbo terebra* PENNANT, 1776; *Turrritella terebra* PAYRAUDEAU, 1826; *Turrritella trisulcata* BLAINVILLE, 1830; *Turritella linnaei* DESHAYES, 1832; *Turrritella ungulina* DESHAYES, 1843; *Turrritella cornea* KIENER, 1846

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1861, 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866, 1907; WEINKAUFF, 1868; M. STOSSICH, 1880; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ODHNER, 1914; ZIMMERMANN; 1905-1906; VATOVA, 1928, 1949; COEN and VATOVA, 1933; COEN, 1937; RIEDL, 1963; GAMULIN-BRIDA, 1962, 1967a,b, 1974; KARAMAN and GAMULIN-BRIDA, 1965, 1970: STJEPČEVIĆ, 1967; GAMULIN-BRIDA *et al.*, 1968; ZAVODNIK, 1971; TAVIANI, 1978, 1980; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; FORBES and HANLEY, 1848b; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; CARUS, 1889-1893; PRIOLO, 1955; NORDSIECK, 1968; PARENZAN, 1970; DANCE, 1974; SABELLI and SPADA, 1978; RIEDL, 1983.

Distribution: Atlantic (from the coast of Norway to Morocco), Mediterranean.

Results of studies:
Trawl: station 2, Fig. 2 (depth: 40 - 30 m; bottom: mud; biocoenosis of coastal terrigeneous muds). Predominantly empty shells (more than 95%). Station 3, Fig. 2 (depth: 44 m; bottom: mud; biocoenosis of coastal terrigeneous muds, facies *Turritella communis*). The number of living specimens was very high (an hour trawl haul would yield more than 4000 specimens). Station 7, Fig. 5 (depth: 60 m; bottom: mud; biocoenosis of muddy bottoms of the open sea). Of 100 examined specimens, 15 were alive. Station 8, Fig. 5 (depth: 62 m; bottom: mud; biocoenosis of muddy bottoms of the open sea). The ratio of living specimens to empty shells is similar to that at station 7. Station 9, Fig. 5 (depth: 45 m; bottom: mud; biocoenosis of coastal terrigeneous muds, facies *Turritella communis*). Large number of living specimens (an hour trawl haul would yield more than 5000 individuals). Station 10, Fig. 7 (depth: 60 m; bottom: mud; biocoenosis of muddy bottoms of the open sea), large numbers, predominantly empty shells. Station 11, Fig. 7 (depth: 64 m; bottom: mud; biocoenosis of muddy bottoms of the open sea), similar as at station 10. Station 12, Fig. 7 (depth: 62 m; bottom: mud; biocoenosis of muddy bottoms of the open sea, facies *Turritella communis*), large numbers of living individuals. Station 13, Fig. 7 (depth: 52 m; bottom: mud; bioceonosis of coastal terrigeneous muds, facies *Turritella communis*). An hour trawl haul would give up to 60 kg of this species (about 33000 individuals). Large number of alive individuals; VELEBIT CHANNEL: (depth: 65-75 m; bottom: mud; biocoenosis of muddy bottoms of the open sea). Not more than 7 to 10 specimens (mainly empty shells) would be obtained by an hour trawl haul throughout the Velebit Channel; "PIPETA" EXPEDITION: Facies *Turitella communis* forms a wider or narrower zones stretching parallel to the sandy coastal zone and spreading in the northern part of the western coast approximatively to the middle of the Adriatic. The species numbers are considerably greater in this part (an hour trawl haul at 30-60 m depths sometimes would give up to 18000 individuals) than in the central part (between Ancona and Monte Gargano) where an hour trawl haul at 30-60 m would give not more than 2000 individuals. With the increasing depth the species density is thinned. At 120 m (trawl sample) small numbers of alive specimens could be found, whereas single specimens of empty shell would occur at 150 m depth. Along the western coast it is frequent in the biocoenosis of fine

muddy sands between 12 and 20 m. An hour trawl haul would give up to 1300 specimens (predominantly alive ones).

Discussion: Turritella communis is one of the most frequent species present on mobile bottoms. It is particularly abundant in the biocoenosis of coastal terrigeneous muds between 30 and 60 m on both Adriatic coasts. Facies *Turritella communis* forms a wider or narrower zone stretching parallel to the sandy coastal zone and spreading in the northern part of the western coast approximatively to the middle of the Adriatic. The species numbers are considerably greater in this part than in the central part (between Ancona and Monte Gargano). It is not rare in shallow coastal area between 12 and 20 m in the biocoenosis of fine muddy sands along the western coast. It occurs down to 120 m (eventually 130 m) in the biocoenosis of the muddy bottoms of the open central Adriatic. It forms its own facies in sites down to 60 m among the islands of the northern Adriatic. Data I collected are just a contribution to the abundant literature available on this species well worked out by the earliest authors. So GAMULIN-BRIDA (1967b, 1974) reported its settlement preference for the biocoenosis of coastal terrigeneous muds where it sometimes made up more than 50% of the biota (cove Kuvi near Rovinj). On the other hand only single specimens were recorded from facies of viscous muds (cove Valdibora near Rovinj). At loose soft muds, usually closer to the coast, it occurs in great numbers being characteristic of the special facies *"Turritella"* in mentioned biocoenosis. Such Adriatic areas VATOVA (1949) named the zoocoenosis of *"Turritella"*. The areas of viscous muds which are usually more offshore, PÉRÈS and PICARD (1958) believed to be the facies of the same biocoenosis (facies of sedentary forms in the biocoenosis of coastal terrigeneous muds) whereas VATOVA (1949) called it the zoocoenosis *"Turritella profunda"* characterized by dead specimens of this gastropod. GAMULIN-BRIDA (1962) held it strictly stenotopic form, not only pelophilic but also bound to special facies of loose soft muds, since it easily moves on loose mud and dies easily in viscous mud.

Conclusion: Turritella communis is a typical representative of soft bottoms. It occurs in greatest numbers in the biocoenosis of coastal terrigeneous muds between 30 and 60 m on both Adriatic sides. It is distributed in the biocoenosis of fine muddy sands. This species is present down to 120 (eventually 130 m) in the biocoenosis of muddy bottoms of the open central Adriatic, and down to about 60 m it forms its own facies among the northern Adriatic islands. It is preferent species of coastal terrigeneous muds.

Bivonia triquetra (BIVONA, 1832)

Syn.: *Vermetus triqueter* BIVONA, 1832

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; B.D.D., 1882-1886; CARUS, 1889-1893; GRAEFFE, 1902; VATOVA, 1928, COEN, 1937; HORVATH, 1963; RIEDL, 1963; ZAVODNIK; 1967a; RADIĆ, 1982.
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; CARUS; 1889-1893; NORDSIECK, 1968; PARENZAN, 1970; RIEDL, 1983.

Distribution: Atlantic (coast of Spain), Mediterranean.

Results of studies:
Transects: ŠIBENIK AREA: transect IV (depth: 15 m), individual specimens on stones; BIOGRAD AREA: transect 4 (depth: 1 m; bottom: rocky with stones) frequent on the lower side of stones; VIR ISLAND AREA: transect 7

(depth: 0.5 m) 2 to 3 specimens below every stone, whereas much rarer on the upper side of stones. Transect 8 (depth: 0.2 to 0.5 m), 2 to 3 specimens below every stone, single specimens occurring on the upper side of stones. Transect 9 (depth: 0-0.5 m) 3 to 4 specimens on the bottom side of every stone (rather continuously), single specimens on the upper side of stones. Transect 10 (depth: 0-3 m), occurring in great numbers. It predominantly choses shelter from the sunlight (below and on the sides of stones) with an abundance of 2 to 3 s. per 1/16 sq m. In sunlight sites 0-1 s. per 1/16 sq m. KRK ISLAND AREA: transect 2 (depth: 0-0.5 m), great numbers (4-5 s. below every bigger stone). Transect 3 (depth: 0.2 to 0.5 m), 6-7 s. below stones, frequently 15 to 20 specimens below and on the sides of stones. Rare on the upper stone sides. Single specimens at transects 5 (depth: 0.5 m), 9 (depth: 1 m) and 10 (depth: 0.2 m); SILBA ISLAND AREA: (depth: 5m; bottom: rocky) single specimens; HVAR ISLAND AREA: cove Pokrivenik (great numbers at the very surface).

Discussion: GRAEFFE (1902) reported the species *Bivonia triquetra* for the area of Trieste and VATOVA (1928) and COEN and VATOVA (1933) for the vicinity of Rovinj, as frequent along the coast. RIEDL (1963) recorded it from hard northern Adriatic substrate, ZAVODNIK (1967a) from phytal in the vicinity of Rovinj and HORVATH (1963) as very frequent, attached to rocks and stones near Split. As shown by the above data this species is a typical representative of hard substrate. From my own observations it prefers shaded sites where it occurs in greatest numbers as distinct from the part of the shores that are in the sunlight, where it is considerably rare. It normally inhabits plate rocks and stones with flat surfaces. Most of its biomass is distributed in the upper five metres depth even though single specimens may be found down to 15 m. I recorded it from the biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis.

Conclusion: The species *Bivonia triquetra* is a typical representative of hard substrate. It prefers shaded sites on the shore. It normally inhabits plate rocks and stones with flat surfaces. Most of its biomass is distributed in the upper five metres depth. I recorded it from the biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis.

Lemintina arenaria (LINNAEUS, 1767)

Syn.: *Serpula arenaria* LINNAEUS, 1767; *Serpula dentifera* LAMARCK, 1818; *Lementima cuvieri* RISSO, 1826; *Serpulorbis polyphragma* SASSI, 1827; *Vermetus gigas* BIVONA, 1832; *Vermetus arenarius* DESHAYES, 1843; *Serpulorbis gigas* BRUSINA, 1866.

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; 1864; GRUBE, 1861; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; B.D.D., 1882-1886; CARUS, 1889-1893; GRAEFFE, 1902; ZIMMERMANN; 1905-1906; ODHNER, 1914; VATOVA, 1928, COEN and VATOVA, 1933; COEN, 1937; HORVATH, 1963; RIEDL, 1963; STJEPČEVIĆ, 1967; STJEPČEVIĆ and PARENZAN; 1980.
Mediterranean: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; CARUS; 1889-1893; PRIOLO, 1956; NORDSIECK, 1968; BOMBACE, 1970; PARENZAN, 1970; RIEDL, 1983.

Distribution: Mediterranean.

Results of studies:
Transects: MAKARSKA AREA: western entrance to the port (depth: 8 m; bottom: rocky), 3 s.; SPLIT AREA: (depth: 1-5 m; bottom: rocky-stony), single specimens; ŠIBENIK AREA: transect III (depth: 5 m; bottom: rocky), 2 s. per sq m in several sites. Depth 20

m (bottom: rocky-stony), 2-3 s. per sq m in several sites. Tansect IV: depth: 8 m; bottom: rocky), 1 s. per 1/16 sq m in several sites. Transect 2 (depth: 3-17 m) single specimens on rocks. In front of Zlarin Island (dredge; depth: 60 m; biocoenosis of coastal detritic bottoms), 3 s. on shells. Transect 3 (depth: 2 m; bottom: rocky-stony), 6 joined together specimens forming a unity; BIOGRAD AREA: transect 1 (depth: 1 to 4 m; bottom: rocky), single specimens. Transect 3 (depth: 1-7 m; bottom: stone blocks), single specimens. Depth 15 m (bottom: sand with *Posidonia oceanica* and stones), 3 s. Transect 4 (depth: 1 to 4 m; bottom: rocky), 1 s. per 3-4 sq m; ZADAR AREA: transect 2 (depth: 10 m), single specimens on stones; VIR ISLAND AREA: transect 6 (depth: 1 to 5 m; bottom: rocky) 2 to 3 s. per sq m in several sites. Transect 9 (depth: 15 m; bottom: sand, stones and *Posidonia oceanica*), several specimens on stones. Transect 10 (depth: 1 to 3 m; bottom: rocky-stony); 1 s. per sq m in several sites. Eight specimens joined together forming a unity were recorded at 2 m depth (Fig. 22); SESTRUNJ ISLAND AREA: (depth: 2 to 8 m; bottom: rocky-stony), single specimens; HVAR ISLAND AREA: outer side of Pokrivenik cove (depth: 15 m; bottom: rocky; precoralline aspect of coralline biocoenosis), single specimens. Zub od Zarače (depth; 15 m; bottom: rocky; precoralline aspect of coralline biocoenosis), 2 s.; VIS ISLAND AREA: in the crevice near Smričevica cove (depth: 20 m; bottom: rocky), 3 s. Area near Gradac cove (dredge; depth: 70 to 85 m; bottom: lithothamnium; coralline biocoenosis), 2 s. BIŠEVO ISLAND AREA: crevice Gatula(depth: 15 m; bottom: rocky), 1 s. ždrilo od Gatule (depth: 35 m; bottom: rocky; coralline biocoenosis), 3 s.

Discussion: HELLER (1864) reported the species *Lemintina arenaria* as frequent on rocks* down to 4 m depth in the central and southern Adriatic, and M. STOSSICH (1880) as occurring in great numbers on shellfishes and different concretions throughout the Adriatic. GRAEFFE (1902) recorded it from the area of Trieste, GRUBE (1861) around Cres Island, COEN and VATOVA (1933) as not a rare species on stones and shellfishes around Rovinj and RIEDL (1963) as common but not frequent on all hard substrates. HORVATH (1963) found it to be rather frequent on rocks and stones down to 8 m depth around Split. STJEPČEVIĆ (1967) recorded it from the coastal area of Boka kotorska Bay where it occurred in relatively small numbers attached to predominantly bottom side of stone between 3 and 10 m. As shown by the above reports this species is a typical representative of hard substrate. Vertically it is distributed down to 80 m. I recorded it from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis, coralline biocoenosis and on mobile bottoms from stones and shells in the biocoenosis of the meadows of marine phanerogams and biocoenosis of coastal detritic bottoms.

Conclusion: The species *Lemintina arenaria* is a typical representative of hard substrate. Vertically it is distributed down to 80 m. I recorded it from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and coralline biocoenosis and on mobile bottoms from stones and shells in the biocoenosis of the meadows of marine phanerogams and biocoenosis of coastal detritic bottoms.

*When speaking of substrate type inhabited by gastropods, we may say that most gastropod species of Prosobranchiata group inhabit hard substrate overgrown with algae and hard substrate. Considerably smaller number of species inhabit sandy bottoms and small number muddy bottoms. In this sense HORVAT (1963) reported on recorded species down to 8 m depth: inhabitants of rocky bottoms, 15 gastropods (14 shelffishes); inhabitants of algae on rocky bottoms, 17 gastropods (1 shellfish); sand inhabitants, 2 gastropods , 2 sporadical gastropods (26 shellfishes). There is an interesting information BOMBACE (1970) reported on the ratio of Gastropoda to Bivalvia expressed in percentages in precoralline and coralline biocoenosis: precoralline biocoenosis (depth: 30-45 m) 75% Gastropoda and 25% Bivalvia; coralline biocoenosis (depth: to 60 m), 73% Gastropoda and 27% Bivalvia; coralline biocoenosis (depth; 80-100 m), 57% Gastropoda and 43% Bivalvia; degraded coralline biocoenosis covered by a sediment layer, 40% Gastropoda and 60% Bivalvia.

Bittium reticulatum (DA COSTA, 1790)

Syn.: *Strombiformis reticulatus* (DA COSTA, 1790); *Cerithium scabrum* OLIVI, 1792; *Cerithium lima* BRUGUIÈRE, 1792; *Rissoa vulgatissima* CLARK, 1855

Previous reviews:
- Adriatic: OLIVI, 1792; DANILO and SANDRI, 1856; GRUBE, 1861, 1864; HELLER, 1864; BRUSINA, 1866; JEFFREYS, 1867; WEINKAUFF, 1868; M. STOSSICH, 1880; B.D.D., 1882-1886; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ZIMMERMANN; 1905-1906; ODHNER, 1914; VATOVA, 1928, COEN and VATOVA, 1933; COEN, 1937; HORVATH, 1963; RIEDL, 1963; GAMULIN-BRIDA; 1967b, 1974; ZAVODNIK, 1967a, 1971; TAVIANI, 1978, 1980; GAMULIN-BRIDA *et al.*, 1968; VIO *et al.*, 1979; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; JEFFREYS, 1867; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; CARUS; 1889-1893; PRIOLO, 1956; NORDSIECK, 1968; PARENZAN, 1970; RIEDL, 1983.

Distribution: Atlantic (from Shetland Islands, across Azores, Madeira to Cannary Islands), Mediterranean.

Results of studies:
Transects: DUBROVNIK AREA: at all four transects occurs in great numbers between 3 and 5 m depth; MAKARSKA AREA (western entrance to the port), between 7 and 10 m bottom is stony and overgrown by *Cystoseira corniculata, Dictyota linearis, Halimeda tuna, Udotea petiolata* and *Padina pavonia*. All these algae, and particularly *Dictyota linearis*, are literally covered by the species *Bittium reticulatum* (it forms a layer of 3 m width completely black in colour); SPLIT AREA: abundant at all 19 transects; ŠIBENIK AREA; it occurs in greatest numbers at transect 1 (Zlarin Island side) in sites where vertical rocks continue as plate rocks (depth: 5 m). The bottom there is covered by a dense "carpet" of algae formed by the species of familie Ceramiaceae, Gelidiaceae and Sfacelariaceae. The species *Dictyota dichotoma* is also well developed. *Bittium reticulatum* spreads continuously in this area with the abundance of 145-155 s. per 1/16 sq m; BIOGRAD AREA: it is frequent in the area of *Cystoseira barbata*. However, it occurs in greatest numbers at transect 3 (t. Biograd) where it may be found on stone blocks (depth: 5-7 m). Of algae *Halimeda tuna* and *Udotea petiolata* are frequent and of animal species *Petrosia ficiformis* and *Chondrilla nucula* (precoralline aspect of coralline biocoenosis). From 160 to 170 s. per 1/16 sq m in places; VIR ISLAND AREA: distributed at all 12 transects in the biocoenosis of photophilic algae. Transect 9 (Pedinka cape), depth: 10 m;occurs in great numbers on the species *Dictyota linearis*. Bottom is muddy-sandy with *Vidalia volubilis* at 35 m depth. Sediment is rich in shelly residues of *Bittium reticulatum*. Transect 6 (Radnjača), depth: 38 m; bottom: sand with lithothamnium pebbles (only shelly residues of the species). Transect 8 (the lighthouse), depth: 30 m; bottom: sandy with thin *Posidonia oceanica* (mass of shelly residues of this species). Transect 11 (Stinice cape), depth: 20 m; bottom: muddy-sandy with *Vidalia volubilis* (shelly residues of the species); KRK ISLAND AREA: distributed at all 10 transects in the area of the biocoenosis of photophilic algae . Transect 3 (Knez cape), depth: 20 m; bottom: sandy with *Vidalia volubilis* (shelly residues of the species). Transect 5 (Glavotok cape), depth: 30 m; bottom: muddy-sandy and *Vidalia volubilis* (a mass of shelly residues). Transect 8 (cape Pelovo), depth: 30 m; bottom: muddy-sandy with the residues of *Vidalia volubilis* (a mass of shelly residues of this species); MLJET ISLAND AREA (Lake Veliko jezero, Fig. 13), depth: down to 3 m the bottom is rocky-stony with well developed "carpet" of algae, the basis of which is the species *Valonia utricularis* with great numbers of fibrous epiphytic forms

of which the genera *Cladophora, Sphacellaria, Gelidiella, Grifithsia, Polysiphonia, Lophosiphonia, Ceramium* dominate as well as species of the group of benthic diatoms and fibrous forms of Cyanophiceae. *Bittium reticulatum* covers more than 96% of the area (predominantly juvenile specimens) as a "never ending" cover. *Cystoseira adriatica* is dominant at 6 m depth and more than 90% of its surface is covered by this gastropod species (mainly adult specimens). Between 14 and 20 m the algae *Phymatolithon calcareum* and *Lithothamnium fruticulosum* are abundant in places, densely covered through by a well developed species *Dasya baillouviana.* The mass occurrence of the species *Bittium reticulatum* was recorded from here, as well (the entire surface between 14 and 20 m depth is inhabited by this gastropod - mainly adult specimens); VIS ISLAND AREA: (crevice near Gradac cove), precoralline aspect of coralline biocoenosis is developed between 3 and 8 m depth. The species *Bittium reticulatum* occurs in great numbers. The fissure near Smričevica cove(depth; 10 m): a large number of specimens of *Bittium reticulatum* was recorded on well developed alga *Dictyota linearis.* Island Jabuka (depth: 20 m; bottom: rocky; coralline biocoenosis), alive specimens of this species; Sušac Island . (depth: 20 m; bottom: rocky; coralline biocoenosis), alive specimens of this species.

Discussion: The species *Bittium reticulatum* belongs to the group of most abundant gastropods in the Adriatic. It is distributed all along the eastern coast. OLIVI (1792) described it as a species which lived on stones and on algae (particularly on the species *Ulva lactuca*). BRUSINA (1866) also reported settlement preference of *Bittium reticulatum* for *Ulva lactuca* but also stated that the largest quantities of this species could be found on sand. VATOVA (1928) reported it as rare on muddy bottoms and very frequent and numerous on algae along the coast. HELLER (1864) found it to be frequent in the meadows of marine phanerogams whereas M. STOSSICH (1880), on the contrary, found it to be frequent on rocky bottoms. HORVATH (1963) reported it as an inhabitant of algae, either on or among them, and stones, and RIEDL (1963) as frequent among algae (particularly *Cystoseira, Laurencia, Cladophora*), in the meadows of marine phanerogams and on soft substrates. GAMULIN-BRIDA (1967b, 1974) believed it to have preferences for such habitats as the biocoenosis of the meadows of posidonia and other marine phanerogams whereas, on the contrary ZAVODNIK (1971) believed it to prefer more the biocoenosis of photophilic algae. I rather agree with the statements that *Bittium reticulatum* prefers the biocoenosis of photophilic algae. I recorded it from the precoralline aspect of coralline biocoenosis and in the coralline biocoenosis. Great numbers of shelly residues in sediment and rare alive specimen on the leaves of marine phanerogams originate from the upper sea layers and came there by occidental dislodgement by wave action or sea currents. Mobile substrate (sand, mud) are major determinants of its distribution. It prefers rather calm and sheltered parts on the shore, so that it occurs in far greater numbers on the species *Cystoseira barbata* which choses the sites which provide shelter than on the species *Cystoseira stricta* v. *spicata* which prefers more open sites. *Bittium reticulatum* occurs below the tidal level on shores directly exposed to wave action. In places where the substrate is hard and where floral component is well developed this species can occur in such a great number that the whole surface it covers is darker in colour. Close to the surface such are the places on the shore, not directly exposed to wave action. This is the case of Mljet Island (the lake Veliko jezero) where the carpet of short algae, the basis of which is the alga *Valonia utricularis* with a large number of fibrous epiphytic forms, is very well developed. Great number of *Bittium reticulatum* may be found even deeper in places where the substrate is hard and where floral component is rich.

Conclusion: The species *Bittium reticulatum* belongs to the group of most abundant gastropods in the Adriatic. It is distributed all along the eastern coast. It has preferences for such

habitats as the biocoenosis of photophilic algae. It occurs in the precoralline aspect of coralline biocoenosis and in the coralline biocoenosis. Mobile substrate (sand and mud) is major determinant of its distribution. It prefers rather calm and sheltered parts on the shore. *Bittium reticulatum* occurs below the tidal level on shores directly exposed to wave action. In places where the substrate is hard and where floral component is well developed this species can occur in such a great number that the whole surface it covers is darker in colour.

Gourmya vulgata (BRUGUIERE, 1789)

Syn.: *Cerithium vulgatum* BRUGUIÈRE, 1789; *Strombus tuberculatus* LINNAEUS, 1767 *Cerithium tuberculatum* LOCARD, 1886

Previous reviews:
- Adriatic: OLIVI, 1792; DANILO and SANDRI, 1856; GRUBE, 1861; 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; B.D.D., 1882-1886; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ZIMMERMANN; 1905-1906; ODHNER, 1914; VATOVA, 1928, COEN and VATOVA, 1933; COEN, 1937; ZEI, 1955; GAMULIN-BRIDA; 1962, 1967a, 1974; GAMULIN-BRIDA *et al.*, 1968; KARAMAN and GAMULIN-BRIDA, 1970; ŠIMUNOIVIĆ, 1970; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; JEFFREYS, 1867; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; B.D.D., 1882-1886; CARUS; 1889-1893; PRIOLO, 1956; NORDSIECK, 1968; PARENZAN, 1970; DANCE, 1974; RIEDL, 1983.

Distribution: Atlantic (from the town of Kristiansund in Norway, across Shetland Islands, Great Britain, France, Spain, Portugal, Azores, Madeira,Cannary Islands to Senegal), Mediterranean.

Results of studies:
Transects: MAKARSKA AREA (western entrance to the port), depth: 4-10 m, single specimens; SPLIT AREA: transect 3 (depth: 3 m; bottom: rocky-sandy), up to 5 s. per sq m; Transect 18 (depth: 3 m; bottom: rocky), up to 11 s. per sq m.Kaštela Bay (Marjan shoal): depth: 12 m; bottom: rocky with the islets of sandy bottom; 45 to 5o s. per sq m in places; ŠIBENIK AREA: transect 2 (mainland side), depth: 0.5-3 m, 4 to 5 s. per sq m; Transect 3 (I. Zlarin side), 1 to 2 specimens and 6 to 7 empty shells (occupied by crustaceans) per sq m (depth: 5 m). Transect 3 (mainland side), low and shallow shore. Bottom is rocky-stony from 1 to 3 m. Its abundance was from 55 to 60 s. per sq m in places. At 10 m depth (sandy bottom) great number of empty shells occupied by crustaceans (12 to 14 shells per sq m) and very few alive specimens (1 to 2 per sq m). Transect IV (depth: 5 m), 2 to 3 s. per sq m; BIOGRAD AREA: transect 1 (Drage), bottom is rocky with *Cystoseira barbata* at 1 m (single specimens of *Gourmya vulgata*). Bottom is sandy at 20 m (single specimens). Transect 3 (Biograd), depth: 10 m; bottom: sand (single specimens). Transect 4 (Filip Jakov), bottom is rocky (small slope angle)-gravelly-sandy at 2-5 m (4-5 s. per sq m); ZADAR AREA: transect 2 (depth: 1-5 m; bottom: plate rocks with crevices filled with sand), 15-16 s. per sq m at 1-2 m depth; 6-7 alive specimens and 4-5 empty shells occupied by crustaceans would be frequently found from 2 to 5 m. Transect 3 (depth: 5-10 m; bottom: sandy with scattered stone blocks), 3-4 alive s. and 9-10 empty shells with crustaceans per sq m. At 30 m where the bottom is muddy-sandy a great number of empty shells inhabited by the crustacean *Paguristes oculatus*; VIR ISLAND AREA: transect 1 (in the cove), rocky plates (depth: 1-2 m) under intensive sedimentation . Aggregations of 35 to 40 s. per sq m would be found. At 3-6 m where the bottom is sandy with the species *Pinna nobilis, Gourmya vulgata* occurred with the abundance of 55-60 s. per sq

m in places. Transect 3 (Jasenovo peninsula), the plate-like rocky bottom stretches down to 5 m depth (the number of s. per sq m: 1 s. at 1 m; up to 5 s. at 2 m; up to 11 s. at 3 m; 2 s. at 4 m; single s. between 5 and 20 m). At transect 4 (Kulina cape) the species *Gourmya vulgata* occurs in markedly large numbers. Aggregations of 65 to 70 s. per sq m were recorded (biocoenosis of fine uniform sands - the entire area is very shallow). Transect 5 (Pag Island), depth: 10 m; bottom: sand with *Cymodocea nodosa*, single specimens of *Gourmya vulgata*. Transect 6 (Radnjača cove), aggregations of 3 to 4 s. would be found between 2 and 5 m depth. At 10 m depth the bottom is sandy with *Cymodocea nodosa;* the abundance of *Gourmya vulgata*: 3-4 alive specimens and 2-3 empty shells, occupied by crustaceans, per sq m. Transect 7 (Vrulja cape), species abundance was 4 s.per sq m at 10 m depth (low rocks which protrude through sand on the bottom are well covered by the algae: *Cystoseira ercegovicii, Cystoseira corniculata* and *Sargassum salicifolium*). Single specimens only at 20 m depth (bottom sandy-muddy with *Posidonia oceanica*). Transect 8 (the lighthouse), single specimens down to 5 m depth (bottom sandy with stones). At 10-15 m the aggregations of 15-16 s. per sq m would be found (bottom sandy with *Posidonia oceanica*). At 40 m single specimens among the species *Vidalia volubilis* (bottom is muddy-sandy). Transect 9 (Pedinka cape), single specimens (depth: 20-30 m; bottom: sandy with *Lithophyllum racemus* and *Posidonia oceanica*). Transect 10 (Kozjak cape), aggregations of 6-7 specimens among the species *Fucus virsoides* (depth: 0.2 to 0.3 m). Great number of empty shells, occupied by crustaceans, would be found at 5 m depth and at 15 m the aggregations of 2-3 s. among the species *Posidonia oceanica* (down to 5 m rocky and from 5 to 15 m sandy). Transect 11 (Stinice cove): occurs with the abundance of 15-16 s. per sq m among the species *Cystoseira barbata* (depth: 0.5-1 m), 2-3 s. per sq m at 2 - 5 m depth and single specimens at 5-20 m. Transect 12 (Nin Bay), the aggregations of 45-50 s. per sq m would be found on rocky plates at 1-2 m depth (an area affected by intensive sedimentation). Between 2 and 5 m (bottom stony-sandy-shelly) 3 to 4 alive specimens and 40 to 45 empty shells (occupied by crustaceans) per sq m. At 5 m (sandy bottom) only single specimens; KRK ISLAND AREA: transect 1(Kijac cape), single specimens between 5 and 8 m. Transect 2 (Tenka punta) single specimens between 1 and 4 m. At 10 m (sandy bottom with *Cymodocea nodosa*) single specimens. At 30 m depth (muddy-sandy bottom with *Vidalia volubilis*) single specimens. Situation is similar at transects 3, 6, 7, 8, 9 and 10. At transect 4 (Sapan cove) aggregations of 3-4 specimens (depth: 2-5 m). Transect 5 (Zaglav cape) aggregations of 3-4 specimens (depth: 1-4 m). Between 4 and 10 m (dominance of *Cystoseira ercegovicii* and *Cystoseira adriatica*) numerous empty shells (12-15 per sq m) occupied by crustaceans; HVAR ISLAND AREA: (reef near Zečevo Island), aggregations of 12-15 specimens (depth: 10-15 m; bottom: rocky; dominant algae: *Cystoseira adriatica, Sargassum salicifolium).*

Discussion: OLIVI (1792) recorded the species *Gourmya vulgata* as frequent on muddy and sandy bottoms in lagoons and town ports; M. STOSSICH (1880) as common throughout the Adriatic; HELLER (1864) reported it frequent on muddy bottoms and in the meadows of marine phanerogams in the central and southern Adriatic. VATOVA (1928) and COEN and VATOVA (1933) found it to occur in great numbers on rocky shores overgrown by algae and much less dense on detritic bottoms. ZEI (1955) decsribed it occurring on the less steep rocky shore parts (in crevices sheltered from wave action) at the infralittoral step and as very rare on vertical rocks, under stones and in the lower part of the emersion belt. STJEPČEVIĆ (1967) supplied information on its inhabiting sandy bottoms in Boka kotorska Bay, where it is frequent below big stones overgrown by algae and also its settling on sandy-muddy substrates covered by marine phanerogams and other algae between 10 and 25 m depth. RIEDL (1963, 1983) described it as common and frequent on secondarily stiffened substrate.

ZAVODNIK (1971) recorded it from the mixed sandy bottom community at 9 m depth (the area of Rovinj). HORVATH (1963) reported it to live on and among algae on stones (around Split). GAMULIN-BRIDA (1974) reported its records from the biocoenosis of photophilic algae (as preference species), posidonia beds, biocoenosis of muddy sands of sheltered shores and biocoenosis of coastal detritic bottoms. As shown by the above data it appears to be the species inhabiting both hard and mobile substrates, all along the Adriatic coast. However, there is a lot of disagreement between different authors as to the depths it occurs at and its habitats. As I found it and from available data most of its biomass occurs down to 15 m depth on both flat and almost flat substrate (small slope angle) of the infralittoral step. Single specimens recorded from small mediolittoral pools are just accidentally there. Its numbers are considerably decreased in circalittoral where it occurs in aggregations of several individuals per sq m. As to its inhabiting hard substrate, it was mostly found on slightly sloping rocky parts of the shore exposed to intensive sedimentation. Of mobile bottoms, it occurs in greatest numbers in places with the dominance of sandy component. I recorded the species *Gourmya vulgata* from the biocoenosis of photophilic algae, biocoenosis of the meadows of marine phanerogams, biocoenosis of fine uniform sands, biocoenosis of coastal detritic bottoms and biocoenosis of detritic more or less muddy bottoms. Coastal terrigeneous muds are limiting factors of its distribution.

Conclusion: The species *Gourmya vulgata* inhabits both hard and mobile substrates, all along the Adriatic coast. Most of its biomass occurs down to 15 m depth on both flat and almost flat substrate (small slope angle) of the infralittoral step. Single specimens recorded from small mediolittoral pools are just accidentally there. Its numbers are considerably decreased in circalittoral where it occurs in aggregations of several individuals per sq m. As to its inhabiting hard substrate, it was mostly found on slightly sloping rocky parts of the shore exposed to intensive sedimentation. Of mobile bottoms, it occurs in greatest numbers in places with the dominance of sandy component. I recorded the species *Gourmya vulgata* from the biocoenosis of photophilic algae, biocoenosis of the meadows of marine phanerogams, biocoenosis of fine uniform sands, biocoenosis of coastal detritic bottoms and biocoenosis of detritic more or less muddy bottoms. Coastal terrigeneous muds are limiting factors of its distribution.

Gourmya rupestris (RISSO, 1826)

Syn.: *Cerithium rupestre* RISSO, 1829; *Cerithium fuscatum* O. G. COSTA, 1829; *Cerithium mediterraneum* DESHAYES, 1843; *Cerithium deliolum* WEINKAUFF, 1868

Previous reviews:
- Adriatic: HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; B.D.D., 1882-1886; WIMMER, 1883; GRAEFFE, 1902; VATOVA, 1928, COEN and VATOVA, 1933; HORVATH, 1963; RIEDL, 1963; GAMULIN-BRIDA, 1967, 1974; STJEPČEVIĆ, 1967; ZAVODNIK, 1967a; ŠIMUNOVIĆ, 1970; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; MONTEROSATO, 1878; B.D.D., 1882-1886; LOCARD, 1886; PRIOLO, 1956; NORDSIECK, 1968; PARENZAN, 1970; RIEDL, 1983.

Distribution: Atlantic (Cannary Islands), Mediterranean.

Results of studies:
Transects: DUBROVNIK AREA: (Lokrum Island - Galia), low rocky shore with a girland of discontinued rocks protruding from the sea surface. The abundance of the species *Gourmya rupestris* 47-50 s. per 1/16 sq m in calm and

sheltered part (well developed "carpet" of algae of different genera: *Cladophora, Sphacellaria, Gelidiella, Polysiphonia, Ceramium*; an area exposed to intensive sedimentation); SPLIT AREA: transect 16 (Bene cove), depth: 0.1-0.3 m; bottom: rocky exposed to intensive sedimentation; species abundance: 28-30 s. per 1/16 sq m; ŠIBENIK AREA: transect 2 (mainland side); depth: 0-0.5 m: bottom: rocky; species abundance: 10-12 s. per 1/16 sq m. Transect 3 (mainland side), depth: 0-0.5 m; shore low and shallow and bottom rocky exposed to intensive sedimentation and with well developed "carpet" of short algae; species abundance: 65-70 s. per 1/16 sq m; BIOGRAD AREA: transect 1 (Drage), 3 to 4 s. per 1/16 sq m. At 5 m depth a great number of empty shells occupied by crustaceans. Transect 2 (Pakoštane), between 0 and 0.5 m on plate rocks 3 to 4 s. per 1/16 sq m. Transect 4 (Filip Jakov), entire area shallow. At 0.5 m rocky plates covered by the species *Cystoseira barbata*; species abundance: 4-5 s. per 1/16 sq m; VIR ISLAND AREA: transect 5 (depth: 10 m; bottom: sand), empty shells with crustaceans. Transect 6 (depth: 0.1 m; bottom: rocky), 10 to 12 s. per 1/16 sq m. At 6 m depth sand with *Cymodocea nodosa* (empty shells with crustaceans). Transect 9 (depth: 0.2m; bottom: rocky), 2 to 3 s. per 1/16 sq m. Transect 10 (depth: 0.2 m; bottom: low rocks exposed to intensive sedimentation), 23 to 25 s. per 1/16 sq m; MLJET ISLAND AREA: (Lake Veliko jezero near hotel "Melita"), down to 0.3 m its abundance is 37 to 40 s. per 1/16 sq m (shore is rocky with well developed "carpet" of algae the basis of which is the species *Valonia utricularis* with numerous fibrous epyphitic forms); HVAR ISLAND AREA: (Pokrivenik cove), exceptionally abundant down to 0.5 m. The topography of the shore provides conditions typical for this species distribution (sheltered, shallow, flat, rocky, exposed to intensive sedimentation and well developed "carpet" of short algae).

Discussion: The species *Gourmyra rupestris* is a representative of hard substrate. It is distributed all along the Adriatic and may be found on low rocks (small slope angles) and stones, primarily on calm and sheltered shore parts. I recorded no specimen of this species either from very wave exposed localities or on those parts of the shore which lay at an angle exceeding 60^0 (irrespective of the level of exposure). It occurs in greatest numbers down to 0.5 m depth in places where hard substrates are exposed to intensive sedimentation and where the "carpet" of short algae is well developed. It is abrubtly thinned below 0.5 so that at 1 m depth only single alive specimens could be found along with a lot of empty shells inhabited by different spacies of Paguridae family. Vertically it is distributed in the uppermost infalittoral in the biocoenosis of photophilic algae. Earlier authors who recorded this species from the Adriatic also reported it to inhabit small depths and hard substrates. M. STOSSICH (1880) reported it as common throughout the Adriatic predominantly on rocky shores; VATOVA (1928) as an intertidal species living on rocky shores; A: STOSSICH (1865) as rare in shoals along the shores and frequent in crevices of rocky shores; WIMMER (1883) recorded it along the coast among algae (the area of Rovinj), between 1 and 3 m depth, whereas on the contrary COEN and VATOVA (1933) reported it as rare on algae in the area of Rovinj. GRAEFFE (1902) recorded this species from the area of Trieste; ZAVODNIK (1967a) in the phytal in the vicinity of Rovinj; HORVATH (1967) on rocks and stones in the interdidal zone (around Split). STJEPČEVIĆ (1967) found small number of specimens between 2.5 and 5 m in Boka kotorska Bay, distributed on hard substrate overgrown by algae. ZEI (1955) also described it as a species of hard bottoms distributed all the emersion zone round and more frequent in shelterd than in wave exposed parts. RIEDL (1963) reported it as common and frequent among algae, on stones and rocky shores at small depths.

Conclusion: The species *Gourmyra rupestris* is a representative of hard substrate. It is distributed all along the Adriatic and may be found on low rocks and stones, primarily on calm and sheltered shore parts. I recorded no specimen of

this species either from very wave exposed localities or on those parts of the shore which lay at an angle exceeding 60^0. It occurs in greatest numbers down to 0.5 m depth in places where hard substrates are exposed to intensive sedimentation and where the "carpet" of short algae is well developed It is abrubtly thinned below 0.5 m. Vertically, it is distributed in the uppermost infalittoral in the biocoenosis of photophilic algae.

Triphora perversa (LINNAEUS, 1767)

Syn.: *Trochus perversus* LINNAEUS, 1767; *Cerithium maroccanum* BRUGUIÈRE, 1789; *Murex radula* OLIVI, 1792; *Murex adversus* MONTAGU, 1803; *Turbo reticulatus* DONOVAN, 1803; *Murex granulosus* BROCCHI, 1814; *Cerithium perversum* LAMARCK, 1822; *Trochus seriatus* MÜHLFELD, 1824; *Cerithium pusillum* PFEIFFER, 1840; *Murex savignyus* DELLE CHIAJE, 1841; *Triforis benoitiana* ARADAS, 1869;

Previous reviews:
- Adriatic: OLIVI, 1792; DANILO and SANDRI, 1856; GRUBE, 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; JEFFREYS, 1867; WEINKAUFF, 1868; M. STOSSICH, 1880; B.D.D., 1882-1886; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ZIMMERMANN, 1905-1906; VATOVA, 1928, COEN and VATOVA, 1933; COEN, 1937; HORVATH, 1963; RIEDL, 1963; ZAVODNIK, 1967a; TAVIANI, 1978, 1980; VIO *et al.*, 1979; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; JEFFREYS, 1867; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878, 1884; B.D.D., 1882-1886; CARUS, 1889-1893; PRIOLO, 1956; NORDSIECK, 1968; BOMBACE; 1970; PARENZAN, 1970; GRAHAM, 1971; RIEDL, 1983.

Distribution: Atlantic (from Zetland Islands, across Norway, Great Britain, France, Spain, Portugal, Azores, Madeira,Cannary Islands to Morocco), Mediterranean.

Results of studies:
As a rule, I recorded the species *Triphora perversa* along with *Bittium reticulatum* (both species are distributed in the same biotope). Greater the number of *Bittium reticulatum* in a sample (surface area 1/16 sq m), the number of *Triphora perversa* is greater and *vice versa*. It may be stated that 1 to 2 specimens of the species *Triphora perversa* occur with about 100 specimens of *Bittium reticulatum*. Grab sediment samples showed shell residues of this species.

Discussion: OLIVI (1792) reported *Triphora perversa* as rare and most probably occurring on muddy-sandy bottoms. VATOVA (1928) also reported it as rare on muddy and sandy bottoms in the area of Rovinj. It was believed to be rare on coarse sands (area of Rovinj) by HELLER (1864); on sand and rocks (throughout the Adriatic) by M. STOSSICH (1880) and on stones (northern Adrtiatic by A. STOSSICH. The species was also recorded from the area of Rovinj by WIMMER (1883), ZIMMERMANN (1905-1906) and ZAVODNIK (1967), on or among algae on the stones in the vicinity of Split by HORVATH (1963), from Boka kotorska Bay by STJEPČEVIĆ and PARENZAN (1980). RIEDL (1963) decribed it as common but not frequent in the stone crevices and also on secondarily stiffened substrates and rarer on soft bottoms. After my own observations and available literature it is in fact found among *Bittium reticulatum*. Greater the number of *Bittium reticulatum* in a sample (surface area 1/16 sq m), the number of *Triphora perversa* is greater and vice versa. One to 2 specimens of the species *Triphora perversa* occur with about 100 specimens of *Bittium reticulatum*. Mobile substrate (sand, mud) are limiting factors of its distribution. I recorded it from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and coralline biocoenosis.

Conclusion: This species is in fact found among *Bittium reticulatum* (both species are distributed in the same biotope). One to 2 specimens of the species *Triphora perversa* occur with about 100 specimens of *Bittium reticulatum*. Mobile substrate (sand, mud) are limiting factors of its distribution.

Epitonium clathrus (LINNAEUS, 1758)

Syn: *Turbo clathrus* LINNAEUS, 1758; *Strombiformis clathratus*, DA COSTA, 1779; *Scalaria communis*, LAMARCK, 1819; *Scalaria laevigata*, CALCARA, 1840.

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; HELLER, 1864; A. STOSSICH, 1865; JEFFREYS, 1867; BRUSINA, 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ZIMMERMANN, 1905-1906; VATOVA, 1928, 1949; COEN and VATOVA, 1933; COEN, 1937; HORVATH, 1963; RIEDL, 1963; STJEPČEVIĆ, 1967; TAVIANI, 1978, 1980; VIO *et al*, 1979; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; FORBES and HANLEY, 1848a; JEFFREYS, 1867; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; LOCARD, 1886; CARUS, 1889-1893; PRIOLO, 1958; NORDSIECK, 1968; PARENZAN, 1970; DANCE, 1974; RIEDL, 1983.

Distribution: Atlantic (the coast of Norway, Denmark, Germany, Netherlands, Great Britain, France, Portugal to Cannaries), Mediterranean.

Results of studies:
Transect: MAKARSKA AREA: fissure near Bratuš, Fig. 11 (depth: 3 m; bottom: vertical rock; submarine fresh water springs; precoralline aspect of coralline biocoenosis), 1 specimen in a rock fissure; SPLIT AREA: near Institute (depth: 2 m; bottom: flat, hard, overgrown by algae; biocoenosis of photophilic algae), 1 specimen. Transect 18, Fig. 2 (cove Lubinski porat). At 2 m depth bottom is rocky, slightly sloping, covered by a thin sediment layer and stones overgrown by algae (biocoenosis of photophilic algae). Submarine fresh water springs are relatively strong. A rather big colony of the species *Epitonium clathrus* is present in this place all year round which is mainly retained along the edges of the bottom side of stones lieing on hard substrate covered by thin sediment layer. Each diving would give 5-6 specimens. Kaštela Bay: the area around the reef between Slatine and Arbanija (depth: 15 m; bottom: coarse sand; submarine springs of fresh water; biocoenosis of coarse sands and fine gravels affected by bottom currents), 2 specimens; VIR ISLAND AREA: transect 10 (depth: 1.5 m; bottom: hard with stones and the species *Cystoseira barbata*), 1 specimen. Small local fresh water springs are at the very surface where the species *Fucus virsoides* is very well developed. Trawl: VELEBIT CHANNEL: between Jurjevo and Lukovo Otočko (depth: 75 m; bottom: mud; biocoenosis of muddy bottoms of the open central Adriatic and the northern Adriatic island area; submarine springs of fresh water), 2 specimens were obtained.

Discussion: GRAEFFE (1902) reported the species *Epitonium clathrus* fror the area of Trieste. ZIMMERMANN (1905-1906) and COEN and VATOVA (1933) as rare in the area of Rovinj, and HELLER (1864) as rather frequent on muddy substrate down to 18-36 m near Hvar and Korčula. WIMMER (1883) reported it from the central Adriatic and M. STOSSICH (1880) as numerous throughout the Adriatic. STJEPČEVIĆ (1967) stated that it was very rare in Boka kotorska Bay. This author recorded it between 5 and 17 m depth on muddy bottoms overgrown by *Zostera*: RIEDL (1963) believed it to be common but not frequent on mobile bottoms at greater depths. As

indicated by the available data this species occurs both on sands and muds and on hard substrates. I recorded it from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis, biocoenosis of coarse sands and fine gravel affected by bottom currents and the biocoenosis of muddy bottoms of the open central Adriatic and the area of the northern Adriatic islands. The smallest depth I recorded it from was 1.5 m and the greatest 75 m. I believe that the presence of fresh water is one of the basic factors affecting its distribution whereas depth, bottom type and biocoenoses which it inhabits are less important.

Conclusion: I recorded the species *Epitonium clathrus* between 1.5 and 75 m depths on both hard and mobile substrates. I also found it in the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis, biocoenosis of coarse sands and fine gravel affected by bottom currents and the biocoenosis of muddy bottoms of the open central Adriatic and the area of the northern Adriatic islands. I believe that the presence of fresh water is one of the basic factors affecting its distribution.

Epitonium tenuicostatum (MICHAUD, 1829)

Syn.: *Scalaria tenuicosta* MICHAUD, 1829; *Turbo turtonis* TURTON, 1819; *Scalaria planicosta* BIVONA, 1832; *Scalaria plicata* SCACCHI, 1836.

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1864; BRUSINA, 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; COEN and VATOVA, 1933; COEN, 1937; TAVIANI, 1978, 1980; RADIĆ, 1982.
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; LOCARD, 1886; CARUS, 1889-1893; HIDALGO, 1917; PRIOLO, 1958; NORDSIECK, 1968; PARENZAN, 1970; DANCE, 1974.

Distribution: Atlantic (from the coast of Norway to Madeira Island), Mediterranean.

Results of studies:
Transects: PELJEŠAC: Bay of Mali Ston (Fig. 12): Željen cape (Usko). Shore topography is rocky descending at and angle of 30-35^0 into the sea down to 20 m depth. The entire surface is covered by a thin sediment layer and with rather big stone blocks in places. At 10 m a single specimens was found (precoralline aspect of coralline biocoenosis). At 20-22 m, which is the greatest depth in this area, the bottom is covered by sandy-muddy sediment. Grab sample contained a single specimen (biocoenosis of detritic more or less muddy bottoms). Trawl: "PIPETA" EXPEDITION: A(1): 3.5 Nm off Chioggia (Fig. 18), 1982, 1983 (depth: 20 m; bottom: sandy-muddy with a great number of stones and submarine rocks; influence of the Po River; the biocoenosis of fine muddy sands). A single (1) specimen of the species *Epitonium tenuicostatum* was recorded in 1982 and 2 specimens in 1983.

Discussion: GRAEFFE (1902) recorded the species *Epitonium tenuicostatum* from the area of Trieste, WIMMER (1883), COENA and VATOVA (1933) from muddy bottoms near Rovinj; GRUBE (1864) near Lošinj and Hvar, and DANILO and SANDRI (1856) and BRUSINA (1866) near Zadar. M: STOSSICH (1880) reported it as rare Adriatic species. Over a long period of my studies of more or less all types of both hard and mobile bottoms throughout the Adriatic I recorded this species from two localities only. The interesting feature of both localities is that they are in an area of reduced salinity which eventually may be one of the major determinants of its distribution (too small number of data to give any definite statement). I recorded it from the precoralline aspect of coralline biocoenosis (1 s.), biocoenosis of

detritic more or less muddy bottoms (1 s.) and biocoenosis of fine muddy sands (3 s.).

Conclusion: I recorded altogether 5 specimens of the species *Epitonium tenuicostatum*, of which 1 specimen from the precoralline aspect of coralline biocoenosis, 1 specimen from the biocoenosis of detritic more or less muddy bottoms and 3 specimens from the biocoenosis of fine muddy sands. Areas of reduced salinity may presumably be the habitats it prefers in its distribution.

Capulus hungaricus (LINNAEUS, 1767)

Syn.: *Patella ungarica* LINNAEUS, 1767; *Patella hungarica* SCHRÖTER, 1784; *Amalthea maxima* SCHUMACHER, 1817; *Pileopsis ungarica* LAMARCK, 1822; *Pileopsis hungarica* POTIEZ & MICHAUD, 1838;

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; HELLER, 1864; A. STOSSICH, 1865; JEFFREYS, 1865; BRUSINA, 1870; WEINKAUFF, 1868; M. STOSSICH, 1880; B.D.D., 1882-1886; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ZIMMERMANN, 1905-1906; ODHNER, 1914; VATOVA, 1928; COEN and VATOVA, 1933; COEN, 1937; ŽUPANOVIĆ, 1961; RIEDL, 1963; GAMULIN-BRIDA, 1962, 1967b; STJEPČEVIĆ, 1967; GAMULIN-BRIDA *et al.*, 1968; ZAVODNIK, 1971; SABELLI and SPADA, 1977; TAVIANI, 1978, RADIĆ, 1982.
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; FORBES and HANLEY, 1848a; JEFFREYS, 1865; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; LOCARD, 1886; CARUS, 1889-1893; PRIOLO, 1961; NORDSIECK, 1968; BOMBACE; 1970; PARENZAN, 1970; GRAHAM, 1971; ABBOT, 1974; DANCE, 1974; SABELLI and SPADA, 1977; RIEDL, 1983.

Distribution: Atlantic (from Florida coast, across Bermudas, Iceland, Norway, Great Britain, Spain, Portugal to Gibraltar), Mediterranean.

Results of studies:
Transects: The samples collected from an area of 1/16 sq m and material collected between 1 and 20 m depth (refer to the species *Calyptraea chinensis*) contained 2 specimens of *Capulus hungaricus*. One specimen was recorded from the precoralline aspect of coralline biocoenosis at 15 m depth near the Jabuka Island and the other at 10 m depth in the biocoenosis of photophilic algae near Dubrovnik. Both specimens were attached to a rock. VIS ISLAND AREA: near Gradac cove (depth: 70-85 m; bottom: lithothamnium). Dominance of the algal species of genus *Lithothamnium*. Two big specimens were found. ZADAR AREA: transect 3 (depth: 20 m; bottom: sandy; biocoenosis of coastal detritic bottoms), 1 s. on a stone and 2 specimens on shells; VIR ISLAND AREA: transect 6 (depth: 10 m; bottom: stones with sand), 1 specimen on the shell of *Arca noae*. At 20 m bottom is sandy with *Posidonia oceanica*.Two specimens on a bottle. Trawl: station 20, Fig. 14 (depth: 80 m; bottom: sandy; biocoenosis of detritic bottoms of the open sea). Single specimens on shells of *Pinna pectinata*. Station 21, Fig. 17 (depth: 104 m; bottom: sandy; biocoenosis of detritic bottoms of the open sea). Single specimens on shells of *Ostrea cochlear*. Station 9, Fig. 5 (depth: 45 m; bottom: mud; biocoenosis of coastal terrigeneous muds), some specimens on plastic waste materials. Station 14, Fig. 7 (depth: 62 m; biocoenosis of detritic bottoms of the open sea), single specimens on shells of *Glossus humanus*. The species *Capulus hungaricus* is common but it does not occur in great numbers in the parts of the Adriatic with well developed settlements of the species *Pinna pectinata* (see the species *Calyptraea chinensis*) the shells of which are inhabited by three gastropod species and a molusc. Their ratio on half a shell, expressed as the number of individuals (21 Nm off Chioggia in the boundary area between the

biocoenosis of coastal terrigeneous muds and biocoenosis of detritic more or less muddy bottoms) at station B (3) of "PIPETA" EXPEDITION is approximatively the following: 18-20 specimens of *Anomia ephippium,* to 8-10 specimens of *Calyptraea chinensis,* to 0-1 specimen of *Crepidula unguiformis,* to 0-1 specimen of *Capulus hungaricus* (7 s. per 100 examined halves); "HVAR" EXPEDITION: "H" 1 (depth: 33 m; bottom: sandy-muddy; biocoenosis of detritic more or less muddy bottoms). A single specimen on the shell of *Pinna pectinata* (5 cm in size). "H" 3 (depth: 32 m: bottom: sandy -muddy; biocoenosis of detritic more or less muddy bottoms). A big specimen on the shell of *Pinna pectinata.* "H" 6 (depth: 60 m; bottom: sandy; biocoenosis of detritic bottoms of the open sea). A single specimen on the shell of *Ostrea edulis.* "H" 31 (depth: 85 m; bottom: sandy-muddy; biocoenosis of detritic bottoms of the open sea). A single specimen on the shell of *Pecten jacobaeus.* "H"67 (depth: 127 m; bottom: sandy-muddy; biocoenosis of detritic bottoms of the open sea). A single specimen on the shell of *Glossus humanus.*

Discussion: GRAEFFE (1902) recorded the species *Capulus hungaricus* from the area of Trieste, HELLER (1864) as frequent on coarse sand between 18 and 36 m depth in the central Adriatic, whereas M. STOSSICH (1880) reported it as rather rare at medium depths of the northern and central Adriatic. VATOVA (1928) reported it as occurring in greater number on rocky-detritic than on detritic and muddy bottoms and as rare at greater depths around Rovinj. FORBES and HANLEY (1848a) and JEFFREYS (1865) believed it to show settlement preferences for such habitats as rocky areas and places where shellfish aggregations are present. SABELLI and SPADA (1977) reported it to be the species which lives on other organisms as epibiont (as a rule on shellfishes) in the circalittoral. PÉRÈS and PICARD (1958) mentioned *Capulus hungaricus* among the species of the facies of big hydroids in the biocoenosis of shelly bottoms of the open sea with a note that they were preference but not characteristic species. GAMULIN-BRIDA (1962) recorded this species from the channels of the central Adriatic but only in sites with shelly bottoms and in small numbers (on the average 2 specimens per net haul). The same author (1967b) reported it for the biocoenosis of detritic more or less muddy bottoms between 30 and 38 m in the northern Adriatic (near Rovinj), and ZAVODNIK (1971) for 35 m in the biocoenosis of coastal detritic bottoms. This author placed it among the species with insufficiently known ecologic distribution. STJEPČEVIĆ (1967) recorded only 8 specimens from submarine rocks and big stones partly covered by algae and from other mollusc shells on hard substrate at 10-30 m depth in Boka kotorska Bay. RIEDL (1963) decribed it as common but not frequent and occurring on all hard substrates and particularly on mollusc shells. It is worth mentioning that JEFFREYS (1865) gave depth distribution of this species, which ranges from 8 to 173 m depth, on the basis of data available by other authors. That is why no scientist working in the Adriatic recorded it down to 10 m depth. In addition, it should be mentioned that the species *Calyptraea chinensis* has never been recorded from the uppermost infralittoral of the Adriatic and JEFFREYS (1865) reported that it was numerous and distributed from the low water boundary deeper in the areas of Devon (southern England) and Cannary Islands. *Capulus hungaricus* and *Calyptraea chinensis* inhabit the same habitats and the same biocoenoses, but they occur with the different number of individuals. Whereas the former occurs in small numbers the latter forms bigger or smaller colonies.

Conclusion: The species *Capulus hungaricus* inhabits different smooth hard substrates. It occurs in far greater numbers on mobile (on shells and other materials) than on rocky bottoms. However, it does not occur in great numbers on mobile substrates, either. As to the biocoenology it is identical to the species *Calyptraea chinensis.*

Calyptraea chinensis (LINNAEUS, 1767)

Syn.: *Patella chinensis* LINNAEUS, 1767; *Patella albida* DONOVAN, 1803; *Patella muricata* BROCCHI, 1814; *Trochita chinensis* SCHUMACHER, 1817; *Calyptraea laevigata* LAMARCK, 1822; *Calyptraea vulgaris* PHILIPPI, 1836; *Calyptraea polii* SCACCHI, 1836; *Calyptraea muricata* SCACCHI, 1836; *Galerus sinensis* ROUX, 1862

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; B.D.D., 1882-1886; WEINKAUFF, 1868; M. STOSSICH, 1880; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; VATOVA, 1928, 1949; COEN and VATOVA, 1933; COEN, 1937; ŽUPANOVIĆ, 1961; GAMULIN-BRIDA, 1962, 1967a, 1974; RIEDL, 1963; STJEPČEVIĆ, 1967; GAMULIN-BRIDA et al., 1968; KARAMAN and GAMULIN-BRIDA, 1970; ZAVODNIK, 1971; SABELLI and SPADA, 1977; TAVIANI, 1978, 1980; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; FORBES and HANLEY, 1848a; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; PRIOLO, 1963; NORDSIECK, 1968; BOMBACE, 1969, 1970; PARENZAN, 1970; DANCE, 1974; SABELLI and SPADA, 1977; RIEDL, 1983.

Distribution: Atlantic (southern coast of England, coast of France, Spain, Portugal, Cannaries, Madeira, Morocco, Senegal, Guinea), Mediterranean.

Results of studies:
Transects: samples from 1/16 sq m and material collected at 1-20 m depth (from Dubrovnik to Vir Island including the islands Jabuka, Sušac and Dugi otok) were collected by completely scraping off the rocky substrate. The species was recorded on only several occasions. A single specimen was recorded at rocky substrate in the biocoenosis of photophilic algae in the vicinity of Makarska. A specimen was found on the rock (coralligene of the lower horizon of littoral rocks) on Sušac Island at 20 m depth and two specimens in the precoralline aspect of coralline biocoenosis between 5 and 10 m on the rocks on the southern side of St. Ivan fortification (Dubrovnik). Several times dredge material sampled from hard substrate contained a few specimens on the algae *Pseudolithophyllum expansum* and *Peyssonnelia squamaria*. It was far more numerous on a found bottle (12 s.), an amphora fragment (7 s.), on different things which were in the area of dredging. It was frequent and common on mobile bottoms, its numbers being affected exclusively by the size of the area suitable for the settlement of this species. SPLIT AREA: Kaštela Bay: the area around the reef between Slatine and Arbanija (dredge; depth: 15 m; bottom: coarse sand; biocoenosis of coarse sands and fine gravel affected by bottom currents); the species was recorded from shells of molluscs and on the bottles (8 specimens on a bottle); BIOGRAD AREA: transect 1 (depth: 10 m; bottom: sand and settlement of *Pinna nobilis*), on shells; ZADAR AREA: transect 3 (depth: 20 to 30 m; sandy-muddy with *Posidonia oceanica* and *Vidalia volubilis*), species could be found on rare shells. Trawl: station 2 (depth: 40 to 30 m; bottom: mud; biocoenosis of coastal terrigeneous muds), large numbers on bottles, plastic sheets and tins. Station 3 (depth: 44 m; bottom: mud; biocoenosis of coastal terrigeneous muds), on shells of *Glossus humanus*, plastic sheet (32 s.) and tins. Station 6 (depth: 40 m; bottom: sandy-shelly; biocoenosis of coastal detritic bottoms). Species was frequent on different shell material and plastic tubes. Station 9 (depth: 45 m; botton: mud; biocoenosis of coastal terrigeneous muds), frequent on plastic packing material. Station 14 (depth: 62 m; biocoenosis of detritic bottoms of the open sea), frequent on shells of the species *Glossus humanus*. The species *Calyptraea chinensis* was frequent in those parts of the Adriatic where the

settlements of the species *Pinna pectinata* are developed. So, for example at station A(7) of "PIPETA" EXPEDITION (depth: 31 m; biocoenosis of detritic more or less muddy bottoms) *Pinna pectinata* was numerous (80 to 100 s. per haul) along with the species *Aequipecten opercularis* (settlement). At station B (6) "PIPETA" (depth: 42 m; biocoenosis of detritic bottoms of the open sea) the second large settlement of this species was recorded (200 s. per haul). *Pinna pectinata* occurred in large numbers in the boundary areas ("PIPETA", B(3)) between the biocoenosis of coastal terrigeneous muds and biocoenosis of detritic bottoms of the open sea (depth: 33 m). Trawling causes the transfer of this species from a biocoenosis to a biocoenosis not suitable to be its habitat so that the number of shells is increased (up to 350 s. per haul). It is interesting that the species *Calyptraea chinensis* primarily inhabits the inner side of the shell; "HVAR" EXPEDITION: checking up of our material showed its deepest occurrence at station "H" 87 (depth: 150 m; bottom: mud; biocoenosis of muddy bottoms of the open sea) on the shell of *Ostrea cochlear* (2 s.).

Discussion: GRAEFFE (1902) reported the species *Calyptraea chinnensis* from the area of Trieste. M STOSSICH (1880) reported it to occur in large numbers throughout the Adriatic, and A. STOSSICH (1865) recorded it from the shells of molluscs of sandy bottoms in the northern Adriatic. COEN and VATOVA (1933) recorded rather large numbers of this species in Lim Channel (muddy bottom). After VATOVA (1928) it is rare out of the Channel on muddy bottoms (32 to 38 m) in the vicinity of Rovinj. PÉRÈS and PICARD (1958) believed it to be abundant in the facies of the biocoenosis of coastal shelly bottoms where *Chlamys varia* is very frequent. GAMULIN-BRIDA (1962) recorded large number of this species on shells of *Pinna pectinata* on sandy bottoms at 84-87 m depth (on the average 100 alive specimens and about 7000 shells per haul) around the islands Pakleni otoci (Vis Channel) and on different shells and the alga *Rhodymenia ardissonei* on muddy bottoms at 30 m depth (on the average 5000 shells per haul) in Malo more (Bay of Mali Ston). GAMULIN-BRIDA (1974) described it as epiphytic species of wide ecological and vertical distribution (from infralittoral to bathyal). ZAVODNIK (1971) recorded it from mixed community of sandy bottom of the island Dvije sestrice (near Rovinj) at 9 m depth and STJEPČEVIĆ (1967) found small numbers of specimens attached to solid things on soft substrates down to 40 m depth throughout Bay of Boka kotorska. SABELLI and SPADA (1977) reported it to live attached to stones or mollusc shells in the infralittoral and circalittoral. RIEDL (1963) reported it for soft bottoms attached to hard substrate, particularly on mollusc shells. BOMBACE (1969) found large numbers of alive specimens of the species *Calyptraea chinensis* at 30 to 45 m depths in the coralline biocoenosis (coralline plateau) developed on detritic bottom (the area of Sicily). As I found it, the species *Calyptraea chinensis* may inhabit all types of hard and mobile bottoms provided the hard substrate to which it is attached is smooth. Such smooth surfaces are relatively rare on rocky substrates so that it is quite normal that it is not frequent there. It could be found in places where algae with leafy surfaces occur, such as the algae *Pseudolithophyllum expansum* and *Peyssonnelia squamaria*. It is common and frequent on shells and other material such as glass and plastic packing material on mobile bottoms. This points to the fact that this species distribution does not depend only on shelly material in individual biocoenoses but on a lots of other waste material which rapidly accumulates on sea bottom. *Calyptraea chinensis* can occur in the same numbers in the biocoenosis of coastal detritic bottoms (different shelly elements) and in the biocoenosis of detritic bottoms of the open sea (shells of *Glossus humanus*) as well as in the biocoenosis of detritic more or less muddy bottoms (shells of *Pinna pectinata*). It can be abundant in some other biocoenoses rich in shelly elements such as the biocoenosis of coastal terrigeneous muds (glass and plastic packing material). In general, it

may be said that its quantities in a particular biocoenosis depend on the surfaces suitable for its settling. I recorded it from different hard substrates in the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis, coralline biocoenosis, biocoenosis of the meadows of marine phanerogams, biocoenosis of coastal detritic bottoms, biocoenosis of coarse sands and fine gravels affected by bottom currents, biocoenosis of detritic bottoms of the open sea, biocoenosis of detritic more or less muddy bottoms, biocoenosis of coastal terrigeneous muds and biocoenosis of muddy bottoms of the open sea.

Conclusion: The species *Caliptraea chinensis* may inhabit all types of hard and mobile bottoms provided the hard substrate to which it is attached is smooth. It inhabits some algae such as *Pseudolithophyllum expansum* and *Peyssonnelia squamaria.* It is common and frequent on shells and other material, such as glass and plastic packing material, on mobile bottoms. Its quantities in a particular biocoenosis depend on the surfaces suitable for its settling. I recorded it from different hard substrates in the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis, coralline biocoenosis, biocoenosis of the meadows of marine phanerogams, biocoenosis of coastal detritic bottoms, biocoenosis of coarse sands and fine gravels affected by bottom currents, biocoenosis of detritic bottoms of the open sea, biocoenosis of detritic more or less muddy bottoms, biocoenosis of coastal terrigeneous muds and biocoenosis of muddy bottoms of the open sea.

Crepidula unguiformis LAMARCK, 1822

Syn.: *Patella crepidula* LINNAEUS, 1767; *Crepidula candida* RISSO, 1826; *Crepidula crepidula* O.G. COSTA, 1829; *Crepidula calceolina* DESHAYES, 1830; *Crypta unguiformis* BRUSINA, 1866

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; B.D.D., 1882-1886; LOCARD, 1886; GRAEFFE, 1902; ODHNER, 1914; VATOVA, 1928; COEN and VATOVA, 1933; COEN, 1937; HORVATH, 1963; RIEDL, 1963; ZAVODNIK, 1971; TAVIANI, 1980; RADIĆ, 1982.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; PRIOLO, 1963; NORDSIECK, 1968; BOMBACE, 1969; PARENZAN, 1970; SABELLI and SPADA, 1977; RIEDL, 1983.

Distribution: Atlantic (coast of Portugal), Mediterranean.

Results of studies:
Transects: the samples collected from an area of 1/16 sq m and material from 1 to 20 m depth (see *Calyptraea chinensis*), four specimens of the species *Crepidula unguiformis* were found. Two specimens were recorded from the area of Split (t. 13, Kašjuni) in the sample of *Cystoseira barbata* from a rock at 1 m depth. A specimen was found near Dubrovnik (Daksa Island) in the sample of *Cystoseira spinosa* from a rock at 5 m depth. The fourth specimen was found on a rock (coralline of the lower horizon of littoral rocks) of Sušac Island at 15 m depth; BIOGRAD AREA: transect 1 (depth: 10 m; bottom: sand) on *Pinna nobilis* at 15 m depth, 1 s.; ZADAR AREA: transect 3 (depth:20 to 30 m; bottom: sandy-muddy with *Posidonia oceanica* and *Vidalia volubilis*), 1 s. on *Laevicardium oblongum*. Trawl:station 1, Fig. 1 (depth: 106 m; bottom: sandy-muddy; biocoenosis of detritic bottoms of the open sea), 2 s. on *Ostrea cochlear* (facies). Station 2, Fig. 2 (depth: 40 to 30 m; bottom: mud; biocoenosis of coastal terrigeneous muds), a single specimen on a plastic sheet. Station 9, Fig. 5 (depth: 45 m; bottom: mud; biocoenosis of coastal terrigeneous muds), 2 s. on plastic packing material. Station 21, Fig. 17 (depth: 104 m; bottom: sandy; bio-

coenosis of detritic bottoms of the open sea), 1 s. on *Ostrea cochlear*. Single specimen would be found in the parts of the Adriatic with developed settlements of *Pinna pectinata* (see *Calyptraea chinensis*). In 100 checked shelly halves I found 3 specimens.

Discussion: A. STOSSICH (1865) reported the species *Crepidula unguiformis* as very rare in the northern Adriatic (on *Pinna*). M: STOSSICH (1880) believed its numbers to be about medium in the northern and central Adriatic. GRAEFFE (1902) recorded this species in the area of Trieste and COEN and VATOVA (1933) as very rare in the area of Rovinj (a single specimen on *Naticarius stercusmuscarum*); depth: 30 m; bottom: detritic). ZAVODNIK (1971) mentioned it to be present in a mixed community of sandy bottom near the island Dvije sestrice (Rovinj area) at 9 m depth (sandy with stones substrate); reporting it as a species with sparsely known ecological distribution. HORVATH (1963) recorded 3 specimens along the shores in the vicinity of Split. RIEDL (1963) also presented this species as rare in the northern Adriatic, distributed on rocks, stones and bigger molluscs: SABELLI and SPADA (1977) reported it to inhabit the infralittoral and circalittoral (recorded it at depth of 80 m). BOMBACE (1969) reported its presence at 30 to 45 m depths in coralline biocoenosis (coralline plateau) developed on detritic bottoms (Sicily area), where this author recorded a large number of alive specimens. After my records and the reports of earlier authors this species does not occur in large numbers in the Adriatic. Mostly one or , more rarely, two specimens together could be found. Vertically I recorded it at greatest depth of 106 m. Along with two preceding species the species *Crepidula unguiformis* is the species inhabiting the same biotope and the same biocoenoses.

Conclusion: The species *Crepidula unguiformis* does not occur in large numbers in the Adriatic. Along with *Capulus hungaricus* and *Calyptraea chinensis* the species *Crepidula unguiformis* is the species inhabiting the same biotope and the same biocoenoses.

Aporrhais pespelecani (LINNAEUS, 1758)

Syn.: *Strombus pes-pelecani* LINNAEUS, 1758; *Rostellaria pes-pelecani* LAMARCK, 1822; *Chenopus pes-pelecani* PHILIPPI, 1836

Previous reviews:
- Adriatic: GRUBE, 1861, 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; JEFFREYS, 1867; WEINKAUFF, 1868; M. STOSSICH, 1880; B.D.D., 1882-1886; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ZIMMERMANN, 1905-1906; ODHNER, 1914; VATOVA, 1928, 1949; COEN and VATOVA, 1933; COEN, 1937; GAMULIN-BRIDA, 1962, 1967a, 1974; RIEDL, 1963, 1983; GAMULIN-BRIDA *et al.*, 1968; STJEPČEVIĆ, 1967; KARAMAN and GAMULIN-BRIDA, 1970; ZAVODNIK, 1971; SABELLI and SPADA, 1977; TAVIANI, 1978, 1980; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; FORBES and HANLEY, 1848a; JEFFREYS, 1867; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; HIDALGO, 1870-1882; PRIOLO, 1963; NORDSIECK, 1968; PARENZAN, 1970; GRAHAM, 1971; SETTEPASSI, 1971; DANCE, 1974; SABELLI and SPADA, 1977; RIEDL, 1983.

Distribution: Atlantic (coasts of Iceland, Norway, Great Britain, Netherlands, France, Portugal, Senegal, Cannaries), Mediterranean.

Results of studies:
Transects: ZADAR AREA: transect 1 (depth: 8-10 m; bottom: sand), 11 s. Transect 1 (depth: 20 m; bottom: sandy), 3 s. Transect 2 (depth: 30 m; bottom: sandy-muddy with *Vidalia volubilis*), 11 s. Transect 3 (depth: 20 m; bottom: sandy-muddy with *Posidonia oceanica*), 7 s. Transect 3 (depth: 30 m; bottom: sandy-muddy with *Vidalia volubilis*), 7 s.; ŠIBENIK AREA: transect IV (depth: 34 m; bottom: sandy-muddy), 29 s.; VIR ISLAND AREA: transect 1 (depth: 20 m; bottom: sandy-muddy), *Vidalia*

volubilis made up 90% of the dredge sample), 3 s. Transect 3 (depth: 10-15 m; bottom: sand with lots of shells), 15 s. Transect 4 (depth: 6-7 m; bottom: sand), 2 s. Transect 6 (depth: 25 to 30 m; bottom: sandy-muddy with *Posidonia oceanica*), 3 s. Transect 10 (depth: 35 to 40 m; bottom: muddy-sandy with *Vidalia volubilis*), 2 s. Transect 11 (depth: 30 m; bottom: muddy-sandy and *Vidalia volubilis*), 5 s. Transect 12 (depth: 15 m; bottom: mud), 54 s. Trawl: station 2 (depth: 40 to 30 m; bottom: mud; biocoenosis of coastal terrigeneous muds), 154 s. Station 3 (depth: 44 m; bottom: mud; biocoenosis of coastal terrigeneous muds), 108 s. Station 22 (depth: 60 m; bottom: mud; biocoenosis of coastal terrigeneous muds), 35 s. Station 7 (depth: 60 m; bottom: mud; biocoenoisis of muddy bottoms of the open sea), 4 s. and lots of empty shells. Station 8 (depth: 61 m; bottom: mud; biocoenosis of muddy bottoms of the open sea), 2 s. Station 9 (depth: 45 m; bottom: mud; biocoenosis of coastal terrigeneous muds), 123 s. Station 10 (depth: 60 m; bottom: mud; biocoenosis of muddy bottoms of the open sea), 3 s. Station 11 (deph: 64 m; bottom: mud; biocoenosis of muddy bottoms of the open sea), 2 s. Station 13 (depth: 52 m; bottom: mud; biocoenosis of coastal terrigeneous muds), 24 s. Station 14 (depth: 62 m; bottom: sandy; biocoenosis of detritic bottoms of the open sea), 96 s. Station 17 (depth: 65 m; bottom: sandy; biocoenosis of detritic bottoms of the open sea), 3 s. Station 18 (depth: 55-60; bottom: sandy; biocoenosis of coastal detritic bottoms), 8 s. Station 21 (deph: 104 m; bottom: sandy; biocoenosis of detritic bottoms of the open sea), 8 empty shells; "HVAR" EXPEDITION (my own studies): "H" 48 (depth: 188 m; bottom: mud; biocoenosis of muddy bottoms of the open sea), 1 empty shell. "H" 57 (depth: 157 m; bottom: mud), 1 empty shell. "PIPETA" EXPEDITION (data from the western Adriatic coast): most of the biomass of the species *Aporrhais pespelecani* was found in the biocoenosis of fine muddy sands up to 3.5 Nm offshore of the shallow coastal zone (down to 30 m depth) with slightly decreased salinity. Its abundance was 400 to 5200 specimens per trawl haul (60 min haul) there. Proceeding more offshore and with subsequent depth increase, the species is abruptly thinned. So at 14 Nm offshore (muddy bottom) it occurred with the abundance of 290 specimens at 30 m depth whereas its abundance was 10 s. per an hour haul at the sam distance offshore and at the same substrate but at 70 m depth.

Discussion: The species *Aporrhais pespelecani* is a typical representative of mobile substrate. After PÉRÈS and PICARD (1958) it is characteristic species of the biocoenosis of coastal shelly bottoms. GAMULIN-BRIDA (1962) recorded this species from almost all the central Adriatic channels, particularly in places where the properties of the coastal shelly bottoms are better pronounced. This author recorded this species from the biocoenosis of detritic more or less muddy bottoms (depth: 30-53 m), biocoenosis of marine phanerogams (depth: 18-20 m), biocoenosis of terrigeneous muds f. of viscous mudds (Valdibora cove, 15 m depth), biocoenosis of terrigeneous muds f. of soft muds (Kuvi cove, 28-35 m depth) in the area of Rovinj (1967b). It reported it to be preference-characteristic species for the biocoenosis of coastal detritic bottoms (1974). ZAVODNIK (1971) reported it from the area of Rovinj in the biocoenoses: of terrigeneous muddy bottoms f. of soft muds (Lim Channel, depth: 30 m) and f. of viscous muds (Valdibora cove, depth: 15 m). This author considered it to be characteristic species of mixed bottom. Distributed all round the Adriatic. GRAEFFE (1902) recorded this species from the area of Trieste; VATOVA (1928) as very frequent species of muddy bottoms between 32 and 38 m in the area of Rovinj; A. STOSSICH (1865) believed it to be common on muddy bottoms of the northern Adriatic; STJEPČEVIĆ (1967) reported great numbers of this species on muddy substrate between 15 and 55 m in Bay of Boka kotorska. HELLER (1864) reported it to be very frequent on muddy bottoms or bottoms covered with algae between 36 and 73 m in the areas of the central and southern Adriatic; M. STOSSICH (1880) found it to be frequent

throughout the Adriatic. RIEDL (1963) described it as common and very frequent on all the mobile and secondarily stiffened bottoms, at depths exceeding 10 m. SABELLI and SPADA (1977) stated that this species inhabits sandy-mudy bottoms of the circalittoral. As I found it the species *Aporrhais pespelecani* prefers mobile bottoms at smaller depths. It is distributed between 6 and 90 m depth. Below and above this depth range a single specimen may be occasionally found. Most of the biomass of *Aporrhais pespelecani* occurs in the biocoenosis of fine muddy snads along the western Adriatic coast up to 3.5 Nm offshore of the shallow coastal zone (to 30 m depth) with slightly lower salinity. There its abundance was 400 to 5200 specimens per trawl haul (60 min haul). Proceeding more offshore and with subsequent depth increase, the species is abruptly thinned. So at 14 Nm offshore (muddy bottom) it occurred with the abundance of 290 specimens at 30 m depth whereas its abundance was 10 s. per an hour haul at the same distance offshore and at the same substrate but at 70 m depth. I recorded this species from the biocoenosis of coastal detritic bottoms, biocoenosis of fine muddy sands, bioceonosis of detritic more or less muddy bottoms, biocoenosis of detritic bottoms of the open sea, biocoenosis of the meadows of marine phanerogams, biocoenosis of coastal terrigeneous muds and biocoenosis of muddy bottoms of the open sea.

Conclusion: The species *Aporrhais pespelecani* is a representative of mobile substrate.
It is distributed between 6 and 90 m depth. Below and above this depth range a single specimen may be occasionally found. Most of the biomass of *Aporrhais pespelecani* occurs in the biocoenosis of fine muddy snads along the western Adriatic coast up to 3.5 Nm offshore of the shallow coastal zone (to 30 m depth) with slightly lower salinity. Proceeding more offshore and with subsequent depth increase, the species is abruptly thinned. I recorded this species from the biocoenosis of coastal detritic bottoms, biocoenosis of fine muddy sands, bioceonosis of detritic more or less muddy bottoms, biocoenosis of detritic bottoms of the open sea, biocoenosis of the meadows of marine phanerogams, biocoenosis of coastal terrigeneous muds and biocoenosis of muddy bottoms of the open sea.

Erato voluta (MONTAGU, 1803)

Syn.: *Cypraea voluta* MONTAGU, 1803; *Voluta laevis* DONOVAN, 1803; *Marginella donovani* PAYRAUDEAU, 1826; *Volvaria donovani* BLAINVILLE, 1826; *Marginella cypraeola* SCACHI, 1834; *Erato laevis* BRONN, 1841

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; BRUSINA, 1865; JEFFREYS, 1867; WEINKAUFF, 1868; M. STOSSICH, 1880; CARUS, 1889-1893; COEN, 1937.
Mediterranean and Atlantic: FORBES and HANLEY, 1848b; JEFFREYS; 1867; WEINKAUFF, 1866; LOCARD; 1886; CARUS; 1889-1893; PRIOLO, 1966; NORDSIECK, 1968; BOMBACE, 1970; PARENZAN, 1970; GRAHAM; 1971; SABELLI and SPADA, 1978; RIEDL, 1983.

Distribution: Atlantic (from Zetland Islands across Great Britain to Gibraltar), Mediterranean.

Results of studies:
Trawl: station 20, Fig. 14 (Hvar Island), 1975, 2 s. on the species *Eunicella singularis* (depth: 80 m; bottom: sandy; biocoenosis of detritic bottoms of the open sea).

Discussion: DANILO and SANDRI (1856) recorded the species *Erato voluta* from the area of Zadar. M. STOSSICH (1880) reported it as a species inhabiting algae at small depths in the area of the central Adriatic, whereas SABELLI and SPADA (1978) recorded it on detritic bottoms of the circalittoral. My own studies and

very poor literature on the ecology of this species show it to be a rare Adriatic species. I can report with certainty only two specimens on the species *Eunicella singularis*. I recorded it from the biocoenosis of detritic bottoms of the open sea.

Conclusion: I recorded the species *Erato voluta* at 80 m depth in the biocoenosis of detritic bottoms of the open sea in the area of Hvar Island (two specimens). The present knowledge of its ecology is still very poor so that it would be difficult to say where it is distributed.

Trivia europaea (MONTAGU, 1808)

Syn.: *Cypraea europaea* MONTAGU, 1808; *Cypraea pediculus* LINNAEUS, 1758; *Cypraea arctica* PULTENEY, 1799; *Cypraea coccinella* LAMARCK, 1810; *Trivia pediculus* BRUSINA; 1866; *Trivia arctica* HIDALGO, 1917

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ODHNER, 1914; VATOVA, 1928, 1949; COEN, 1937; GAMULIN-BRIDA, 1962, 1967b; RIEDL, 1963.
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; HIDALGO, 1870-1882; MONTEROSATO, 1878; B.D.D., 1882-1886; LOCARD; 1886; CARUS; 1889-1893; PRIOLO, 1963; NORDSIECK, 1968; PARENZAN, 1970; SABELLI and SPADA, 1978; RIEDL, 1983.

Distribution: Atlantic (coasts of Norway, Great Britain, Belgium, France, Spain, Portugal), Mediterranean.

Results of studies:
Transects: ZADAR CHANNEL (Fig. 6): shoal Sajda (depth; 7 m; bottom: coarse sand and pebbles; biocoenosis of coarse sands and fine gravel exposed to waves), 1 s. Of algae *Sargassum salicifolium* dominated; VIR ISLAND AREA: transect 11 (depth: 10 m; bottom: low rocks protruding from sandy bottom). Of algae *Sargassum salicifolium* and *Dasycladus clavaeformis* (the biocoenosis of photophilic algae was found on hard substrate and the biocoenosis of coastal detritic bottoms on mobile substrate), 3 s.; Bottom is muddy-sandy at 40-50 m with the dominance of *Vidalia volubilis*. Two dead specimens were recorded; KRK ISLAND AREA: transect 5 (depth: 20 m; bottom: sandy with *Posidonia oceanica*; biocoenosis of the meadows of *Posidonia oceanica*), 1 s. CHANNEL UNIJE: from the cape Beli art 1.4 Nm towards the reef Šilo (depth: 40 m; bottom coarse sand), 3 s. A transient area from coralline biocoenosis to the biocoenosis of coastal detritic bottoms. Material contained shells of different molluscs, fragments and small branches of *Myriapora truncata* and *Sertella beaniana*. Of algae there was a lot of lithothamnium pebbles, then *Udotea petiolata* and *Halimeda tuna*; HVAR ISLAND AREA: shoal near Jerolim (depth: 11 m; bottom: rocky with islets of sandy bottom), 1 s. *Peyssonnelia polymorpha* and *Posidonia oceanica* are developed on mobile substrate. The biocoenosis of photophilic algae, biocoenosis of the meadows of *Posidonia oceanica* and biocoenosis of coastal detritic bottoms are present; HVAR ISLAND AREA: Lukavci cliffs (depth: 54-62 m; bottom: lithothamnium; coralline biocoenosis), 2 s. The biocoenosis of the meadows of *Posidonia oceanica* is developed on mobile substrate and precoralline aspect of coralline biocoenosis is well developed on hard substrate. Trawl: station 19, Fig. 6 (depth: 65 m; bottom: sandy; biocoenosis of coastal detritic bottoms), 2 s. The biomass of zoobenthic material is considerable in this area (more than a ton of material was obtained per half an hour trawl haul). Station 20, Fig. 14 (depth: 80 m; bottom: sandy; biocoenosis of detritic bottoms of the

open sea), 2 s.; "HVAR" EXPEDITION: "H" 11 (depth: 60 m; bottom: sandy; biocoenosis of detritic bottoms of the open sea), 1 s. Dead specimens: I recorded dead specimens of the species *Trivia europaea* on muddy bottoms on several occasions and from different Adriatic parts).

Discussion: The species *Trivia europaea* was recorded from the area of Rovinj by : WIMMER (1883), on muddy bottom at 28 m depth; ODHNER (1914) and VATOVA (1928) as rare species of detritic bottoms; GAMULIN-BRIDA (1967b) recorded two specimens from the biocoenosis of detritic more or less muddy bottoms between 30 and 38 m depth. GRAEFFE (1902) reported this species for the area of Trieste, GRUBE (1864) from the area of the islands Veli Lošinj and Mali Lošinj, at 55-64 m, and DANILO and SANDRI (1856) near Zadar. M. STOSSICH (1880) described it as rather numerous at greater depth throughout the Adriatic, whereas on the contrary A. STOSSICH (1865) as very rare at greater depths in the northern Adriatic. SABELLI and SPADA (1978) reported it to inhabit detritic bottoms of the infralittoral and circalittoral at 45 m depth. RIEDL (1963) described it as common but not frequent on secondarily stiffened substrates. As I found it the species *Trivia europaea* inhabits both hard and mobile substrates. On mobile substrates it is most frequent in places where some elements of hard substrate are present or where there is a large biomass of zoobenthic material. I believe that muddy substrate is a limiting factor of its distribution. I recorded it from the biocoenosis of photophilic algae, biocoenosis of coarse sands and fine gravel wave exposed, biocoenosis of the meadows of *Posidonia oceanica*, biocoenosis of coastal detritic bottoms, biocoenosis of detritic bottoms of the open sea, precoralline aspect of coralline biocoenosis and coralline biocoenosis.

Conclusion: *Trivia europaea* inhabits both hard and mobile substrates. On mobile substrates it is most frequent in places where some elements of hard substrate are present or where there is a large biomass of zoobenthic material. Muddy substrate is a limiting factor of its distribution. I recorded it from the biocoenosis of photophilic algae, biocoenosis of coarse sands and fine gravel wave exposed, biocoenosis of the meadows of *Posidonia oceanica*, biocoenosis of coastal detritic bottoms, biocoenosis of detritic bottoms of the open sea, precoralline aspect of coralline biocoenosis and coralline biocoenosis.

Trivia pulex (GRAY, 1828)

Syn.: *Cypraea pulex* GRAY, 1828

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; CARUS, 1889-1893; GRAEFFE, 1902; COEN, 1937.
Mediterranean and Atlantic: PHILIPPI, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; HIDALGO, 1870-1882; MONTEROSATO, 1878; B.D.D., 1882-1886; LOCARD, 1886; CARUS, 1889-1893; PRIOLO, 1963; NORDSIECK, 1968; PARENZAN, 1970; GRAHAM, 1971; SABELLI and SPADA, 1978.

Distribution: Atlantic (Cannaries and Azores, Madeira and coasts of Morocco), Mediterranean.

Results of studies:
Transects: KOLOČEP ISLAND AREA (Fig. 1): north-western side (depth: 45 to 50 m; bottom: lithothamnium; coralline biocoenosis), 1 s; KAŠTELA BAY (Fig. 2): the area of the reef between Slatine and Arbanija (depth: 15 m; bottom: coarse sand; submarine springs; the biocoenosis of coarse sand and fine gravel affected by bottom currents), 1 s.; UNIJE CHANNEL: from the Beli art cape 1.4 Nm towards cliff Šilo (depth: 40 m; coarse sand), 2 s.

A transient area from coralline biocoenosis and biocoenosis of coastal detritic bottoms. Trawl: station 20, Fig. 14 (depth: 80 m; bottom: sandy; biocoenosis of detritic bottoms of the open sea), 1 s. Station 6, Fig. 16 (depth: 40 m; bottom: sandy-shelly; biocoenosis of detritic bottoms of the open sea), 1 s.

Discussion: GRAEFFE (1902) recorded the species *Trivia pulex* from the area of Trieste. DANILO and SANDRI (1856) reported it for the vicinity of Zadar. HELLER (1864) described it as very rare along the coast of Korčula Island between 37 and 55 m. M. STOSSICH (1880) also held it a very rare species in the northern and central Adriatic where it prefers greater depths, whereas SABELLI and SPADA (1978) reported it to inhabit the rocks fissures and coarse-grained detritus of the infralittoral (a specimen was found at 1 m depth). As I found it this species occurs on both mobile and hard substrates. Muddy substrate is very likely a limiting factor of its distribution. It belongs to the group of rare Adriatic gastropods. I recorded it from the biocoenosis of coarse sands and fine gravel affected by bottom currents, biocoenosis of coastal detritic bottoms, biocoenosis of detritic bottoms of the open sea and coralline biocoenosis.

Conclusion: The species *Trivia pulex* occurs on both mobile and hard substrates. Muddy substrate is very likely a limiting factor of its distribution. It belongs to the group of rare Adriatic gastropods. I recorded it from the biocoenosis of coarse sands and fine gravel affected by bottom currents, biocoenosis of coastal detritic bottoms, biocoenosis of detritic bottoms of the open sea and coralline biocoenosis.

Luria lurida (LINNAEUS, 1758)

Syn.: *Cypraea lurida* LINNAEUS, 1758; *Talparia lurida* PRIOLO, 1964

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866, 1907; WEINKAUFF, 1868; CARUS, 1889-1893; ZIMMERMANN, 1905-1906; VATOVA, 1928; COEN and VATOVA, 1933; COEN, 1937; GAMULIN-BRIDA, 1962, 1967b; RIEDL, 1963; GRUBIŠIĆ, 1967; STJEPČEVIĆ, 1967; GAMULIN-BRIDA *et al.*, 1968; KARAMAN and GAMULIN, BRIDA, 1970; STJEPČEVIĆ and PARENZAN, 1980.

Mediterranean and Atlantic: PHILIPPI, 1836; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; HIDALGO, 1870-1882, 1917; MONTEROSATO, 1878; LOCARD, 1886; CARUS, 1889-1893; PRIOLO, 1964; NORDSIECK, 1968; BURGESS, 1970; PARENZAN, 1970; SETTEPASSI, 1971; DANCE, 1974; SABELLI and SPADA, 1979; RIEDL, 1983.

Distribution: Atlantic (coast of Portugal, southwestern coast of Spain, Cape Verde Islands, Azores and Cannaries, coasts of Senegal and Angola), Mediterranean.

Results of studies:
Transects: VIS ISLAND AREA (Fig. 17): fissure near Smričevica cove (depth: 0-15 m; shore configuration: a "pavement" about 50 cm wide and vertical rock). Precoralline aspect of coralline biocoenosis is well developed from a shaded part of the very surface. A single specimen was recorded from the precoralline aspect of coralline biocoenosis at 11 m depth; HVAR ISLAND AREA (Fig. 14): outer side of the Pokrivenik cove (depth: 0-20 m; shore configuration: a 30-35^0 slope under the sea). Precoralline aspect of coralline biocoenosis is well developed from 10 to 20 m. A single specimen was recorded from precoralline aspect of coralline biocoenosis at 8 m depth; SESTRUNJ ISLAND AREA (Fig. 6): opposite the island Tri sestrice (depth: 4-8 m; bottom: rocky slightly sloping with stone bulks and stones). A single specimen was recorded from precoralline as-

pect of coralline biocoenosis at 5 m depth. Personal communication: after the information by friar Mr. Jure Radić (Franciscan monastery, Makarska) the species *Luria lurida* was recorded on several occasions on hard substrate between Makarska and Bratuč at depths of 1.5 to about 10 m. I did not find it myself in the same area. Trawl: station 18, Fig. 6 (depth: 55-60 m; bottom: sandy; biocoenosis of coastal detritic bottoms), a single dead specimen. Station 20, Fig. 14 (depth: 80 m; bottom: sandy; biocoenosis of detritic bottoms of the open sea), 2 dead specimens. Station 22, Fig. 10 (depth: 85 m; bottom: sandy; biocoenosis of detritic bottoms of the open sea), 1 dead specimen.

Discussion: The species *Luria lurida* was described by A. STOSSICH (1865) as markedly rare at greater depths in the vicinity of Rvinj. M. STOSSICH (1880) reported it as very rare in the area of Rovinj and Kvarner and less rare in the area of Zadar, Korčula and Hvar. GAMULIN-BRIDA (1967b) recorded a single specimen from the biocoenosis of detritic more or less muddy bottoms at 38 m near Rovinj. HELLER (1864) found it on sandy bottoms between 18 and 36 m in the central Adriatic. DANILO and SANDRI (1856) reported it from the vicinity of Zadar. BRUSINA (1907) found juvenile individuals to be quite different from the adults. STJEPČEVIĆ (1967) described it as rare species in Bay of Boka kotorska where he recorded it from sandy bottoms at 20-35 m depth. GRUBIŠIĆ (1967) stated that this species was distributed all along the Adriatic coast from the depth of few metres to 100 m depth, inhabiting usually sandy-muddy bottoms along with different bottom organisms. This author mentioned that trawling ground around mid-Dalmatian islands and along western Istrian coast as well known fishing grounds for this species. RIEDL (1963) held it to be rare in the Adriatic reporting it only from the great depths of the southern Adriatic on secondarily stiffened and soft bottoms. SABELLI and SPADA (1979) reported it to inhabit the infalittoral and circalittoral mostly hidden below stones. As I found it and from the available literature the species *Luria lurida* belongs to the group of rare Adriatic gastropods. It is a scyaphilous species. Wherever I recorded this species the coral representatives (*Cladocora cespitosa, Eunicella cavolini, Cariophyllia smithi*) were also well developed. This may point to the close relationship between the distribution of the class Anthozoa and the species *Luria lurida.* I recorded it only from the precoralline aspect of coralline biocoenosis between 5 and 12 m depth. I also recorded some dead specimens from the biocoenosis of coastal detritic bottoms and biocoenosis of detritic bottoms of the open sea.

Conclusion: The species *Luria lurida* belongs to the group of rare Adriatic gastropods. The sites at which this species was recorded point to the close relationship between the distribution of the class Anthozoa and the species *Luria lurida.* I recorded it only from the precoralline aspect of coralline biocoenosis between 5 and 12 m depth.

Zonaria pyrum (GMELIN, 1790)

Syn.: *Cypraea pyrum* GMELIN, 1790; *Cypraea cinnamomaea* OLIVI, 1792; *Cypraea siciliana* VON SALIS , 1793; *Cypraea rufa* LAMARCK, 1811; *Erronea pyrum* COEN and VATOVA, 1932

Previous reviews:
- Adriatic: OLIVI, 1792; DANILO and SANDRI, 1856; GRUBE, 1864; HELLER; 1864; BRUSINA, 1866, 1907; WEINKAUFF, 1868; M. STOSSICH, 1880; CARUS, 1889-1893; VATOVA, 1928; COEN, 1937; RIEDL, 1963; STJEPČEVIĆ, 1967; SETTEPASSI, 1971; RADIĆ, 1982.
- Mediterranean and Atlantic: PHILIPPI, 1836; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; HIDALGO, 1870-1882, 1917; MONTEROSATO, 1875, 1878; LOCARD, 1886; CARUS; 1889-1893; NOBRE,

1938-1940; PRIOLO, 1964; NORDSIECK, 1968; BURGESS, 1970; PARENZAN, 1970; SETTEPASSI, 1971; DANCE, 1974; RIEDL, 1983.

Distribution: Atlantic (coasts of Portugal, Senegal, Angola, Cannaries and Madeira), Mediterranean.

Results of studies:
Transects: HVAR ISLAND AREA: outer side of the Stiniva cove (depth: 0-35 m; shore configuration: vertical rock). Coralline biocoenosis is developed from 15 m deeper (lower horizon of littoral rocks). A single specimen of the species *Zonaria pyrum* was found in a rock recess at 20 m depth. MAKARSKA AREA: fissure near small settlement Bratuš (depth: 0-12 m; bottom: vertical rock). Precoralline aspect of coralline biocoenosis occurs at already 0.5 m on shaded shore parts. A single specimen was found in a rock fissure at 7 m depth. Western entrance to the port: dredge sample from 20 m contained a specimen of this species. Trawl: station 21, Fig. 17 (depth: 104 m; bottom: sandy; biocoenosis of detritic bottoms of the open sea with elements of the biocoenosis of muddy bottoms of the open sea), 1 s.; "HVAR" EXPEDITION (my own studies): "H" 67, Fig. 19 (depth: 127m; bottom: sandy-muddy; biocoenosis of detritic bottoms of the open sea with elements of the biocoenosis of muddy bottoms of the open sea). I recorded three specimens of *Zonaria pyrum* on the species *Alcyonium palmatum* on two occasions. This species was very numerous there (up to 950 s. per haul).

Discussion: OLIVI (1972) recorded the species *Zonaria pyrum* from the area of Venice as rare, living among stones in deeper waters. GRUBE (1864) reported a single specimen from the vicinity of small settlement Krivica (Lošinj Island) at 58-64 m depth. VATOVA (1928) described it as rare in the vicinity of Rovinj. STJEPČEVIĆ (1967) found a single specimen in Bay of Boka kotorska or more precisely in Bay of Herceg Novi. DANILO and SANDRI (1856) mentioned it for the area of Zadar and BRUSINA (1907) reported the record of 10 specimens from greater depths in the vicinity of Split. RIEDL (1963) believed it to be the species inhabiting mobile and secondarily stiffened substrates of greater depths of the southern Adriatic. SETTEPASSI (1971) reported it as rare in the Adriatic. This author pointed out that this species in general occurs in varying numbers in different Mediterranean parts, reporting the area of Sicily in the Mediterranean and western coast of Africa in the Atlantic as areas where it was frequent. BURGESS (1970) stated that hard substrate with little sand, well developed short algae and a lot of stones was an ideal area for Cypraidae collection. Here this author also included coral plateaus and the sites with developed small coralline formations where most species of this family hide during the day. My own studies and the data of earlier authors show that individuals of this species can be found all along the eastern Adriatic coast irrespective of its being a scyaphilous species, due to which it is pretty difficult to find their shelters when diving. *Zonaria pyrum* belongs to the group of rare Adriatic gastropods. It is interesting that at four out of five localities where I recorded this species the coral representatives (*Eunicella singularis, Paramuricea clavata, Cladocora cespitosa, Alcyonium palmatum*) were also well developed. This may point to the close relationship between the distribution of the class Anthozoa and the species *Zonaria pyrum.* I recorded it from the precoralline aspect of coralline biocoenosis, from the coralline biocoenosis and biocoenosis of detritic bottoms of the open sea.

Conclusion: The species *Zonaria pyrum* belongs to the group of rare Adriatic gastropods.This species can be found all along the eastern Adriatic coast. The sites at which this species was recorded point to the close relationship between the distribution of the class Anthozoa and the species *Zonaria pyrum.* I recorded it from the precoralline aspect of coralline biocoenosis, from the coralline biocoenosis and biocoenosis of detritic bottoms of the open sea.

Pseudosimnia adriatica (SOWERBY, 1828)

Syn.: *Ovulum adriaticum* SOWERBY, 1828; *Amphiperas adriaticum* HIDALGO, 1917; *Primovula adriatica* PRIOLO, 1963

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1864; HELLER; 1864; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; WIMMER, 1883; CARUS, 1889-1893; VATOVA, 1928; COEN, 1937; GAMULIN-BRIDA, 1962, 1974; RIEDL, 1963; STJEPČEVIĆ, 1967; ZAVODNIK, 1967b, 1971; GAMULIN-BRIDA *et al.*, 1968; PÉRÈS and GAMULIN-BRIDA, 1973; RADIĆ, 1982.
- Mediterranean: PHILIPPI, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; HIDALGO, 1870-1882; MONTEROSATO, 1878; B.D.D., 1882-1886; LOCARD, 1886; CARUS, 1889-1893; NORDSIECK, 1968; PARENZAN, 1970; SABELLI and SPADA, 1979; RIEDL, 1983.

Distribution: Mediterranean.

Results of studies:
Transects: HVAR ISLAND AREA, (Fig. 14): Lukavci cliffs (depth: 54-62 m; bottom: lithothamnium; coralline biocoenosis), 1 specimen. Of algaea the species of genus *Lithothamnium* were dominant; PELJEŠAC AREA (Fig. 12): Bay of Mali Ston: Željen cape. The collonies of the species: *Lophogorgia ceratophyta* and *Paramuricea clavata* (coralline biocoenosis) were abundant and well developed at 12-20 m depth. I worked in this area on several occasions in the years 1980 and 1981. I recorded a total of 2 specimens on the species *Lophogorgia ceratophyta.* Trawl: station 20, Fig. 14 (depth: 80 m; bottom: sandy; biocoenosis of detritic bottoms of the open sea). I found a specimen of the species *Pseudosimnia adriatica* on the species *Eunicella stricta* in 1970.

Discussion: WIMMER (1883) recorded the species *Pseudosimnia adriatica* from muddy bottoms and 28 m depth of Lim Channel. ZAVODNIK (1967b) reported it for the phytal and in 1971 for the mixed biocoenosis developed at 9 m depth near the island Dvije sestrice (the area of Rovinj). GRUBE (1864) found it in the area of Veli Lošinj, HELLER (1864) among algae at 18 to 36 m depth near Hvar Island, and M. STOSSICH (1880) near Trieste, Kvarner and Hvar Island, reporting that it lives on corals and algae at greater depths. A. STOSSICH (1865) believed it to be rare in the northern Adriatic. STJEPČEVIĆ (1967) recorded it from sandy substrate between 30 and 40 m only in Bay of Herceg Novi. PÉRÈS and GAMULIN-BRIDA, (1973) reported it as accompanying species in the biocoenosis of bathyal muds. GAMULIN-BRIDA (1974) stated that this species occurred in the biocoenosis of muddy bottoms of the open central Adriatic and among the islands in the northern Adriatic and vertically in the circalittoral and bathyal. RIEDL (1963) described it as rare Adriatic species inhabiting soft substrates at greater depths. In his paper issued in 1983 this author also mentioned corals as its habitats along with already reported soft substrates. As shown by the reports of the earlier authors and my own studies *Pseudosimnia adriatica* belongs among rarer species. During my work I managed to collect not more than four specimens of this species. Three were recorded from the coralline biocoenosis and one from the biocoenosis of detritic bottoms of the open sea between 12 and 80 m. On the basis of some earlier reports the species is distributed all along the Adriatic. It practically can occur from the very surface down to very great depths and inhabits all types of mobile and hard bottoms.

Conclusion: Pseudosimnia adriatica belongs among rarer species. Of four specimens of this species, I recorded, three were recorded from the coralline biocoenosis and one from the biocoenosis of detritic bottoms of the open sea. On the basis of some earlier reports the species is distributed all along the Adriatic. It practically

can occur from the very surface down to very great depths and inhabits all types of mobile and hard bottoms.

Simnia spelta (LINNAEUS, 1758)

Syn.: *Bulla spelta* LINNAEUS, 1758; *Ovula spelta* LAMARCK, 1822; *Volva spelta* BRUSINA, *1866*

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1861; HELLER; 1864; BRUSINA, 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; CARUS, 1889-1893; COEN, 1937.
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; HIDALGO, 1870-1882; MONTEROSATO, 1878; B.D.D., 1882-1886; LOCARD, 1886; CARUS; 1889-1893; PRIOLO, 1963; NORDSIECK, 1968; PARENZAN, 1970; SABELLI and SPADA, 1979; RIEDL, 1983.

Distribution: Atlantic (Cannaries, Portugal and western coast of Spain), Mediterranean.

Results of studies:
Transects: KOLOČEP ISLAND AREA (Fig. 1): north-western side (depth: 45-50 m; bottom: lithothamnium; coralline biocoenosis), 1 s.; MAKARSKA AREA (Fig. 11): a fissure near Bratuš (depth 12 m; bottom: vertical rock; precoralline aspect of coralline biocoenosis), 2 s. on the species *Eunicella cavolini*; VIS ISLAND AREA: a fissure near Smričevica cove (depth: 15 m; shore configuration: vertical rock; precoralline aspect of coralline biocoenosis), 1 s. on the species *Eunicella cavolini*; HVAR ISLAND AREA: outer side of the Pokrivenik cove (depth: 18 m; shore configuration: submarine 30-35^0 slope; precoralline aspect of coralline biocoenosis), 1 s. on the species *Eunicella cavolini*. Outer side of Stiniva cove (shore configuration: vertical rock from O to 35 m). Three specimens of *Simnia spelta* were found. Two were recorded on the species *Eunicella singularis* at 20 m depth and one on *Paramuricea clavata* (coralline biocoenosis) at 30 m depth. JABUKA ISLAND AREA: western side (depth: 35-40 m; bottom: vertical rock; coralline biocoenosis), 4 s. Three were found on the species *Lophogorgia ceratophyta* and one on the species *Paramuricea clavata;* PELJEŠAC AREA (Fig. 12): Bay of Mali Ston: Željen cape. Numerous and well developed collonies of the species: *Lophogorgia ceratophyta* and *Paramuricea clavata* (coralline biocoenosis) were found at 12-20 m depth. A few specimens of the species *Simnia spelta* were frequently found on the collony of *Lophogorgia ceratophyta* whereas they were much rarer on the species *Paramuricea clavata*. Trawl: station 20, Fig. 14 (depth: 80 m; bottom: sandy; biocoenosis of detritic bottoms of the open sea). In 1969 I recorded 1 s. on the species *Eunicella singularis*, 2 s. in 1972, 2 s. in 1973, 2 s. in 1975.

Discussion: DANILO and SANDRI (1856) recorded the species *Simnia spelta* in the area of Zadar and HELLER (1864) in the area of Korčula Island. M. STOSSICH (1880) believed it to be rare in the middle Adriatic. RIEDL (1963) reported its distribution on the gorgonias (*Eunicella* and *Paramuricea*) from the western Mediterranean to the Adriatic. This author described it as not a frequent species. SABELLI and SPADA (1979) stated that it lives on gorgonians, as a rule on *Eunicella singularis* in the infralittoral and circalittoral. I recorded alive specimens of the species *Simnia spelta* exclusively on the species of the order Gorgonacea: *Eunicella cavolini, Eunicella singularis*, *Lophogorgia ceratophyta* and *Paramuricea clavata,* distributed in the biocoenosis of detritic bottoms of the open sea, precoralline aspect of coralline biocoenosis and coralline biocoenosis. I believe that the distribution and numbers of the species *Simnia spelta* is closely related to the spatial distribution and numbers of the species of Gorgonacea order in the Adriatic.

Conclusion: I recorded alive specimens of the species *Simnia spelta* exclusively on the species of the order Gorgonacea: *Eunicella cavolini, Eunicella singularis, Lophogorgia ceratophyta* and *Paramuricea clavata*, distributed in the biocoenosis of detritic bottoms of the open sea, precoralline aspect of coralline biocoenosis and coralline biocoenosis. I believe that the distribution and numbers of the species *Simnia spelta* is closely related to the spatial distribution and numbers of the species of Gorgonacea order in the Adriatic.

Lunatia alderi (FORBES, 1838)

Syn.: *Natica alderi* FORBES, 1838; *Natica intermedia* PHILIPPI, 1836; *Natica poliana* DELLE CHIAJE, 1841;

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1864; JEFFREYS, 1867; WEINKAUFF, 1868; CARUS, 1889-1893; COEN, 1937; RIEDL, 1963; STJEPČEVIĆ, 1967; GAMULIN-BRIDA *et al.*, 1968; KARAMAN and GAMULIN-BRIDA, 1970; ZAVODNIK, 1971; SABELLI and SPADA, 1977; TAVIANI, 1978, 1980; STJEPČEVIĆ and PARENZAN, 1980.
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; JEFFREYS, 1867; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; LOCARD, 1886; CARUS; 1889-1893; NORDSIECK, 1968; PARENZAN, 1970; GRAHAM, 1971; SABELLI and SPADA, 1977; RIEDL, 1983.

Distribution: Atlantic (from the coast of Norway, Great Britain; Netherlands, France, Spain, Portugal to Gibraltar), Mediterranean.

Results of studies:
Transects: ZADAR AREA: transect 2 (depth: 10 m; bottom: sandy; biocoenosis of the meadows of *Posidonia oceanica*), 1 s.; depth: 30 m (biocoenosis of coastal detritic bottoms), 1 s.; depth: 40 m (biocoenosis of coastal detritic bottoms), 2 s.; VIR ISLAND AREA: transect 7(depth: 10 m; bottom: sandy and *Cymodocea nodosa*), 1 s.; depth: 40 m (biocoenosis of coastal detritic bottoms), 2 s. Transect 6 (depth: 50 m; biocoenosis of detritic more or less muddy bottoms, dominance of the species *Vidalia volubilis*), 2 s. Transect 10 (depth: 60 m; biocoenosis of detritic more or less muddy bottoms and *Vidalia volubilis*), 3 s.; SESTRUNJ ISLAND AREA: depth: 10 m; bottom: sand and *Posidonia oceanica*, 1 s.; depth: 20 m; bottom: sandy and *Posidonia oceanica*, 2 s; KRK ISLAND AREA: transect 2 (depth: 15 m; bottom: sandy; biocoenosis of coastal detritic bottoms), 1 s. Transect 3 (depth: 30 m; bottom: muddy-sandy and *Vidalia volubilis*; biocoenosis of detritic more or less muddy bottoms), 6 s. and 10 shells. Transect 10 (depth: 30 m; bottom: mud; biocoenosis of coastal detritic bottoms), 5 s. Trawl: station 3, Fig. 2 (depth: 44 m; bottom: mud; biocoenosis of coastal terrigeneous muds), 2 s. Station 7, Fig. 5 (depth: 60 m; bottom: mud; biocoenosis of muddy bottoms of the open sea), 3 s. Station 8, Fig. 5 (depth: 62 m; bottom: mud; biocoenosis of muddy bottoms of the open sea), 1 s. Station 20, Fig. 14 (depth: 80 m; bottom: sandy; biocoenosis of detritic bottoms of the open sea), 5 s. Station 21, Fig. 17 (depth: 104 m; bottom: sandy; biocoenosis of detritic bottoms of the open sea), 1 s. Station 26, Fig. 13 (depth: 100 m; bottom: mud; biocoenosis of muddy bottoms of the open sea), 1 s.

Discussion: GRUBE (1864) reported the species *Lunatia alderi* (1864) for the shores of Cres Island, RIEDL (1963) for all mobile bottoms of the northern Adriatic, and DANILO and SANDRI (1856) for the area of Zadar. ZAVODNIK (1971) recorded it from the biocoenosis of terrigeneous muds (Valdibora Bay near Rovinj - depth: 15 m), f. of viscous muds.

This author described it as a species with sparsely known ecological distribution. STJEPČEVIĆ (1967) recorded only 5 specimens from muddy bottoms at 20 m in Bay of Boka kotorska. SABELLI and SPADA (1977) presented the photo of a specimen from 70 m in the central Adriatic. They believed it to live on muddy and detritic bottoms of circalittoral and bathyal. JEFFREYS (1867) recorded it (along the Great Britain coast) on sand from the low tide boundary to great depths. NORDSIECK (1968) also described it as a species of large depth distribution (from 2 to 2300 m), whereas GRAHAM (1971) reported its distribution range of 9-82 m on sandy-muddy and coralline bottoms. Comparing the distribution of this species with that of the species *Lunatia guillemini* and *Lunatia fusca*, and on the basis of my own studies, *Lunatia guillemini* appears to be frequent down to 20 m, *Lunatia alderi* from 10 to 100 m and *Lunatia fusca* below 100 m. I recorded this species from the biocoenosis of the meadows of marine phanerogams, biocoenosis of coastal detritic bottoms, biocoenosis of detritic more or less muddy bottoms, biocoenosis of detritic bottoms of the open sea, biocoenosis of coastal detritic bottoms and biocoenosis of muddy bottoms of the open sea.

Conclusion: The species *Lunatia alderi* is a representative of mobile substrates. It is frequent between 10 and 100 m. I recorded this species from the biocoenosis of the meadows of marine phanerogams, biocoenosis of coastal detritic bottoms, biocoenosis of detritic more or less muddy bottoms, biocoenosis of detritic bottoms of the open sea, biocoenosis of coastal detritic bottoms and biocoenosis of muddy bottoms of the open sea.

Lunatia fusca (BLAINVILLE, 1825)

Syn.: *Natica fusca* BLAINVILLE, 1825; *Natica sordida* PHILIPPI, 1844; *Polynices fusca* PRIOLO, 1963;

Previous reviews:
- Adriatic: BRUSINA, 1866; WEINKAUFF, 1868; CARUS, 1889-1893; COEN, 1937; SABELLI and SPADA, 1977.
Mediterranean and Atlantic: WEINKAUFF, 1868; ARADAS and BENOIT, 1870; LOCARD, 1886; CARUS, 1889-1893; PRIOLO, 1963; NORDSIECK, 1968; PARENZAN, 1970; SABELLI and SPADA, 1977.

Distribution: Atlantic (from the coast of Great Britain, France, Spain, Portugal), Mediterranean.

Results of studies:
Trawl: "HVAR" EXPEDITION: biocoenosis of muddy bottoms of the open sea: "H" 40 (depth: 181 m), 1 s. "H" 43(depth: 220 m), 2 s. "H" 44 (depth: 220 m), 3 s., "H" 47 (depth: 199 m), 1 s. "H" 48 (depth: 188 m), 2 s. "H" 49 (depth: 240 m), 2 s. "H" 55 (depth: 186 m), 1 s. "H" 57 (depth 157 m), 2 s. "H" 60 (depth: 210 m), 2 s. "H" 66 (depth: 135 m), 1 s. "H" 97 (depth: 128 m), 1 s. "H" 99 (depth: 174 m), 1 s. "H" 103 (depth: 186 m), 1 s. "H" 104 (depth: 128 m), 2 s. "H" 118 (depth: 153 m), 2 s. "H" 119 (depth: 155 m), 1 s. Biocoenosis of detritic bottoms of the open sea: "H" 42 (depth: 132 m), 1 s. "H" 67 (depth: 127 m), 5 s. "H" 70 (depth: 110 m), 1 s. "H" 78 (depth: 111 m), 1 s. "H" 88 (depth: 124 m), 1 s. "H" 92 (depth: 61 m), 1 s. "H" 110 (depth: 168 m), 1 s.

Discussion: SABELLI and SPADA (1977) recorded it from 110 m in the area of Jabuka Island. They describe it as a species of detritic-muddy bottoms of the circalittoral. PARENZAN (1970) reported it as common at depths of several tenths metres to 200 m and even at 2000 m in the Mediterranean. NORDSIECK (1968) stated that it was the species inhabiting sands between 10 and 185 m. As I found it the species *Lunatia fusca* is common at depths exceeding 100 m even though it may be found at smaller depths, as well. I recorded it from the biocoenosis of muddy bottoms of the open sea and the biocoensis of detritic bottoms of the open sea.

Conclusion: Lunatia fusca is common at muddy and detritic bottoms at depths exceeding 100 m. I recorded it from the biocoenosis of muddy bottoms of the open sea and the biocoenosis of detritic bottoms of the open sea.

Lunatia guillemini (PAYRAUDEAU, 1826)

Syn.: *Natica guillemini* (PAYRAUDEAU, 1826); *Natica fusca* PAYRAUDEAU, 1826; *Natica marmorata* RISSO, 1826; *Polynices guillemini* COEN & VATOVA, 1932

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; BRUSINA, 1865, 1866; WEINKAUFF, 1868; B.D.D., 1882-1886; M. STOSSICH, 1880; CARUS, 1889-1893; GRAEFFE, 1902; ODHNER, 1914; VATOVA, 1928; COEN, 1937; RIEDL 1963; ZAVODNIK, 1971; GAMULIN-BRIDA, 1974.
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; LOCARD, 1886; CARUS, 1889-1893; PRIOLO, 1963; NORDSIECK, 1968; PARENZAN, 1970; SABELLI and SPADA, 1977; RIEDL, 1983.

Distribution: Atlantic (Portugal and western coast of Spain), Mediterranean.

Results of studies:
Transects: ŠIBENIK AREA: transect 3 (depth: 20 m; bottom: sandy and *Posidonia oceanica*), 2 s.; ZADAR AREA: transect 3 (depth: 15 m; bottom: sand; biocoenosis of coastal detritic bottoms), 5 s.; VIR ISLAND AREA: transect 5 (depth: 10 m; bottom: sandy and *Cymodocea nodosa*), 3 s. Transect 6 (depth: 10 m; bottom: sandy and *Cymodocea nodosa*), 2 s. Transect 11 (depth: 20 m; bottom: muddy-sandy and *Vidalia volubilis*; biocoenosis of detritic more or less muddy bottoms), 3 s. Transect 12 (depth: 10 m; bottom: mud; biocoenosis of coastal terrigeneous muds), 5 s.; KRK ISLAND AREA: transect 2 (depth: 10 m; bottom: sand and *Cymodocea nodosa*), 2 s. Transect 5 (depth: 20 m; bottom: sandy-muddy and *Vidalia volubilis*), 2 s. Transect 10 (depth: 20 m;bottom: sandy-muddy and *Vidalia volubilis*), 3 s.

Discussion: The species *Lunatia guillemini* is a representative of mobile substrate. It belongs to the group of common but not numerous Adriatic gastropods. GRAEFFE (1902) recorded it from the area of Trieste, ODHNER (1914), VATOVA (1928) and ZAVODNIK (1971) near Rovinj, and DANILO and SANDRI (1856) and M. STOSSICH (1880) in the area of Zadar. After B.D.D. (1882-1886) it occurs in rather high numbers in the Adriatic. RIEDL (1963) considered it a common species at all mobile bottoms, and GAMULIN-BRIDA (1974) as a species of biocoenosis of mobile transient bottoms in the infralittoral and circalittoral. SABELLI and SPADA (1977) reported it as a shallow infralittoral species of sandy and muddy bottoms, and ZAVODNIK (1971) as a species preferring fine sandy and muddy bottoms. This author recorded it from the biocoenosis of terrigeneous muddy bottoms, facies of viscous muds (Valdibora bay, depth: 15 m) and from mixed biocoenosis of sandy bottoms (Dvije sestrice Island, depth: 9 m). I recorded alive specimens of *Lunatia guillemini* down to 20 m depth in the biocoenosis of coastal terrigeneous muds, biocoenosis of detritic more or less muddy bottoms, biocoenosis of coastal detritic bottoms and biocoenosis of the meadows of marine phanerogams.

Conclusion: The species *Lunatia guillemini* is a common species down to 20 m depth. I recorded it from the biocoenosis of coastal terrigeneous muds, biocoenosis of detritic more or less muddy bottoms, biocoenosis of coastal detritic bottoms and biocoenosis of the meadows of marine phanerogams.

Naticarius stercusmuscarum
(GMELIN, 1790)

Syn.: *Nerita stercusmuscarum* GMELIN, 1790; *Natica millepunctata* LAMARCK, 1822; *Natica punctata* RISSO 1826; *Natica millepoints* BLAINVILLE, 1826; *Natica sanguinolenta* BRUSINA, 1865

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1864; HELLER, 1864; BRUSINA, 1865; A: STOSSICH, 1865; WEINKAUFF, 1868; M. STOSSICH, 1880; WIMMER; 1883; CARUS, 1889-1893; GRAEFFE, 1902; ZIMMERMANN, 1905-1906; ODHNER, 1914; VATOVA, 1928; COEN and VATOVA, 1933; COEN, 1937; RIEDL, 1963; STJEPČEVIĆ, 1967; KARAMAN and GAMULIN-BRIDA, 1970; SABELLI and SPADA, 1980; STJEPČEVIĆ and PARNZAN, 1980; RADIĆ, 1982.
Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; CARUS, 1889-1893; PRIOLO, 1963; NORDSIECK, 1968; PARENZAN, 1970; SABELLI and SPADA, 1980; RIEDL, 1983.

Distribution: Atlantic (Cannaries, Portugal and western coast of Spain), Mediterranean.

Results of studies:
Trawl: station 15, Fig. 8 (depth: 48 m; bottom: sandy; biocoenosis of detritic bottoms of the open sea), 420 shells with *Adamsia palliata* and *Pagurus pridauxi*. Station 17, Fig. 8 (depth: 65 m; bottom: sandy; biocoenosis of detritic bottoms of the open sea), 382 shells with *Adamsia palliata* and *Paguristes oculatus;* "HVAR" EXPEDITION: "H" 76 (depth: 111 m; biocoenosis of detritic bottoms of the open sea), 3 shells. "H" 136 (depth: 457 m; mixed bottom), 1 shell. "PIPETA" EXPEDITION (number of specimens per an hour haul): data for western coast: 3.0 to 3.5 Nm offshore (biocoenosis of fine muddy sands): A(1), depth: 20 m, 5 specimens. B (1), depth: 30 m, 64 specimens. C (1), depth: 12 m; 361 specimen. D (1), depth: 15 m, 105 specimens. E (1), depth: 26 m, 52 specimens. F (1), depth: 15 m, 23 specimens. H (1), depth: 28 m, 4 specimens.

Discussion: GRAEFFE (1902) recorded the species *Naticarius stercusmuscarum* from the area of Trieste, WIMMER (1883), ZIMMERMANN (1905-1906) and ODHNER (1914) near Rovinj, and GRUBE (1864) near Mali Lošinj. COEN and VATOVA (1933) recorded only empty shells with *Paguristes oculatus* and *Pagurus pridauxi* on bottoms with the dominance of mud, between 20 and 33 m. M. STOSSICH (1880) believed it to be very rare in the northern Adriatic and numerous in the central Adriatic. HELLER (1864) reported it as rather frequent in the area of Hvar and Vis islands on bottoms covered with algae, between 37 and 47 m. STJEPČEVIĆ (1967) decribed it as rarae in Bay of Boka kotorska (a total of 11 specimens found) inhabiting muddy-sandy bottoms at 10-30 m depths. SABELLI and SPADA (1980) recorded it from muddy bottoms of the circalittoral step, starting from 25 m (reported it for the area of Chioggia, from 25 m depth). After my own records the species *Naticarius stercusmuscarum* is a nearshore species. It is distributed from about 7 to about 30-35 m depth about 5Nm offshore. It inhabits the biocoenosis of fine muddy sands.

Conclusion: The species *Naticarius stercusmuscarum* is a nearshore species. It is distributed from about 7 to about 30-35 m depth about 5Nm offshore. It inhabits the biocoenosis of fine muddy sands.

Naticarius maculatus (ULYSSES, 1795)

Syn: *Nerita maculata* ULYSSES, 1795; *Nerita hebraea* MARTYN, 1769; *Natica cruentata* PAYRAUDEAU, 1826; *Nacca maxima* RISSO, 1826; *Natica fustigee* BLAINVILLE, 1826; *Natica adspersa* MENKE, 1830; *Natica hebraea* MARTYN, 1854

Previous reviews:
- Adriatic: HELLER, 1864; BRUSINA; 1865, 1866; A. STOSSICH, 1865; WEINKAUFF, 1868; M. STOSSICH, 1880; CARUS; 1889-1893; VATOVA, 1928; COEN and VATOVA, 1933; COEN, 1937; RIEDL, 1963; STJEPČEVIĆ, 1967; GAMULIN-BRIDA *et al.*, 1968; KARAMAN and GAMULIN -BRIDA, 1970; SABELLI and SPADA, 1980; STJEPČEVIĆ and PARENZAN, 1980.
- Mediterranean and Atlantic: WEINKAUFF, 1868; MONTEROSATO, 1878; B.D.D., 1882-1886; LOCARD, 1886; CARUS, 1889-1893; PRIOLO, 1963; NORDSIECK, 1968; PARENZAN, 1970; SABELLI and SPADA, 1980; RIEDL, 1983.

Distribution: Atlantic (Portugal and western coast of Spain), Mediterranean.

Results of studies:
Trawl: this species inhabits the same habitat as *Naticarius stercusmuscarum.* However, its number is far lower than that of the preceeding species.

Discussion: HELLER (1864) reported the species *Naticarius maculatus* as frequent in the area of Korčula Island, in the meadows of algae (as stated by that author) between 37 and 55 m depth. More authors reported it as rare in the Adriatic, such as A. STOSSICH (1865) and COEN and VATOVA (1933) for the area of Rovinj, M. STOSSICH (1880) in the northern Adriatic, BRUSINA (1865, 1866) around ZADAR, STJEPČEVIĆ (1967), KARAMAN and GAMULIN-BRIDA (1970) and STJEPČEVIĆ and PARENZAN (1980) throughout Bay of Boka kotorska. After STJEPČEVIĆ (1967) this species inhabits muddy-sandy substrate partly covered with marine phanerogams down to 50 m. RIEDL (1963) believes it to be a muddy species of greater depths, and SABELLI and SPADA (1980) stated for *Naticarius maculatus* to live on detritic bottoms of the infralittoral and circalittoral. There it inhabits coarser particles (mentioned authors reported it for the area of Chioggia at 10 m depth). After my own data this species inhabits the same area and the same habitat type as *Naticarius stercusmuscarum* being, however, much rarer.

Conclusion : The species *Naticarius macultus* is a nearshore species. It inhabits the same area and the same habitat type as *Naticarius stercusmuscarum* being, however, much rarer.

Ranella gigantea LAMARCK, 1816

Syn. *Ranella olearium* LINNAEUS, 1758; *Agrobuccinum giganteum* DAUTZENBERG, 1827

Previous reviews:
- Adriatic: RADIĆ, 1982.
- Mediterranean and Atlantic: CARUS, 1889-1893; NOBRE, 1938-1940; NORDSIECK, 1968; PARENZAN, 1970; SABELLI and SPADA, 1980.

Distribution: Atlantic (Madeira, coasts of France, Spain, Portugal),Mediterranean.

Results of studies:
Trawl: during "PIPETA" EXPEDITION in 1982, five (5) specimens of this species were found at stations I(4), depth: 200-260 m and station I(5), depth: 396-430 m (Fig. 18) on macroscopically very fine sandy bottom. Bottom at station I(5) was of markedly wavy configuration. Qualitative and quantitative structure of fauna is almost the same at both stations. The species dominating the Cnidaria groups were: *Amphianthus dohrnii* and *Hormathia coronata*; of Arthropoda: *Macropipus tuberculatus, Pagurus variabilis;* of Echinodermata: *Echinus melo* and *Cidaris cidaris,* and of the group Tentaculata: *Terebratula vitrea.* Of five recorded specimens of the species *Ranella gigantea*, four were recorded from station I(5) and one from I(4).

Biometrical data of recorded specimens:

I	length	: 18.0 cm	width	: 6.6 cm	height : 7.8 cm
II	"	: 17.0 cm	"	: 6.5 cm	" : 5.7 cm
III	"	: 16.5 cm	"	: 6.6 cm	" : 5.8 cm
IV	"	: 12.8 cm	"	: 5.3 cm	" : 4.9 cm
V	"	: 12.7 cm	"	: 5.3 cm	" : 4.8 cm

Discussion: During my long-term studies covering a large part of the Adriatic and almost all bottom types and depths, I recorded the species *Ranella gigantea* only from the depths exceeding 200 m in the southern Adriatic. Checking up the literature on Mollusca available for the Adriatic a single datum on this species I found in the paper by RADIĆ (1982, page 190) among the list of species of the area of Makarska, with no annotation. PARENZAN (1970) reported its distribution down to 150-200 m depth on coralline bottoms and as distinct from other seas, this author reported it as frequent in the Ionian Sea. It may be worth mentioning that at both stations wherefrom I recorded this specie the only gear used is long-line. That is an area with a number enclaves of hard substrate, so that trawl hauls give many fragments of hard bottoms. Comparing this bottom type with the report of PARENZAN (1970) that species was distributed on coralline bottoms, it most likely prefers hard substrate. SABELLI and SPADA (1978) stated that it lived on detritic-muddy bottoms of the circalittoral and bathyal between 80 and 300 m. The northernmost point in the Adriatic wherefrom it was recorded (if the record is correct) is the area of Makarska (central Adriatic). Earlier studies point to the fact that this species is mostly distributed in the deeper southern Adriatic (no specimen has ever been recorded from the northern Adriatic and there is only one report for a single specimen in the list of species for Makarska area in the central Adriatic), where every trawl haul gives one to two specimens of this species.

Conclusion: I recorded the species *Ranella gigantea* only from the depths exceeding 200 m in the southern Adriatic on macroscopically fine sandy bottom with enclaves of hard substrate. I believe that this species is mostly distributed in the deeper southern Adriatic, particularly in places where there are enclaves of hard substrate within the biocoenosis of bathyal muds, facies of sandy and sandy-shelly muds.

Charonia tritonis seguenza
(ARADAS and BENOIT, 1870)

Syn.: *Tritonium seguenzae* ARADAS & BENOIT, 1870; *Tritonium variegatum* LAMARCK, 1816

Previous reviews:
- Adriatic: HELLER, 1864; BRUSINA, 1865, 1907;ARADAS and BENOIT, 1870;M. STOSSICH, 1880; COEN, 1937; GRUBIŠIĆ, 1967,1982.
- Mediterranean and Atlantic: ARADAS and BENOIT, 1870; HIDALGO, 1917; PRIOLO, 1964; SETTEPASSI, 1967; NORDSIECK, 1968; PARENZAN, 1970.

Distribution: Atlantic (southern Atlantic, Cannaries), Mediterranean.

Results of studies:
Transects: VIS ISLAND AREA: fissure near Smričevica cove: 1 s. in 1963 (depth: 2 m; shore configuration: vertical rock), precoralline aspect of coralline biocoenosis. Fissure near Gradac cove: 1 s. in 1975 (depth: 8 m; shore configuration: vertical rock), precoralline aspect of coralline biocoenosis, HVAR ISLAND AREA: outer side of Stiniva cove: 1 s. in 1973

(depth: 25 m; shore configuration: vertical rock), coralline biocoenosis (lower horizon of littoral rocks); SUŠAC ISLAND AREA: southern side, near Gradeška cape: 1 s. in 1987 (depth: 37 m; shore configuration: vertical rock), coralline biocoenosis (lower horizon of littoral rocks).

Discussion: During my long-term studies in the larger part of the Adriatic on almost all types of both hard and mobile bottoms (studies covered the nearshore and open deep Adriatic of the littoral, that is the bionomic steps: supralittoral, mediolittoral, infralittoral, circalittoral and bathyal of hard and mobile substrate) by trawl, dredge and SCUBA divers, I found the gastropod *Charonia tritonis seguenza* only in the area of mid-Dalmatian islands (Vis Island, 2 s; Hvar Island, 1 s; Sušac Island, 1 s). All four specimens were found (SCUBA divers) on vertical rocks between 2 and 37 m depth, in coralline biocoenosis (lower horizon of littoral rocks), 2 specimens and 2 specimens in precoralline aspect of coralline biocoenosis. BRUSINA (1907) also reported a rare gastropod of the middle and southern Dalmatia (Šibenik, 1 s.; Vis Island, 5 s; Hvar Island, 2 s.; Makarska, 1 s.; Dubrovnik, 1 s.). GRUBIŠIĆ (1967, 1982*) believes that it inhabits southern Adriatic (down to 100 m depth), particularly in the vicinity of Dubrovnik. This author also reported it to live in the area of steep rocks and stones, and that it may creep up almost to the surface. Due to its size (the biggest Adriatic gastropod) and beauty, after GRUBIŠIĆ, it has almost completely disappeared from the Adriatic being almost completely devastated by divers who collect anything that may be sold. It belongs to the group of rare Adriatic gastropods. The northernmost point reached by this gastropod is the area of the middle Adriatic (no specimen has ever been recorded from the northern Adriatic). Biocoenologically, it is distributed in the areas of well developed coralline biocoenosis or precoralline aspect of coralline biocoenosis.

Conclusion: Charonia tritonis seguenza is a representative of hard substrate. It belongs to the group of rare Adriatic gastropods. This species lives in the area of steep rocks and stones, and it may creep up almost to the surface. The northernmost point reached by this gastropod is the area of the middle Adriatic. Biocoenologically, it is distributed in the areas of well developed coralline biocoenosis or precoralline aspect of coralline biocoenosis.

Tonna galea (LINNAEUS, 1758)

Syn.: *Buccinium galea* LINNAEUS, 1758; *Coclea cassidiformis* PLANCHUS, 1739; *Dolium galea* POLI & DELLE CHIAJE, 1791

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; CARUS, 1889-1893; ZIMMERMANN, 1905-1906; VATOVA, 1928, 1949; COEN and VATOVA, 1933; COEN, 1937; RIEDL, 1963; GRUBIŠIĆ, 1967, 1982; STJEPČEVIĆ , 1967; GAMULIN-BRIDA, 1974; RADIĆ, 1982.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; LOCARD, 1886, 1892; CARUS, 1889-1893; HIDALGO, 1917; NOBRE, 1938-1940; PRIOLO, 1964; NORDSIECK, 1968;
- PARENZAN, 1970; SETTEPASSI, 1971; ABBOT, 1974; DANCE, 1974; RIEDL, 1983.

Distribution: Atlantic (Cannaries, coasts of Senegal, Gabon, Angola, Portugal)and southern Spain, as well as along the coast of South and North America, from North Carolina to Texas and Antilles and along Brasilian coast),

* GRUBIŠIĆ, 1967 (page 243) and 1982 (page 213) - The figure depicts the gastropod *Charonia tritonis seguenza* and not *Tritonia nodiferum* LAM. (comment by Šimunović) as shown by the figure caption.

Indo-Pacific (DANCE, 1974; ABBOT, 1974), Mediterranean.

Results of studies:
Transects: VIS ISLAND AREA: cove in front of the rock Rogačić (depth: 12-15 m; bottom: sandy). A settlement of 67 specimens; HVAR ISLAND AREA: cove Maslinica near Starigrad (depth: 15 m; bottom: sandy). A settlement of 53 alive specimens. Zub od Zarače (bottom: rocky with sand patches). Two (2) big specimens were recorded; UNIJE ISLAND AREA: bottom sandy and depth of the cove 17 m. A settlement of 35 specimens. Trawl: station 18 (depth: 55-60 m; bottom: sandy), 2 s. Station 20 (depth: 80 m; bottom: sandy). This stations was sampled on seven occasions and I recorded this species on two occasions , 3 s. on October 24, 1969 and 2 s. on April 27, 1974. Station 23 (depth: 85 m; bottom: sandy). Every trawl haul gave frequently 1 to 2 or even 3 alive specimens (high biomass of demersal organisms are regularly obtained from this and preceeding station).

Discussion: A. STOSSICH (1865) stated that *Tonna galea* was very rare in the northern Adriatic and that it was always recorded from great depth far off the coast. VATOVA (1928) reported it from the area of Rovinj as very rare species. ZIMMERMANN (1905-1906) recorded it from Lim Channel, and COEN and VATIOVA (1933) reported it to be very rare in Lim Channel on rocky bottoms at 18 m depth. DANILO and SANDRI (1856) recorded it from the area of Zadar, BRUSINA (1866) from the areas of Zadar, Split and Dubrovnik, HELLER (1864) on a coarse sand in the area of Hvar and Vis islands between 37 and 55 m, and M. STOSSICH (1880) as very rare in Kvarner and occurring at great depths and far larger numbers in Dalmatia. RIEDL (1963) reported it as a species of soft and secondarily stiffened bottoms and rare at greater depths of the southern Adriatic. STJEPČEVIĆ (1967) recorded only 4 specimens from muddy-sandy bottoms of Bay of Boka kotorska at 30-60 m depth. The data I obtained on this species are mainly in agreement with those of GRUBIŠIĆ (1967) who reported the species *Tonna galea* to live not far from the coast all along the Adriatic but not at depth smaller than 10 m nor exceeding 150 m and preferring sandy-muddy bottoms, more the sites abundantly inhabited with bottom organisms. The densest settlements GRUBIŠIĆ recorded from mid-Dalmatian channels, big bays and coves such as the big bay of Starigrad on Hvar Island and Vis port. I would add to the report of GRUBIŠIĆ (1967) concerning its horizontal distribution that I recorded no alive specimen further than 5 Nm offshore. GAMULIN-BRIDA (1974) believed it to have preferences for the biocoenoses of detritic bottoms of rather open areas around islands and those of the open sea. As to its vertical distribution this authoress reported its occurrence in the circalittoral and bathyal steps. I do not believe that this species occurs in bathyal step in the Adriatic. In addition, it occurs in far larger numbers at infra- than at circalittoral step. I recorded it from the biocoenosis of coastal detritic bottoms and the biocoenosis of detritic bottoms of the open areas around islands.

Conclusion: Tonna galea is a nearshore species of mobile bottoms with the dominance of sandy component. It is distributed in the biocoenosis of coastal detritic bottoms and detritic bottoms of the open areas around islands. Vertically it occurs in infra and circalittoral.

Truncullariopsis trunculus
(LINNAEUS, 1767)

Syn.: *Murex trunculus* LINNAEUS, 1767

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1861; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; WIMMER, 1883; CARUS, 1889-1893; GRA-

EFFE, 1902; ZIMMERMANN, 1905-1906; BRUSINA, 1907; ODHNER, 1914; VATOVA, 1928, 1949; COEN, 1937; ZEI, 1955; GAMULIN-BRIDA, 1962, 1967b, 1974; HORVATH, 1963; RIEDL, 1963; GRUBIŠIĆ, 1967, 1982; STJEPČEVIĆ , 1967; ZAVODNIK, 1967a, 1971; GAMULIN-BRIDA *et al.*, 1968; ŠIMUNOVIĆ, 1970; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; CARUS, 1889-1893; PRIOLO, 1964; SETTEPASSI, 1967; NORDSIECK, 1968; PARENZAN, 1970; DANCE, 1974; SABELLI and SPADA, 1977; RIEDL, 1983.

Distribution: Atlantic (from the coast of Portugal to Senegal and along Cannaries), Mediterranean.

Results of studies:
Transects: DUBROVNIK AREA (Mokošica): between 3 and 6 m depth (stony bottom) the species is not rare. Between 6 and 12 m (sand and *Cymodocea nodosa*), in places 3 to 4 specimens were recorded together; PELJEŠAC AREA (Bay of Mali Ston): in shellfish breeding ponds (*Ostrea edulis*) this species aggregated very fast on shells of molluscs taken close to the sea surface (0.1 to 0.2 m) so that in a day or two the species *Truncullariopsis trunculus* specimens cover the whole shell. So about 120 specimens may be counted in an area of a sq m. On the contrary, diving in the bay showed far less numbers of this species; SPLIT AREA: it is frequent all over the area, making big aggregations in the area of the port and inside the port. Several "spawns" covered by this species were also recorded. (40 to 50 specimens per "spawn"). ŠIBENIK AREA: I recorded frequently a rather large number of specimens from Šibenik Bay (t. I, depth: 5 m; t II : depth 8-15 m; bottom: sand; t. IV, depth: 5 m; bottom: rocky) as compared to Šibenik Channel (t. 2, depth: 2 to 4 m; bottom: rocky; t. 1, depth: 20 m, bottom: sandy with *Posidonia oceanica*); BIOGRAD AREA: the species was recorded from all four transects. Between 1 and 10 m depth mainly single specimens occurred on all bottom types (rocky, stony, sandy with *Cymodocea nodosa*). At transect 4 (depth: 4 m; bottom: rocky with sand patches), "spawn" with 64 s.; VIR ISLAND AREA: transect 3(depth: 2-5 m;), the species occurred on plate rocks, up to 1 s. per sq m. Sand begins at 5 m. Frequently large numbers of this species occur around *Cladocora cespitosa*. Transect 4 (depth: 2-6 m; the biocoenosis of fine uniform sands). The species occurs in large numbers (in many sites 20 to 25 s. per sq m). Transect 6 (depth: 5 -10 m; bottom: sand and *Cymodocea nodosa*), single specimens. Depth: 20 m (bottom: sandy-muddy and *Posidonia oceanica*), 5 specimens in dredge.Transect 12 (depth: 2 to 6 m; bottom: mud covered with *Modiolus barbatus*). On shellfish 35 to 40 s. per sq m. AREA OF ISLANDS: in the area among islands single specimens may be found in different biocoenoses, from those of photophilic algae to coralline biocoenosis. Two specimens can rarely be found together. Trammel sets: it entangles in nets attracted by dead fish. In the area among islands, 10 trammel sets can, on the average, give 10-12 specimens, the quantity which is twice or even thrice that in the nearshore areas and even up to six times that quantity in the area of Bay of Mali Ston. Trawl: "PIPETA" EXPEDITION: in the northwestern part of the northern Adriatic at stations A(2), A(3), A(6) and depths 20-25 m, in a part of well formed biocoenosis of coarse sands and fine gravel affected by bottom currents (bottom coarse sand with large number of stones and submarine rocks) an hour trawl haul gives up to 40 specimens of this species. Some areas with a large number of specimens of this species may be found in the open Adriatic waters, as well. So, for instance, at "PIPETA" station A(7), between 30 and 32 m depth (biocoenosis of detritic more or less muddy bottoms) in a well developed settlement of *Aequipecten opercularis* (up to 1500 kg of this shellfish is obtained per haul) an hour trawl haul gave five, six hundred to a thousand specimens of the species *Truncullariopsis trunculus*.

Following the line 3 Nm offshore (data for the western Adriatic coast) the specimens of *Trunculariopsis trunculus* were obtained only in the vicinity of Chioggia (depth: 18-20 m) and Monte Gargano (Vieste, depth: 40 m) where an hour trawl haul gave 15 to 20 specimens; "HVAR" EXPEDITION: checking up the material I found no specimen from depths exceeding 45 m.

Discussion: VATOVA (1928) decribed the species *Truncullariopsis trunculus* as numerous on detritic and muddy bottoms and much less frequent on rocky bottoms. GRUBE (1861) reported it to be commonly sold on Trieste market and HORVATH (1963) as carnivorous predator numerous on sandy bottoms in the vicinity of Split. RIEDL (1963) reported it as common and frequent on all hard bottoms, from tidal zone to greater depths. ZEI (1955) believed it to be the species primarily inhabiting infralittoral step although frequent also in the emersion zone, particularly among *Fucus virsoides*. This author reported it rare on exposed shores. ZAVODNIK (1971) recorded it as a species with wide ecological distribution. After GRUBIŠIĆ (1967, 1982) the species is well known to occur all along the coastal belt at 2 to 30 m depth. It prefers muddy and sandy-muddy bottoms as well as hard bottoms overgrown with algae. It is particularly abundant in the vicinity of ports and in sites where organic matter is settled. Its settlements are denser in the northern than in the southern Adriatic and densest in the area of Zadar, followed by Split and Istrian waters. As I found it the species *Truncullariopsis trunculus* is vertically distributed from little below the surface down to 45 m. I found no specimens deeper. As to the density of its settlements they are better developed in areas richer in organic matter and on shelly bottoms. This is quite understandable, since this is a predator gastropod, carrion-carnivore. STJEPČEVIĆ (1967) found a large number of specimens (up to 10 alive specimens per sq m in the nearshore zone) throughout Bay of Boka kotorska between 1 and 5 m on bigger stones and rocks overgrown with algae. GAMULIN-BRIDA (1974) reported it from the biocoenosis of photophilic algae, biocoenosis of marine phanerogams, biocoenosis of coastal detritic bottoms, biocoenosis of detritic bottoms of the open sea and biocoenosis of coastal terrigeneous muds. Apart from the above mentioned biocoenoses I found *Truncullariopsis trunculus* in the biocoenosis of fine uniform sands, biocoenosis of coarse sands and fine gravel affected by bottom currents, biocoenosis of detritic more or less muddy bottoms, precoralline aspect of coralline biocoenosis and coralline biocoenosis.

Conclusion: The species *Truncullariopsis trunculus* is vertically distributed from little below the surface down to 45 m. As to the density of its settlements they are better developed in areas richer in organic matter and on shelly bottoms. Its biocoenological aspect is very broad.

Murex brandaris LINNAEUS, 1758

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1861, 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866, 1907; WEINKAUFF, 1868; M. STOSSICH, 1880; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ZIMMERMANN, 1905-1906; ODHNER, 1914; VATOVA, 1928, 1949; COEN, 1937; GAMULIN-BRIDA, 1962, 1967b, 1974; RIEDL, 1963; GRUBIŠIĆ, 1967, 1982; SETTEPASSI, 1967; STJEPČEVIĆ , 1967; ZAVODNIK, 1967a, 1971; GAMULIN-BRIDA *et al.*, 1968; TAVIANI, 1978; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; CARUS, 1889-1893; PRIOLO, 1964; SETTEPASSI, 1967; NORDSIECK, 1968; PARENZAN, 1970; SABELLI and SPADA, 1977; RIEDL, 1983.

Distribution: Atlantic (from the coast of Portugal to Senegal and along Cannaries), Mediterranean.

Results of studies:
DUBROVNIK AREA (Mokošica): from 3 to 6 m (bottom stony), the species is rare. At 6 m depth (sand and *Cymodocea nodosa*) two "spawns" were found covered by this species; SPLIT AREA: in the shallow nearshore area single specimens. The number of specimens is slightly higher on mobile bottoms with depth increase; ŠIBENIK AREA: Šibenik Channel: transect 2 (depth: 4 m; bottom: rocky), rare. Transect 3 (depth: 10 m; bottom: sand), rare. Šibenik Bay: transect III (depth: 20 m; bottom: sandy; dredge), 6 s.; BIOGRAD AREA: transect 1 (depth: 10 m; bottom: sand), 3 s. Transect 3 (depth: 7 m; bottom: stone bulks), rare. Transect 4 (depth: 5-8 m; bottom: rocky with sand patches), single specimens. Depth: 10 m (bottom: sand and *Posidonia oceanica*), 2 s. (dredge); ZADAR AREA: transect 1 (depth: 30 m; bottom: mud; the biocoenosis of coastal terrigeneous muds), 2 s. (dredge). Transect 3 (depth: 5 m; bottom: stones), single specimens; VIR ISLAND AREA: transect 3 (depth:15-20 m; sand and *Posidonia oceanica*), rare specimens. Transect 4 (depth. 4-6 m; biocoenosis of fine uniform sands. Transect 8 (depth: 5-10 m; bottom: sand), rare specimens. Transect 10 (depth: 3-5 m), on rocks and stones, 2 s. Transect 12 (depth:5-10 m; bottom: mud), 0-1 s. per sq m. AREA AMONG ISLANDS: individual specimens found in biocoenoses, from that of photophilic algae to coralline biocoenosis. Trammel sets: among islands and in the nearshore area, 10 trammel sets gave a single or, rarely two, specimens. A crustacean (of Paguridae family) which inhabits empty shells of the species *Murex brandaris* frequently entangles. Trawl: station 2 (depth: 40-30 m; bottom: mud; biocoenosis of coastal terrigeneous muds), 3 s. Station 3 (depth: 44 m; botom: mud; the biocoenosis of coastal terrigeneous muds), 22 to 25 s.; "PIPETA" EXPEDITION: in the northwestern part of the northern Adriatic at stations: A(2), A(3), A(6) and 20 to 25 m depth, in a part of formed biocoenosis of coarse sand and fine gravel affected by bottom currents, an hour haul gave up to 80 specimens. Areas with large number of specimens could be found in the open Adriatic waters, as well. So, for example, at station B(6) "Pipeta" at 40-42 m (biocoenosis of detritic bottoms of the open sea) in well developed settlement of the species *Pinna pectinata*, an hour haul gave from 250 to 300 specimens of *Murex brandaris*. Following the line of 3.0 Nm offshore (data for the western Adriatic coast) this species is most numerous in the area of Chioggia (depth: 20 m; the biocoenosis of fine muddy sands) and Monte Gargano (Vieste, depth: 40 m; the biocoenosis of coastal terrigeneous muds) where an hour trawl haul gave 280 to 320 specimens. It occurs nearshore in some other parts, as well, but not in large numbers (2 to 35 s. per haul); "HVAR" EXPEDITION: the worked out material showed no specimen to occur deeper than 50 m.

Discussion: GRAEFFE (1902) reported the species *Murex brandaris* for the area of Trieste, and M. STOSSICH (1880) for the entire Adriatic. RIEDL (1963) described it as common and frequent on soft bottoms and rarer on secondarily stiffened substrate. STJEPČEVIĆ (1967) recorded smaller numbers of individuals throughout Bay of Boka kotorska on hard substrate, close to river mouths and submarine springs on hard substrates, between 5 and 15 m, but also on sandy bottoms and at greater depths (20-40 m). After GRUBIŠIĆ (1967, 1982) it lives all along the coast, on all bottoms, being most frequent on muddy and muddy-sandy bottoms. Its settlements are equally dense near river mouths and along the shores of outer islands, at 3 to 100 m depths. During spawning it aggregates in compact batches which can weigh several kilos. It forms denser settlements in the northern than in the southern Adriatic. After my own studies the species *Murex brandaris* occurs from 3 to maximum 50 m. I found no specimen deeper. As to the settlement density, it is much denser on mobile than on hard bottoms, and as to the vertical distribution, it occurs in greater numbers between 20 and 50 m than

down to 20 m. As distinct from the species *Truncullariopsis trunculus,* which occurs in greatest numbers in most polluted waters, such as town ports, *Murex brandaris* does not inhabit such places, but on the contrary, it prefers better aerated and less polluted areas. GAMULIN-BRIDA (1967b) reported it from the biocoenosis of detritic more or less muddy bottoms, biocoenosis of coastal terrigeneous muds and biocoenosis of marine phanerogams, and ZAVODNIK (1971) from the biocoenosis of coastal terrigeneous muds, biocoenosis of coastal detritic bottoms, mixed community of sandy bottom. This author (1967a) recorded this species from the phytal in the area of Rovinj. He believes it to be the species with poorly known ecological distribution. Apart from the above mentioned biocoenoses, I recorded the species *Murex brandaris* from the biocoenosis of fine uniform sands and the biocoenosis of coarse sands and fine gravel affected by bottom currents. Single specimens of this predator carnivore could be found on hard substrate searching for food, where I recorded it from the biocoenosis of photophilic algae to the biocoenosis of coralline biocoenosis.

Conclusion: Vertically, the species *Murex brandaris* occurs between about 3 and 50 m. It is much denser on mobile than on hard bottoms, and as to the vertical distribution, it occurs in greater numbers between 20 and 50 m than down to 20 m. It prefers better aerated and less polluted areas. Its biocoenological aspect is very broad.

Muricopsis cristatus (BROCCHI, 1826)

Syn.: *Murex cristatus* BROCCHI, 1826; *Murex blainvillei* PAYRAUDEAU, 1826

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1861 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1866, 1907; WEINKAUFF, 1868; M. STOSSICH, 1880; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ZIMMERMANN, 1905-1906; ODHNER, 1914; VATOVA, 1928; COEN, 1937; HORVATH, 1963; RIEDL 1963; ZAVODNIK, 1967a; SETTEPASSI, 1971; TAVIANI, 1978, 1980; VIO *et al.*, 1979; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; CARUS, 1889-1893; NORDSIECK, 1968; BOMBACE, 1970; PARENZAN, 1970; SETTEPASSI, 1971; SABELLI and SPADA, 1977; RIEDL, 1983.

Distribution: Atlantic (southern coast of Spain, Madeira, coast of Senegal and Guinea), Mediterranean.

Results of studies:
Transects: ŠIBENIK AREA: transect 2 (depth: 2 m; bottom: rocky), 1 s. Transect 3: side of Drvenik Island (depth: 2 m; bottom: rocky), 5 s. Transect 3 (depth: 2 m; sample of the species *Cystoseira ercegovicii* from the surface of 1/16 sq m), 1 s. Transect IV (depth: 8 m; bottom: rocky), 6 s. ; BIOGRAD AREA: transect 2 (depth: 4 to 7 m; bottom: incontinuous submarine rocks covered by plant material), 2 s. Transect 4 (depth: 0.5 m; sample of the species *Cystoseira barabata* from the surface of 1/16 sq m), 1 s. Transect 4 (depth: 0.7 to 4.5 m; bottom: rocky overgrown by all species of algae and sand patches), 5 s. VIR ISLAND AREA: transect 1 (depth: 0.5 m), on the bottom side of a stone, 1 s. Transect 6 (depth: 0.2 m; plate rocks covered with a thin layer of sediment and smaller or bigger stones), 2 s. Transect 9 (depth: 15 m;bottom: sandy, *Posidonia oceanica* and lots of stones), 1 s.; KRK ISLAND AREA: transect 10 (depth: 0.2 m; bottom: stone plate covered by a thin sediment layer), 1 s. ; SPLIT AREA: Kaštela Bay: Marjan shoal (depth: 12 m; bottom: rocky with sand patches), 3 s. PELJEŠAC AREA: Bay of Mali Ston: Čeljen Cape (shore configuration rocky sloping

at an angle of 30 to 35 ^{0} down to 20 m depth), 6 s.; SESTRUNJ ISLAND AREA: opposite the island Tri sestrice (depth: 4-8 m; bottom: rocky, slightly sloping, with stone bulks and stones; plant component well represented; the biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis), 8 s. ; SILBA ISLAND AREA: Pocukmarak cape (depth: 0-20 m; bottom: rocky-stony covered with different plant material; the biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis), on - hard substrate and among different species of algae 17 s.; HVAR ISLAND AREA: Lukavci cliffs (depth: 54-62 m; bottom: lithothmnium; coralline biocoenosis), 2 s. Zub od Zarače (depth: 12 m; bottom: flatened rocky bottom), 1 s. ; VIS ISLAND AREA: fissure near Gradac cove (depth: 8 m; bottom: vertical rock), 1 s. Grab: down to 30 m depth in the nearshore area grab samples very frequently gave two to three shells of the species. The number of shells slightly differs from the small number of alive specimens I recorded at transects.

Discussion: The species *Muricopsis cristatus* is a representative of hard substrate*. GRAEFFE (1902) recorded it from the area of Trieste. The following authors reported it for the area of Rovinj: ZIMMERMANN (1905-1906), ODHNER (1914), VATOVA (1928) as rare on rocky bottoms and ZAVODNIK (1967a) for the phytal. GRUBE (1861, 1864) recorded it near Cres and Lošinj islands, DANILO and SANDRI (1856) in the vicinity of Zadar, HORVATH (1963) near Split on rocky sandy bottom covered with algae and STJEPČEVIĆ and PARENZAN (1980) in Bay of Boka kotorska . A. STOSSICH (1865) believed it to be rather rare in the northern Adriatic, inhabiting greater depths always attached to lithophytes, whereas M. STOSSICH (1880) reported it to be frequent at smaller depths, attached to stones and occuring at greater depths always attached to lithophytes and sponges all along the coast. WIMMER (1883), as well, believed it to be frequent all along the coast among algae-between 0.5 and 4 m depth. RIEDL (1963) reported it to be common on stones in phytal but, as well, on secondarily stiffened substrates. SABELLI and SPADA (1977) found it to live mainly in infralittoral, sometimes in circalittoral on solid substrate. All said above points to the fact that this species is a hard substrate species. Vertically, it reaches depths exceeding 60 m. The number of shells found in grab samples down to 30 m in the coastal belt differs from the number of alive specimens recorded from transects. I recorded it from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and coralline biocoenosis, and on stones on mobile bottoms in the biocoenosis of the meadows of *Posidonia oceanica.*

Conclusion: This species is a hard substrate species. Vertically, it reaches depths exceeding 60 m. I recorded it from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and coralline biocoenosis, and on stones on mobile bottoms in the biocoenosis of the meadows of *Posidonia oceanica* .

Ocinebrina aciculata (LAMARCK, 1822)

Syn.: *Murex aciculatus*, LAMARCK, 1822; *Murex corallinus* SCACCHI, 1836; *Fusus lavatus* PHILIPPI, 1836; *Ocinebrina corallina* MONTEROSATO, 1884; *Tritonalia corallina* PRIOLO, 1964

* When speaking of preferences of individual gastropod species for a substrate, then for most of the species hard substrate is always associated with algal species inhabiting that particular substrate. Namely, as cited in the literature, a defined species occurs in large numbers (or is rare) on rocks, stones, different concretions and in the end: among algae developed on that substrate. As I believe, both factors: "hard" substrate and "algae" are inseparable. In this sense irrespective of the fact that different species of gastropods may be found among algae, it may be spoken of gastropod species inhabiting hard substrate because algae themselves represent , with respect to gastropods, a kind of, let's say, hard substrate.

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1864; HELLER, 1864; BRUSINA, 1866; JEFFREYS, 1867; WEINKAUFF, 1868; M. STOSSICH, 1880; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; VATOVA, 1928; COEN, 1937; RIEDL 1963; ZAVODNIK, 1967a; SABELLI and SPADA, 1978.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; JEFFREYS, 1867; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; CARUS, 1889-1893; HIDALGO, 1917; PRIOLO; 1964; NORDSIECK, 1968; BOMBACE, 1970; PARENZAN, 1970; SETTEPASSI, 1971; SABELLI and SPADA, 1978; RIEDL, 1983.

Distribution: Atlantic (southern coast of England, Spain, Portugal, Morocco, Cannaries and Azores, Madeira), Mediterranean.

Results of studies:
Transects: DUBROVNIK AREA: transect 2 (depth: 50 m; bottom: sandy; the biocoenosis of coastal detritic bottoms) , 2 s.; MAKARSKA AREA: entrance to the port (depth: 7-10 m; bottom: rocky overgrown with algae), 1 s. SPLIT AREA: transect 10 (depth: 1-3 m; bottom: low submarine rocks partly covered with a thin sediment layer), 1 s. Transect 17 (depth: 5 m; bottom: sandy and *Zostera noltii*), 3 s. Transect 6 (depth: 15 m; bottom: sandy and *Posidonia oceanica*), 15 s.; ŠIBENIK AREA: transect 3 (depth: 2 m; bottom: rocky and *Cystoseira ercegovicii*), 1 s. Transect II (depth: 10 m; bottom: sandy ; the biocoenosis of coastal detritic bottoms), 1 s.; ZADAR AREA: transect 2 (depth: 2 to 5 m; bottom: recesses of plate rocks filled with sediment), 1 s. Shoal Sajda (depth: 7 m; bottom: coarse sand and pebbles; the biocoenosis of coarse sands and fine gravel wave exposed), dredge sample 11s.; VIR ISLAN AREA: transect 3 (depth: 1-5 m; bottom: plate rocks), 1 s. Transect 5 (depth: 1 m; bottom: compact rocks forming smaller and bigger plateaus), among *Cystoseira abrotanifolia*, 1 s. Transect 6 (depth: 5 -10 m; bottom: sand and *Cymodoce nodosa*), 4 s. Depth: 5-20 m (bottom: sandy; stones and *Posidonia oceanica*), 6 s.; UNIJE ISLAND AREA: cove near Unije (depth: 17 m; bottom: sandy; the biocoenosis of coastal detritic bottoms), 3 s.; SESTRUNJ ISLAND AREA: opposite the island Tri sestrice (depth: 2-10 m; bottom: rocky and well developed floral elements; the biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis), several specimens; SILBA ISLAND AREA: (depth: 2 to 8 m; rocky and well developed floral elements; the biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis), several specimens; HVAR ISLAND AREA: outer side of Stiniva cove (depth: 35 m; bottom: vertical rock; coralline biocoenosis), 1 s. Outer side of Pokrivenik cove (depth: 15 m; bottom: sandy; the biocoenosis of coastal detritic bottoms), 1 s. VIS ISLAND AREA: fissure near Smričevica cove (depth: 15 m; bottom: rocky; precoralline aspect of coralline biocoenosis), 1 s. Grab: shells of the species were found in grab samples from muddy bottoms.

Discussion: GRAEFFE (1902) reported the species *Ocinebrina aciculata* for the area of Trieste, ZAVODNIK (1967a) for the phytal of the vicinity of Rovinj. GRUBE (1864) found it in the area of Cres and Lošinj islands, DANILO and SANDRI (1856) near Zadar and HELLER (1864) near Dubrovnik and Hvar, Korčula and Lastovo silands. M. STOSSICH (1880) reported it as occurring in large numbers distributed on stones at greater depths, and RIEDL (1963) as frequent in the nearshore zone during vegetative period of algae. SABELLI and SPADA (1978) reported it to inhabit rocky bottoms of the infralittoral but also to be more numerous on coarse- particle detritic bottoms. As I found it, the species *Ocinebrina aciculata* is ditributed from little below the surface down to 50 m depth on hard and mobile, sandy bottoms. Mud is a limiting factor of its distribution. I recorded it from the biocoenosis of photophylic algae, precoralline aspect of coralline biocoenosis, coralline biocoenosis, biocoenosis of the mead-

ows of *Posidonia oceanica*, biocoenosis of the meadows of *Zostera noltii* and *Cymodocea nodosa*, biocoenosis of coarse sands and fine gravel wave exposed and biocoenosis of coastal detritic bottoms.

Conclusion: the species *Ocinebrina aciculata* is ditributed from little below the surface down to 50 m depth on hard and mobile, sandy bottoms. Mud is a limiting factor of its distribution. I recorded it from the biocoenosis of photophylic algae, precoralline aspect of coralline biocoenosis, coralline biocoenosis, biocoenosis of the meadows of *Posidonia oceanica*, biocoenosis of meadows of *Zostera noltii* and *Cymodocea nodosa*, biocoenosis of coarse sands and fine gravel wave exposed and biocoenosis of coastal detritic bottoms.

Ceratostoma erinaceum (LINNAEUS, 1767)

Syn.: *Murex erinaceus* LINNAEUS, 1767, *Ocinebra erinaceus* FISCHER, 1884; *Tritonalia erinaceus* THIELE, 1929

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1864; BRUSINA, 1865; A. STOSSICH, 1865; WEINKAUFF, 1868; M. STOSSICH, 1880; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ZIMMERMANN, 1905-1906; COEN, 1937; RIEDL 1963; GAMULIN-BRIDA, 1967a,b, 1974; STJEPČEVIĆ, 1967, GAMULIN-BRIDA *et al.*, 1968; KARAMAN and GAMULIN-BRIDA, 1970, SABELLI and SPADA, 1978; VIO *et al.*, 1979; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
- Mediterranean and Atlantic: PHILIPPI, 1844; FORBES and HANLEY, 1848b, JEFFREYS, 1867; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; CARUS, 1889-1893; PRIOLO; 1964; NORDSIECK, 1968; PARENZAN, 1970; GRAHAM, 1971; SABELLI and SPADA, 1978; RIEDL, 1983.

Distribution: Atlantic (Great Britain, Denmark, Netherlands, France, Spain, Portugal, Cannaries and Azores, Madeira), Mediterranean.

Results of studies:
Transects: DUBROVNIK AREA: transect 4 (depth: 10 m; bottom: stone blocks), 1 s.; SPLIT AREA: transects 3 and 10 (depth: 1-3 m; bottom: submarine low rocks partly covered with a thin sediment layer), 3 s. Transect 17 (depth: 5 m; bottom: sandy and *Zostera noltii*), 1 s. Transect 6 and 18 (depth: 15 m; bottom: sandy and *Posidonia oceanica*), 2 s.; ŠIBENIK AREA: transect 3 (depth: 2 m; bottom: rocky-stony), 1 s. Transect IV (depth: 20 m; the biocoenosis of coastal detritic bottoms), 2 s. Depth: 5-11 m (bottom: rocky, oblique, in places covered with bigger and smaller stones), 7 s.; BIOGRAD AREA: transect 2 (depth: 4 to 7 m; bottom: stone bulks with a lot of shaded areas; the biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis), several specimens. Transect 4 (depth: 2-3 m; bottom: plate rocks partly covered with a thin sediment layer and well developed floral element), 1 s. ; VIR ISLAND AREA: transect 5 (depth: 0-0.5 m; bottom: compact rocks forming smaller or bigger plateaus; *Cystoseira abrotanifolia* well represented), 1 s. Transect 6 (depth: 5-10 m; bottom: sand and *Cymodocea nodosa*), 1 s. Depth: 15 m (bottom: sandy and *Posidonia oceanica*), 1 s. Transect 9 (depth: 20 m; bottom: sandy, stones and *Posidonia oceanica*), 2 s. Transect 11 (depth: 2 to 10 m; bottom: rocky with sand patches and *Cymodocea nodosa*), 1 s.; UNIJE ISLAND AREA: cove near the small town Unije (depth: 17 m; bottom: sandy; the biocoenosis of coastal detritic bottoms), 3 s. in dredge; SESTRUNJ ISLAND AREA: opposite the island Tri sestrice (depth: 0 - 15 m; the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis, biocoenosis of the meadows of *Posidonia oceanica*), several specimens; HVAR ISLAND AREA: Lukavci cliffs (depth: 54-62 m; bottom: lithothamnium; coralline biocoenosis), 3 s. Outer side of Pokrivenik cove (depth: 0-20 m; bottom: rocky; the biocoenosis of photophilic algae, precoral-

line aspect of coralline biocoenosis), several specimens. Outer side of Stiniva cove (depth: 30 m; bottom: rocky; the coralline biocoenosis), 1 s.; VIS ISLAND AREA: reef near Zečevo (depth: 10-15 m; bottom: rocky; the biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis), 3 s. Grab: grab samples from muddy bottoms contained shells of this species.

Discussion: GRAEFFE (1902) recorded the species *Ceratostoma erinaceum* from the area of Trieste. It was reported for the area of Rovinj by: WIMMER (1883) as frequent among algae between 2 and 4 m depth, ZIMMERMANN (1905-1906), GAMULIN-BRIDA (1967b) in the biocoenosis of detritic more or less muddy bottoms (single specimen at depth of 35 m). GRUBE (1864) recorded it in the vicinity of Lošinj, BRUSINA (1865) in shoals in the vicinity of Zadar on muddy-rocky substrate, GAMULIN-BRIDA (1967a) on submarine reefs west of Vis Island at 10-15 m depth and STJEPČEVIĆ (1967) in Bay of Boka kotorska where this author recorded it on sandy substrate at 15-30 m in Risan Bay. The same author discovered a large number of specimens on hard substrate at 2-5 m depth in the area of Verige . RIEDL (1963) reported it as common but not frequent on all hard bottoms in shallow waters, GAMULIN-BRIDA (1974) stated it to be a preference species in the biocoenosis of photophilic algae, but also in the biocoenosis of coastal detritic bottoms. SABELLI and SPADA (1978) reported it to inhabit rocky bottoms of the infralittoral and detritic bottoms of circalittoral. As I found it *Ceratostoma erinaceum* is ditributed between the surface and about 60 m depth. It occurs on both hard and mobile sandy bottoms. Muddy bottom is a limiting factor of its distribution. I recorded it from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis, coralline biocoenosis, biocoenosis of the meadows of *Zostera noltii* and *Cymodocea nodosa*, biocoenosis of the meadows of *Posidonia oceanica* and biocoenosis of coastal detritic bottoms.

Conclusion: *Ceratostoma erinaceum* is ditributed between the surface and about 60 m depth. Muddy bottom is a limiting factor of its distribution. I recorded it from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis, coralline biocoenosis, biocoenosis of the meadows of marine phanerogams and biocoenosis of coastal detritic bottoms.

Columbella rustica (LINNAEUS, 1767)

Syn.: *Voluta rustica* LINNAEUS, 1767

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1861, 1864; HELLER, 1864; A. STOSSICH 1865; BRUSINA, 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ZIMMERMANN, 1905-1906; ODHNER, 1914; VATOVA, 1928; COEN, 1937; HORVATH, 1963; RIEDL, 1963; STJEPČEVIĆ, 1967; ZAVODNIK, 1967a; GAMULIN-BRIDA *et al.*, 1968; ŠIMUNOVIĆ, 1970; GAMULIN-BRIDA, 1974; VIO *et al.*, 1979; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B. D. D., 1882-1886; CARUS, 1889-1893; PRIOLO; 1965; NORDSIECK, 1968; PARENZAN, 1970; DANCE, 1974; RIEDL, 1983.

Distribution: Atlantic (Cannaries and Azores, Madeira, coast of Senegal to Guienea), Mediterranean.

Results of studies:
Transects: DUBROVNIK AREA: at transect 4 on flattened part of the coast in the mediolittoral some specimens were found. The area of Balkuni, Lokrum Island (rocky shore descends into the sea at an angle of 15^0). Unbroken belt of the species *Cystoseira stricta* v. *spicata*

down to 0.3 m. *Columbell rustica* is rather uniformly distributed with an abundance of 1 to 2 s. per 1/16 sq m. Going deeper empty shells exceed alive specimens in number (in places 3 to 4 shells per 1/16 sq m) and they are inhabited by the species of crustaceans of Paguridae family. This species is also frequent in the area of Klek-Neum, where 1 to 2 s. per 1/16 sq m were recorded from surface to 0.5 m depth on rocky shores (in many shaded places). It is also frequent among the *Cystoseira barbata* down to 0.5 m depth. A sample of the species *Cystoseira barbata* collected from a surface of 1/16 sq m at 0.5 m depth I recorded 3 specimens, and in the sample collected from a sq m only one specimen; MAKARSKA AREA: down to 2 m depth, single specimens; SPLIT AREA: single specimens throughout the area; ŠIBENIK AREA: transect 1 (depth: 0.1 to 0.5 m), 0 to 1 s. per 1/16 sq m on sheltered parts of the shore. At 2 m a single alive specimen could be rarely found. At transect 1 (mainland side) 1 to 2 s. per 1/16 sq m could be found in calm sea on flat rocks and mobile stones; BIOGRAD AREA: at transect 1, on, among and below stones (depth: 0.2 m) on the sheltered shore parts its abundance was 0 to 1 s. per 1/16 sq m. In the sample of *Cystoseira barbata* collected from a surface of 1/16 sq m at 0.3 m I recorded 2 specimens and in the sample taken from 0.7 m, 1 s. At transect 2 on plate rocks at the boundary of mediolittoral and surface part of infralittoral, 0 to 1 s. could be found per 1/16 sq m in places; ZADAR AREA: at transects 1 and 3 single specimens. At transect 2, on plate rocks at 1 m depth 0 to 1 s. per 1/16 sq m; VIR ISLAND AREA: at transect 1 in the sample of *Cystoseira corniculata* taken from 1/16 sq m, 2 s. At transect 3, on plate rocks and below stones, at 0.5 - 1 m depth in sheltered shore parts its abundance was 0-1 s. per 1/16 sq m. At transect 5 the shore slightly slopes into the sea forming plateaus. There among the species *Cystoseira compressa* (down to 0.3 m depth) frequently 1 to 2 s. per 1/16 sq m. At transect 8 on sheltered shore parts down to 0.2 m, 1 to 2 s. were found below every bigger stone on the sand. At transect 9, down to 0.2 m it is relatively frequent (abundance: 0 to 1 s. per 1/16 sq m). I found 5 specimens in the sample of *Cystoseira barbata* taken from 1/16 sq m at 0.5 m depth. At transect 11 down to 0.2 m depth rather frequent with the abundance of 0 to 1 s. per 1/16 sq m. In the sample of *Cystoseira barbata* from 1/16 sq m at 0.5 m I recorded 2 s. and in the sample from 1m depth, 3 s; KRK ISLAND AREA: at transect 3, down to 0.5 m, on rocks and below stones frequently 1 to 2 s. per 1/16 sq m. Deeper than 1 m empty shells occur in large numbers inhabited by crabs from the family Paguridae; HVAR ISLAND AREA: Pokrivenik cove: on rocky shore down to 1 m depth 0 to 1 s. per 1/16 sq m; VIS ISLAND AREA: Biševo Island (Ždrilo od Gatule): on one of the most beautifully developed "pavement" in the Adriatic (an area protected from direct wave action) I recorded the species *Columbella rustica* with the abundance of 1 to 2 s. per 1/16 sq m.

Discussion: The species *Columbella rustica* is a hard substrate representative. It is distributed on rocky and stony shores all along the Adriatic. It occurs in greatest numbers on low rocks and mobile stones down to 1 m depth on shore parts sheltered from direct wave action. It is not rare on hard substrate overgrown with the species of genus *Cystoseira* and below stones. Deeper than 2 m singles alive specimens could be found along with empty shells inhabited by crabs of Paguridae family. Vertically, it occurs in the boundary areas between mediolittoral and uppermost part of infralittoral, that is in the biocoenosis of lower mediolittoral rocks and the biocoenosis of photophilic algae. Many earlier authors reported on the horizontal and vertical distribution of this species as well as on the habitats it inhabits. So GRAEFFE (1902) reported it for the area of Trieste, ZIMMERMANN (1905-1906) and ODHNER (1914) for the vicinity of Rovinj, WIMMER (1883) among algae at 1 to 3 m and 28 m depth near Rovinj, ZAVODNIK (1967a) for the phytal near Rovinj, GRUBE (1861) for the area of Cres Island, HELLER (1864) for the areas of Hvar, Vis, Korčula and Latovo islands and Du-

brovnik (down to 18 m depth, on rocks), DANILO and SANDRI (1856) for Zadar area, HORVATH (1963) for Split (among algae on stones). STJEPČEVIĆ (1967) recorded it from hard substrate, among gravel, smaller stones and frequently on algae between 1 and 3 m depth throughout Bay of Boka kotorska. M. STOSSICH (1880) believed it to be common throughout the Adriatic and reported it to inhabit small depths. This author described it as a species frequently attached to rocks above water. RIEDL (1963) reported it as common and very frequent in the upper phytal of rocky shores (immediately above the water level). GAMULIN-BRIDA (1974) recorded it as characteristic species of the biocoenosis of photophilic algae and points to its distribution in the infralittoral.

Conclusion: The species *Columbella rustica* is a hard substrate representative. It is distributed on rocky and stony shores all along the Adriatic. It occurs in greatest numbers on low rocks and mobile stones down to 1 m depth on shore parts not directly wave exposed. It is not rare on hard substrate overgrown by the species of genus *Cystoseira* and below stones. Deeper than 2 m singles alive specimens could be found along with empty shells inhabited by crabs of Paguridae family.

Buccinulum corneum (LINNAEUS, 1758)

Syn.: *Murex corneus* LINNAEUS, 1758; *Fusus lignarius* LAMARCK, 1816; *Fusus conulus* RISSO, 1826; *Euthria cornea* GRAY, 1830; *Fusus corneus* SCACCHI, 1836; *Euthria lignaria* CHENU, 1859; *Pisania cornea* MONTEROSATO, 1875

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1864; HELLER, 1864; A. STOSSICH 1865; BRUSINA, 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ZIMMERMANN, 1905-1906; ODHNER, 1914; VATOVA, 1928; COEN, 1937; GAMULIN-BRIDA, 1967b; STJEPČEVIĆ, 1967, GAMULIN-BRIDA *et al.*, 1968; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; CARUS, 1889-1893; PRIOLO; 1965; NORDSIECK, 1968; BOMBACE, 1970; PARENZAN, 1970; SETTEPASSI, 1971; DANCE, 1974; RIEDL, 1983.

Distribution: Atlantic (coast of Spain and Portugal), Mediterranean.

Results of studies:
Transects: DUBROVNIK AREA: Koločep Island (depth: 0.5 m; bottom: rocky, slightly sloping with a number of fissures, protrusions and recesses), 1 s.; MAKARSKA AREA: western entrance to the port (depth: 20 m; bottom: sandy with a number of stones and lithothamnium pebbles). Among stones 2 s; SPLIT AREA: transect 10 (depth: 2 m; bottom: low rocks), 1 s.; ŠIBENIK AREA: transect 2 (mainland side), depth 3 m; bottom rocky (the entire area is shallow), 2 s; BIOGRAD AREA: transect 2 (depth: 4 to 7 m; bottom: stone bulks with a lot of shaded crevices and well developed floral component), 3 s.- all found in crevices. Two specimens at 5 m and one at 7 m. Transect 4 (depth: 1.5 m; bottom: rocky, slightly sloping), 1 s.; VIR ISLAND AREA: transect 3 (depth: 3 m; bottom: plate rocks and stones overgrown with *Cystoseira compressa*). Among stones 1 s. Transect 11, among stones at 2 m depth 1 s.; HVAR ISLAND AREA: shoal near Jerolim (depth: 11 m; bottom: rocky with sand patches), 2 s. Reef near Zečevo (depth: 10 to 15 m; bottom: rocky), 1 s. Cape of Pokrivenik cove (depth: 0-20 m; shore configuration: shore slopes at an angle of 30 to 35° below the sea surface). Between 10 and 20 m precoralline aspect of coralline biocoenosis is well developed. At 11 m depth 2 s. Trawl and dredge: dredge and trawl hauling on sandy, muddy and deeper lithothamnium bottoms, gave empty shells of

this species on several occasions. No haul gave alive specimens.

Discussion: The species *Buccinulum corneum* is a hard substrate representative. It does not occur in large numbers in the Adriatic. GRAEFFE (1902) recorded it from the area of Trieste, WIMMER (1883) at 28 m depth near Rovinj; ODHNER (1914) and ZIMMERMANN (1905-1906) also near Rovinj. VATOVA (1928) described it as rare in the area of Rovinj prefering rocky and detritic bottoms. GAMULIN-BRIDA (1967b) reported 3 specimens recorded from the biocoenosis of detritic more or less muddy bottoms, between 10 and 38 m in the area of Rovinj. GRUBE (1864) recorded it from the area of Mali Lošinj Island at 31 m depth and A. STOSSICH (1865) small numbers from the northern Adriatic (it was found on several occasions in the shoals among algae). HELLER (1864) reported it for the area of central Adriatic on rocky bottoms between 4 and 18 m depth and M. STOSSICH (1880) small numbers throughout the Adriatic, distributed on rocky bottoms at medium depths. STJEPČEVIĆ (1967) recorded 4 specimens from Bay of Boka kotorska on sandy-muddy substrate between 15 and 40 m in an area of marine phanerogams. RIEDL (1963) believed it to be the species of rocky bottoms. As I found it this is an infralittoral species, distributed on hard substrates. I recorded most specimens either among stones or in shore crevices. It seems that this species seeks shelter from the sunlight. Dredge and bottom trawl hauls on sandy, muddy and deeper lithothamnium bottoms gave empty shells of *Buccinulum corneum* on several occasions. No haul gave alive specimens. I recorded it from the biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis.

Conclusion: The species *Buccinulum corneum* is a hard substrate representative. It does not occur in large numbers in the Adriatic. It is an infralittoral species. I recorded it from the biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis.

Pisania striata (GMELIN, 1790)

Syn.: *Voluta striata* GMELIN, 1790; *Buccinum maculosum* LAMARCK, 1816;*Purpura maculosa* BLAINVILLE, 1826; *Buccinum pusio* PHILIPPI, 1844; *Pisania maculosa* WEINKAUFF, 1868; *Pollia pusio* ARADAS & BENOIT, 1870

Previous reviews:
- Adriatic: GRUBE, 1861; HELLER, 1864; BRUSINA, 1866; WEINKAUFF, 1868; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ZIMMERMANN, 1905-1906; VATOVA, 1928; COEN, 1937; ZEI, 1955; HORVATH, 1963; RIEDL, 1963; STJEPČEVIĆ, 1967, ZAVODNIK, 1967a; GAMULIN-BRIDA *et al.*, 1968; ŠIMUNOVIĆ, 1970; STJEPČEVIĆ and PARENZAN, 1980; VIO *et al.*, 1979; RADIĆ, 1982.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; MONTEROSATO, 1878; B.D.D., 1882-1886; CARUS, 1889-1893; PRIOLO; 1965; NORDSIECK, 1968; PARENZAN, 1970; SETTEPASSI, 1971; DANCE, 1974; RIEDL, 1983.

Distribution: Atlantic (coast of Spain, Portugal and Azores), Mediterranean.

Results of studies:
Transects: DUBROVNIK AREA: transects: 1,2,3 (vertical rock), single specimens in lower mediolittoral. At transect 4 the shore is not that steep and its abundance was 0 to 1 s. per 1/16 sq m. In the area of Balkuni, Lokrum Island (rocky shore descends into the sea at an angle of 15^0), unbroken belt of *Cystoseira stricta* v. *spicata* stretches down to 0.3 m depth. The species *Pisania striata* is rather uniformly distributed with the abundance of 1 to 2 s. per 1/16 sq m. Going deeper empty shells are far more numerous and inhabited by Paguridae crabs. This species is also numerous in the area of Klek-Neum on rocky shores from surface to 0.5 m depth, in a number of places (predominantly sheltered ones) 2 to 3 s. per 1/16 sq m. It occurs

in rather large numbers among the species *Cystoseira barbata* at 0.5 m depth. In a smaple of *Cystoseira barbata* taken from an area of 1/16 sq m 10 specimens were counted; MAKARSKA AREA: down to 2 m depth, single specimens; SPLIT AREA: single specimens can be found throughout the area; ŠIBENIK AREA: transect 1 (depth:0.1-0.5 m), 0 to 1 s. per 1/16 sq m in sheltered places. At 1.5 m depth rare single alive specimens. At transect 1 (mainland side) it occurs in rather large numbers in calm sea on flat rocks and loose stones. From 3 to 4 s. per 1/16 sq m could be found in a number of places. At transect 3 (Zlarin Island side) single specimens and at transect 3 (mainland side) bottom is rocky-stony and nearshore sea relatively shallow. In the lower mediolittoral and infralittoral down to 0.5 m 1 to 2 s. per 1/16 sq m in a number of places. At 2 m depth among the species *Cystoseira ercegovicii* I found 1 s. per 1/16 sq m on several occasions; BIOGRAD AREA: at transect 1 on and among stones (depth: 0.2 m) in sheltered shore parts (calm sea) its abundance was 0 - 1 s. per 1/16 . I recorded 4 specimens from a sample of *Cystoseira barbata* from 0.3 m and 1 s. in a sample from 0.7 m. At trasnect 2, on plate rocks of lower mediolittoral and surface part of infralittoral, 2 to 3 s. per 1/16 sq m frequent. Single specimens elsewhere; ZADAR AREA: at transect 1 single specimens. At trasect 2 frequently 2 to 3 s. per 1/16 sq m on plate rocks at 0.1 to 0.5 m. In a part of lower mediolittoral and surface part of infralittoral in the belt of the species *Mytilus galloprovincialis* it occurs with the abundance of 0 to 1 s. per 1/16 sq m. VIR ISLAND AREA: at transect 3 on plate rocks and below stones between 0.5 and 1 m it is rather numerous in sheltered shore parts. Very frequently 2 to 3 s. per 1/16 sq m. At transect 5 the shore slightly slopes into the sea forming bigger or smaller plateaus. In this part 2 to 3 s. per 1/16 sq m frequent among the species *Cystoseira compressa* (depth: 0.3 m). At transect 6, down to 0.2 m 3 to 4 specimens below every bigger stone. At transect 8 in sheltered shore parts down to 0.2 m depth 2 to 3 specimens below every bigger stone on sand. At trasnect 10, down to 0.2 m depth, single specimens among the species *Fucus virsoides*. At transect 11, down to 0.2 m depth its abundance 0 - 1 s. per 1/16 sq m.; KRK ISLAND AREA: at transects 1 and 2 its abundance was 0 to 1 s. per 1/16 sq m. At transect 3, down to 0.5 m depth, 1 to 2 s. per 1/16 sq m on rocks and below stones. At transect 9 it occurs in rather large numbers. From 3 to 4 s. per 1/16 sq m occurred in a number of places of the lower mediolittoral and surface part of infralittoral.; HVAR ISLAND AREA: Pokrivenik cove: on rocky shore down to 0.5 m depth, 1 to 2 s. per 1/16 sq m frequent; VIS ISLAND AREA: Biševo Island (Ždrilo od Gatule): the species *Pisania striata* occurred with the abundance of 3 to 4 s. per 1/16 sq m on the "pavement".

Discussion: The species *Pisania striata* is a hard substrate representative. It is distributed on rocky and stony shores all along the Adriatic. It occurs in largest numbers on low rocks and mobile stones down to 1 m depth, in parts of the shore not directly wave exposed. It is not rare on hard substrate overgrown with the species of genus *Cystoseira*. Deeper than 1 m the species is thinned throughout the study area so that only single specimens and large number of empty shells inhabited by Paguridae crabs could be found below 2 m depth. It occurs more below stones than among stones. Vertically, it occurs in the boundary area between lower mediolittoral and uppermost infralittoral, that is in the biocoenosis of lower mediolittoral rocks and biocoenosis of photophilic algae. Many earlier authors reported on its horizontal and vertical distribution as well as habitats it inhabits. So GRAEFFE (1902) reported it for the area of Trieste, ZIMMERMANN (1905) for Rovinj, GRUBE (1861) for Cres Island, HELLER (1864) for Hvar, Korčula and Lastovo islands, WIMMER (1883) for the area of Rovinj where he found it among algae between 2 and 4 m and for Dalmatia, between 10 and 80 m. ZEI (1955) describing this species for the area of Rovinj, stated that it was not a typical representative of the emersion zone where the variations in humidity and other life conditions

are extremely high and that it was distributed in the lower part of the emersion zone, on and among algae and below stones where there is enough humidity. RIEDL (1963) reported it for the phytal of rocky shores, believing it to be frequent in the area of *Ulva*, a species of polluted ports. HORVATH (1963) recorded it on or among algae on stones around Split. STJEPČEVIĆ (1967) reported it to be well represented throughout Bay of Boka kotorska with a large number of specimens, most frequent down to 4 m depth, on hard substrate, below stones, on gravel or sand.

Conclusion: The species *Pisania striata* is a hard substrate representative. It is distributed on rocky and stony shores all along the Adriatic. It occurs in largest numbers on low rocks and mobile stones down to 1 m depth, in parts of the shore not directly wave exposed. Vertically, it occurs in the boundary area between lower mediolittoral and uppermost infralittoral that is in the biocoenosis of lower mediolittoral rocks and biocoenosis of photophilic algae.

Sphaeronassa mutabilis (LINNAEUS, 1767)

Syn.: *Buccinum mutabile* LINNAEUS, 1767; *Nassa mutabilis* LAMARCK, 1816; *Nassa mediterranea* RISSO, 1826; *Buccinum foliosum* WOOD, 1826; *Buccinum inflatum* LAMARCK, 1844

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1861; HELLER, 1864;A. STOSSICH, 1865; BRUSINA, 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; CARUS, 1889-1893; GRAEFFE, 1902; ODHNER, 1914; VATOVA, 1928; COEN, 1937; RIEDL, 1963; SABELLI and SPADA, 1977; ALVISI *et al.*, 1978; TAVIANI, 1978; RADIĆ, 1982.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; PRIOLO; 1965; NORDSIECK, 1968; PARENZAN, 1970; SABELLI and SPADA, 1977; RIEDL, 1983.

Distribution: Atlantic (west coast of Africa, Cannaries), Mediterranean.

Results of studies:
Trawl: the number of specimens per an hour haul: "PIPETA" EXPEDITION: 3.0 to 3.5 Nm offshore (biocoenosis of fine muddy sands): B(1), 200 specimens (depth: 30 m). C(1), 3500 specimens (depth: 12 m). D(1), 360 specimens (depth: 15 m). E(1), 150 specimens (depth: 26 m). F(1), 850 specimens (depth: 15 m). Other data (for the western Adriatic coast) : in 200 "pots" set on 5-10 m depth 30 to 35 boxes of this species are caught in 24 hours (7 to 8 kg per box). Twelve years ago (1978) when this kind of "pot" began to be used 200 "pots" gave up to 100 boxes of this species.

Discussion: The species *Sphaeronassa mutabilis* is a mobile substrate representative. It is a commercial species along the western Adriatic coast. GRUBE (1861) and GRAEFFE (1902) recorded it from the area of Trieste, and A. STOSSICH (1865) and RIEDL (1963) as frequent and numerous on sandy bottoms of the northern Adriatic. DANILO and SANDRI (1856) reported it for the area of Zadar, RADIĆ (1982) for Makarska and HELLER (1864) for Hvar Island. They described it as occurring in large numbers on sandy bottoms between 4 and 18 m depth. ODHNER (1914) recorded it as very numerous on sand between 1 and 3 m depth and NORDSIECK (1968) between 7 and 18 m on sand in calm water. SABELLI and SPADA (1977) reported it to inhabit the infralittoral step (in Chioggia lagoon at 4 m depth), and ALVISI *et al.* (1978) described it for the area of Cesenatico (northern Adriatic) as abundant down to 3 m depth in the biocoenosis of fine uniform sands. As I found it *Sphaeronassa mutabilis* inhabits mobile bottoms down to about 30 m depth and about 3.0

to 3.5 Nm offshore in the biocoenoses of fine surficial sands, fine uniform sands and fine muddy sands.

Conclusion: *Sphaeronassa mutabilis* inhabits mobile bottoms down to about 30 m depth and about 3.0 to 3.5 Nm offshore in the biocoenoses of fine surficial sands, fine uniform sands and fine muddy sands.

Cyclope neritea (LINNAEUS, 1767)

Syn.: *Buccinum neriteum* LINNAEUS, 1767; *Fabula nana* CHEMNITZ, 1788; *Nassa neritoides* LAMARCK, 1816; *Cyclonassa neritea* MONTEROSATO, 1878

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1861; HELLER, 1864; A. STOSSICH, 1865; BRUSINA; 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ZIMMERMANN, 1905-1906; VATOVA, 1928; COEN, 1937; HORVATH, 1963; RIEDL, 1963; STJEPČEVIĆ, 1967; TAVIANI, 1980; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; CARUS, 1889-1993; PRIOLO; 1965; NORDSIECK, 1968; PARENZAN, 1970; SABELLI and SPADA, 1977; RIEDL, 1983.

Distribution: Atlantic (southern coast of Spain), Mediterranean.

Results of studies:
Transects: SPLIT AREA: Bačvice beach (the biocoenosis of fine surficial sands). Distributed all over the beach. In many places 1 to 2 s. per 1/16 sq m. At 5 m depth sandy bottom. Numerous dead specimens and single alive specimen. At 10 m depth bottom is sandy. Grab sample - only empty shells. Stobreć: beach near Žrnovnica River mouth (the biocoenosis of fine surficial sands). The species occurs in relatively large number all along the beach. In many places 3 to 4 s. per 1/16 sq m; OMIŠ AREA: Omiš beach (25 km from Split): entire area affected by Cetina River. Bottom: sand (the biocoenosis of fine surficial sands). Species numerous all over the beach. In many places 3 to 4 s. per 1/16 sq m. At 5 m bottom sandy. A number of dead specimens. At 10 m bottom sandy. Grab sample contained only empty shells; MAKARSKA AREA: Makarska beach. Bottom sandy (the biocoensosi of fine surficial sands). In places 1 to 2 s. per 1/16 sq m. At 10 m grab sample contained only empty shells.

Discussion: The species *Cyclope neritea* is a representative of mobile substrate. It is ditributed on the Adriatic sandy beaches. A large number of researchers reported it from different Adriatic parts. So GRUBE (1861) recorded it from the areas of Trieste, Rijeka and Cres Island, WIMMER (1883) near Rovinj (as frequent among algae at 4 to 6 m), GRAEFFE (1902) from Trieste, DANILO and SANDRI (1856) near Zadar, HORVATH (1963) near Split (in rock fissures and on stony-sandy substrate in the lower tidal zone and below), RADIĆ (1982) near Makarska, HELLER (1864) near Hvar and Vis islands (as frequent on sand down to 4 m depth). A. STOSSICH (1865) reported it for the northern Adriatic as occurring in large numbers along sandy beaches, and M. STOSSICH (1880) as common throughout the Adriatic. RIEDL (1963) described it as frequent and common in the northern Adriatic on sandy bottom in shallow water. STJEPČEVIĆ (1967) recorded only 15 specimens on muddy-sandy substrate in the zone of marine phanerogams in Bay of Boka kotorska. This author reported it for smaller depths, as well (1 to 5 m) occurring in small numbers. SABELLI and SPADA (1977) reported it to inhabit shallow bottoms and fine muddy sand of the infralittoral step. It was reported for the biocoenosis of fine surficial sands, particularly

in more or less polluted waters where salinity is below mean value. I observed this species in the area from Split to Makarska. It is distributed on sandy beaches as a characteristic species of fine surficial sands. With depth the species is suddenly thinned so that it is extremely rare at already 5 m. It, very likely, prefers the beaches where salinity is reduced.

Conclusion: The species *Cyclope neritea* is a representative of mobile substrate. It is distributed on the Adriatic sandy beaches as a characteristic species of fine surficial sands. This species belongs to gastropods inhabiting shallow waters. It, very likely, prefers the beaches where salinity is reduced.

Hinia reticulata (LINNAEUS, 1767)

Syn.: *Buccinum reticulatum* LINNAEUS, 1767; *Buccinum pullus* PENNANT, 1777; *Buccinum vulgatum* GMELIN, 1790; *Buccinum tesulatum* OLIVI, 1792 *Buccinum hepaticum* MONTAGU, 1803; *Planaxis reticulata* RISSO, 1826; *Nassa reticulata* BROWN, 1844

Previous reviews:
- Adriatic: OLIVI, 1792; DANILO and SANDRI, 1856; GRUBE, 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA; 1866; JEFFREYS, 1867; WEINKAUFF, 1868; M. STOSSICH, 1880; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ODHNER, 1914; VATOVA, 1928, 1949; GAMULIN-BRIDA, 1962; HORVATH, 1963; STJEPČEVIĆ, 1967; GAMULIN-BRIDA *et al.*, 1968; SABELLI and SPADA, 1977: TAVIANI, 1980; RADIĆ, 1982.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; FORBES and HANLEY, 1848b; JEFFREYS, 1867; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; CARUS, 1889-1993; PRIOLO; 1965; NORDSIECK, 1968; PARENZAN, 1970; GRAHAM, 1971; ABBOT, 1974; DANCE, 1974; SABELLI and SPADA, 1977; RIEDL, 1983.

Distribution: Atlantic (coast of Norway, Great Britain, Netherlands, France, Spain, Portugal, Cannaries and Azores), Mediterranean.

Results of studies:
Trawl: the number of specimens per an hour haul: "PIPETA" EXPEDITION: 3.0 to 3.5 Nm offshore (the biocoenosis of fine muddy sands): A(1), 5100 specimens (depth: 20 m). B(1), 3000 specimens (depth: 30 m). C(1), 970 specimens (depth: 12 m). F(1), 40 specimens (depth: 15 m). Other data (for the western coast): *Hinia reticulata* inhabits the same type of habitat as *Sphaeronassa mutabilis* (both species were found in same "pots").

Discussion: The species *Hinia reticulata* is a mobile substrate representative. Its biomass has been increased recently (due to its bitter taste it is not consumed so that complete catches are turned back to the sea) in relation to the commercial species *Sphaeronassa mutabilis*. GRAEFFE (1902) recorded it from the area of Trieste, ODHNER (1914) near Rovinj (on sand as very frequent between 1 and 3 m depth), GRUBE (1864) near Mali Lošinj Island, DANILO and SANDRI (1856) near Zadar, HORVATH (1963) near Split and RADIĆ (1982) near Makarska. A. STOSSICH (1865) reported it as common in the northern Adriatic, and M. STOSSICH (1880) throughout the Adriatic. OLIVI (1792) mentioned it as frequent species. STJEPČEVIĆ (1967) decribed it as occurring in large numbers throughout Bay of Boka kotorska between 2 and 8 m. RIEDL (1963) reported it as a sandy species of small depths and not frequent. On the contrary JEFFREYS (1867) defined the range of its distribution from surface to 128 m (on sand, as well). SABELLI and SPADA (1977) stated that this species inhabits muddy and sandy bottoms of the infralittoral in the biocoenosis of euryhaline and eurythermal lagoons, biocoenosis of fine

uniform sands (Rimini, 3 m depth) as well as that it could be found in the circalittoral as an element of the biocoenosis of detritic muddy bottoms. As I found it this species inhabits mobile bottoms down to 30 m and 3.0 to 3.5 Nm offshore in the biocoenosis of fine surficial sands, fine uniform sands and fine muddy sands.

Conclusion: The species *Hinia reticulata* inhabits the same habitats as the species *Sphaeronassa mutabilis*. Due to its bitter taste it is not consumed. Its biomass has been increased recently in relation to the commercial species *Sphaeronassa mutabilis*.

Hinia incrassata (MÜLLER, 1768)

Syn.: *Buccinum incrassatum* STROM, 1768; *Tritonium incrassatum* MÜLLER , 1776; *Buccinum minutum* PENNANT, 1777; *Murex incrassatus* GMELIN, 1790 *Buccinum nanum* GMELIN, 1790; *Buccinum ascanias* BRUGUIERE, 1792; *Buccinum coccinella* LAMARCK, 1822; *Buccinum lacepedii* PAYRADEAU, 1826, *Nassa granulata* BRUSINA, 1866; *Buccinum saxatile* CHIEREGHINI, 1870

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1864; HELLER, 1864; BRUSINA; 1865; JEFFREYS, 1867; WEINKAUFF, 1868; M. STOSSICH, 1880; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ZIMMERMANN, 1905-1906; ODHNER, 1914; VATOVA, 1928; COEN, 1937; HORVATH, 1963; RIEDL, 1963; GAMULIN-BRIDA, 1967b; ZAVODNIK, 1967a, 1971; GAMULIN-BRIDA *et al.*, 1968; VIO *et al.*, 1979; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; FORBES and HANLEY, 1848b; JEFFREYS, 1867; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; CARUS, 1889-1993; PRIOLO; 1966; NORDSIECK, 1968; PARENZAN, 1970; GRAHAM, 1971; RIEDL, 1983.

Distribution: Atlantic (Iceland, Norway, Denmark, Germany, Great Britain, Netherlands, France, Spain, Portugal, Azores and Madeira), Mediterranean.

Results of studies:
Transects: SPLIT AREA: transect 8 (depth: 0.2 m; bottom: rocky and algae), 8 s. per 1/16 sq m. Transect 13 (depth: 10 m; bottom sandy and *Posidonia oceanica*), frequent; ŠIBENIK AREA: transect II (depth: 10 m; bottom: sandy; the biocoenosis of coastal detritic bottoms), frequent. Lake Prokljan (depth: 10 m; bottom: sandy- rocky), 39 s. in a grab sample; BIOGRAD AREA: transect 2 (depth: 5-7 m; bottom: rocky with sand patches and *Posidonia oceanica*), frequent. Transect 3: (depth: 10 m; bottom: sandy; the biocoenosis of coastal detritic bottoms), frequent; ZADAR AREA: transect 2 (depth: 2 to 5 m; recesses of plate rocks covered with sediment), frequent; VIR ISLAND AREA: transect 1(depth: 0.5 m; bottom rocky and *Cystoseira corniculata*), 2 s. per 1/16 sq m. Transect 3 (depth: 5 m; bottom: sand), frequent on sand and on *Cladocera cespitosa*. Transect 4 (depth: 2 to 6 m; bottom: sand; the biocoenosis of fine uniform sands), frequent. Transect 6 (depth: 15 m; bottom: sandy and *Posidonia oceanica*), frequent. Depth: 5 - 10 m (bottom: sand and *Cymodocea nodosa*), frequent. Transect 8 (depth: 0.5 to 1 m) , frequent among algae. Transect 9 (depth: 0.5 m; well developed *Cystoseira barbata*), 7 s. per 1/16 sq m. Transect 11(depth: 3 to 6 m; bottom: rocky with sand patches and *Cymodocea nodosa*), frequent; SESTRUNJ ISLAND AREA: (depth: 4 to 15 m; down to 10 m rocky bottom and deeper sand with *Posidonia oceanica*; the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and biocoenosis of the meadows of *Posidonia oceanica*), frequent; HVAR ISLAND AREA: out-

er side (cape) of Pokrivenik cove (depth: 0-20 m; bottom: rocky; the biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis), frequent; VIS ISLAND AREA: Ploča shoal (depth: 15 m; bottom: rocky - a reef in an area of sandy bottom; the biocoenosis of the meadows of *Posidonia oceanica* and precoralline aspect of coralline biocoenosis), frequent. Grab: grab sample from muddy bottom at 30 m depth frequently contained shells.

Discussion: GRAEFFE (1902) recorded the species *Hinia incrassata* from the area of Trieste. It was reported for the area of Rovinj by: WIMMER (1883) and ODHNER (1914) as frequent on sand between 2 and 4 m; GAMULIN-BRIDA (1967b) in the biocoenosis of detritic more or less muddy bottoms (depth: 30-38 m), ZAVODNIK (1967a, 1971) in phytal and mixed biocoenosis of sandy bottom at 9 m depth (bottom sandy, stones and well developed floral elements). GRUBE (1864) found it in the area of Lošinj Island, BRUSINA (1865) near Pag Island and Zadar, HORVATH (1963) in the vicinity of Split on stony bottom covered with algae, HELLER (1864) on bottoms covered with algae near Hvar Island and STJEPČEVIĆ and PARENZAN (1980) in Bay of Boka kotorska. M. SOSSICH (1880) reported it to occur in large numbers in shoals, on rocks, and RIEDL (1963) as common and very frequent on soft bottoms but, as well, among algae of rocky bottoms. As I found it *Hinia incrassata* is a nearshore species. It occurs from surface down to about 20-25 m on hard and mobile sandy bottoms. Muddy bottom is a limiting factor of its distribution. It inhabits the biocoenosis of photophilic algae, biocoenosis of fine uniform sands, mixed biocoenosis of sandy bottom, biocoenosis of the meadows of *Cymodocea nodosa*, biocoenosis of the meadows of *Posidonia oceanica*, biocoenosis of coastal detritic bottoms and precoralline aspect of coralline biocoenosis.

Conclusion: *Hinia incrassata* is a nearshore species. It occurs from surface down to about 20-25 m on hard and mobile sandy bottoms. Muddy bottom is a limiting factor of its distribution. It inhabits the biocoenosis of photophilic algae, biocoenosis of fine uniform sands, mixed biocoenosis of sandy bottom, biocoenosis of the meadows of *Cymodocea nodosa*, biocoenosis of the meadows of *Posidonia oceanica*, biocoenosis of coastal detritic bottoms and precoralline aspect of coralline biocoenosis.

Fasciolaria lignaria (LINNAEUS, 1767)

Syn.: *Murex lignarius* LINNAEUS, 1767; *Fasciolaria tarentina* LAMARCK, 1822

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA; 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; CARUS, 1889-1893; VATOVA, 1928; COEN, 1937; RIEDL, 1963; RADIĆ, 1982.
- Mediterranean: WEINKAUFF, 1868; ARADAS and BENOIT, 1870; HIDALGO, 1870-1882; CARUS, 1889-1993; PRIOLO; 1966; NORDSIECK, 1968; PARENZAN, 1970; RIEDL, 1983.

Distribution: Mediterranean.

Results of studies:
Transects: MAKARSKA AREA: western entrance to the port (depth: 7 - 10 m; bottom: stony), among algae on a stone, 1 s; SPLIT AREA: transect 18 (depth: 2 to 4 m; bottom: rocky), 1 s. Marjan shoal (depth: 12 m; bottom: hard with sand), 1 s.; ŠIBENIK AREA: transect 3 (mainland side), at 0.5 m bottom is rocky with stones, 1 s. on a stone; BIOGRAD AREA: transect 3 (depth: 11 m; bottom: gravelly-sandy with discontinuous rocks protruding from mobile bottom), 1 s. on a submarine rock. Transect 4 (depth: 1 m; bottom: rocky, slightly sloping and with well developed *Cystoseira barbata*), 1 s. At 3 m depth bottom is formed of plate rocks covered with a tin sand layer and bigger stones), 3 s. (found at feet of stones);

ZADAR AREA: trasnect 3 (depth: 5 m; bottom: stony), 1 s.; VIR ISLAND AREA: transect 5 (depth: 0.2 m; bottom: plate rocks with stones overgrown with alga *Cystoseira compressa*), on stones among *Cystoseira compressa* , 9 s. Transect 11 (depth: 0.2 m; bottom: rocky), 1 s.; VIS ISLAND AREA: Ploča shoal (depth: 15 m; bottom: rocky; a reef in an area of sandy bottom. On the reef (precoralline aspect of coralline biocoenosis) 2 s.; HVAR ISLAND AREA: reef near Zečevo Island (depth: 10 to 15 m; bottom: rocky), 1 s. at 10 m depth. Trawl and dredge: hauling of dredge and trawl along lithotamnium bottom on several occasions I found empty shells of *Fasciolaria lignaria*. No haul gave alive specimens. Empty shells were inhabited by Paguridae family crabs.

Discussion: The species *Fasciolaria lignaria* is a hard substrate representative. GRUBE (1864) recorded it from the area of Mali Lošinj Island. M. STOSSICH (1880) reported it as rare in the area of Kopar, Piran, Rovinj and Dubrovnik, distributed on stony bottoms. VATOVA (1928) decribed it as markedly rare in the vicinity of Rovinj. This author recorded a single specimen on muddy-sandy bottom and empty shells with the species of crab *Paguristes oculatus* on rocky bottom. RIEDL (1963), as well, described it as rare species distributed on hard rocky bottoms (in recesses). DANILO and SANDRI (1856) recorded it from the area of Zadar, RADIĆ (1982) near Makarska, and HELLER (1864) on rocky bottoms of the central Adriatic down to 4 m depth. From everything said above it is quite obvious that this is a species inhabiting hard substrates, not occurring in large numbers in the Adriatic. As I found it and on the basis of obtained data I think that it is an infralittoral species distributed on hard substrate. In general, it is a rather rare Adriatic species. However, up to 10 s. could be found in places (e.g. Vir Island, t. 5). On several occasions I recorded empty shells on lithotamnium bottoms. It inhabits the biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis.

Conclusion: The species *Fasciolaria lignaria* is a hard substrate representative. It is an infralittoral species. In general, it is a rather rare Adriatic species inhabiting the biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis.

Fusinus syracusanus (LINNAEUS, 1758)

Syn.: *Murex syracusanus* LINNAEUS, 1758; *Fusus syracusanus* LAMARCK, 1816; *Trophon syracusanus* MONTEROSATO; 1878; *Aptysis syracusanus* MONTEROSATO, 1884

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA; 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ZIMMERMANN, 1905-1906; ODHNER, 1914; VATOVA, 1928; COEN, 1937; RIEDL, 1963; GAMULIN-BRIDA, 1967b; STJEPČEVIĆ, 1967; GAMULIN-BRIDA *et al.*, 1968; ZAVODNIK; 1971; RADIĆ, 1982.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; CARUS, 1889-1893; PRIOLO; 1966; NORDSIECK, 1968; PARENZAN, 1970; RIEDL, 1983.

Distribution: Atlantic (Cannaries), Mediterranean.

Results of studies:
Transects: MAKARSKA AREA: western entrance to the port: at 15 depth bottom is sandy with a large number of stones. Among algae on stones 1 specimen; SPLIT AREA: transect 3 (depth: 3 m; bottom: rocky-sandy-gravelly), 1 s. Transect 10 (depth: 2 m; bottom: rocky-sandy), 1 s. Marjan shoal (depth: 12 m; bottom: rocky with sand patches), 1 s; ŠIBENIK

AREA: transect 3 (mainland side), shore low and shallow. Down to 3 m depth bottom is rocky-stony-sandy, 1 s.; BIOGRAD AREA: transect 2 (depth: 4-7 m; bottom: stone bulks with a number of shaded recesses and well developed floral component), 2 s. Transect 4 (at 2-5 m depth bottom is rocky, slightly sloping , gravelly-sandy), 1 s.; ZADAR AREA: transect 2 (down to 5 m depth plate rocks with recesses filled with sediment), 1 s.; VIR ISLAND AREA: transect 3 (down to 5 m depth formed bottom stretches as plate rocks), 1 s. Transect 5 (depth: 0.5 m; bottom: plate rocks and stones overgrown with *Cystoseira compressa*), 2 s. Transect 11 (at 5 m depth large number of stones), 1 s.; VIS ISLAND AREA: Ploča shoal (depth: 15 m; bottom: reef in an area of sandy bottom), 1 s. on reef; HVAR ISLAND AREA: reef near Zečevo Island (depth: 10-15 m; bottom: rocky), at 12 m depth 1 s. Trawl: "PIPETA" EXPEDITION: A(2), 1 s. (depth: 20 m). A(3), 2 s. Bottom is coarse sand with a number of stones and rocks. A lot of shelly material (40 to 50 kg per haul). Stations are set in an area (northwestern part of the northern Adriatic) of formed biocoenosis of coarse sands and fine gravel affected by bottom currents. Shells of three specimens of *Fusinus syracusanus* were overgrown with the spcies *Suberites domuncula*.

Discussion: *Fusinus syracusanus* prefers hard substrate. It is not numerous in the Adriatic. GRAEFFE (1902) recorded it from the area of Trieste, WIMMER (1883) and ODHNER (1914) near Rovinj on sand between 1 and 3 m depth, GAMULIN-BRIDA (1967b) near Rovinj in the biocoenosis of detritic more or les muddy bottoms (depth: 37-41 m) and biocoenosis of coastal terrigeneous muds, f. of viscous muds (depth: 30-33 m), ZAVODNIK (1971) near Rovinj in the biocoenosis of terrigeneous mudy bottoms (Valdibora Bay, depth: 15 m). This author reported it as a species with poorly known ecological distribution. A. STOSSICH (1865) decribed it as rare in the northern Adriatic and near Dubrovnik at small depths. DANILO and SANDRI (1856) recorded it from the vicinity of Zadar, HELLER (1864) from the central Adriatic on sandy bottom between 4 and 18 m. STJEPČEVIĆ (1967) found only three specimens in Bay of Boka kotorska on sandy substrate between 30 and 50 m. RIEDL (1963) reported it as relatively rare Adriatic species distributed among algae of rocky bottoms and on secondarily stiffened bottoms. As I found it this is an infralittoral species, which inhabits smaller depths and primarily hard substrate. I found several specimens on sandy bottom where the component of hard substrate is pronounced. I recorded it from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and biocoenosis established and described already by VATOVA (1949) as the biocoenosis of coarse sands and fine gravel affected by bottom currents, in the nortwestern part of the northern Adriatic. GAMULIN-BRIDA, POŽAR and ZAVODNIK (1968) reported that this biocoenosis could mainly be encountered in the infralittoral.

Conclusion: *Fusinus syracusanus* is an infralittoral species which prefers hard substrate. I found several specimens on sandy bottom where the component of hard substrate was pronounced. It does not occur in large numbers in the Adriatic. I recorded it from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and biocoenosis of coarse sands and fine gravel affected by bottom currents.

Fusinus rostratus (OLIVI, 1792)

Syn.: *Murex rostratus* OLIVI; 1792; *Fusus strigosus* LAMARCK, 1822; *Fusus provincialis* BLAINVILLE, 1830; *Fusus rostratus* PHILIPPI, 1836; *Trophon rostratus* MONTEROSATO, 1878; *Pseudofusus rostratus* MONTEROSATO, 1884

Previous reviews:
- Adriatic: OLIVI, 1792; DANILO and SANDRI, 1856; GRUBE, 1861, 1864; HELLER,

1864; A. STOSSICH, 1865; BRUSINA; 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ZIMMERMANN, 1905-1906; ODHNER, 1914; VATOVA, 1928; COEN, 1937; GAMULIN-BRIDA, 1962; RIEDL, 1963; STJEPČEVIĆ, 1967; GAMULIN-BRIDA *et al.*, 1968; KARAMAN and GAMULIN-BRIDA, 1970; ZAVODNIK; 1971; TAVIANI, 1978,1980; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; CARUS, 1889-1893; PRIOLO; 1966; NORDSIECK, 1968; BOMBACE, 1970; PARENZAN, 1970; RIEDL, 1983.

Distribution: Atlantic (Cannaries), Mediterranean.

Results of studies:
Transects (dredge): ŠIBENIK AREA: transect 2 (depth: 50 m; the biocoenosis of coastal detritic bottoms), 3 s.; ZADAR AREA: transect 3 (depth: 20 m; bottom: sandy-muddy; the biocoenosis of the meadows of *Posidonia oceanica*), 1 s.; VIR ISLAND AREA: transect 11 (depth: 50 m; bottom: muddy-sandy with *Vidalia volubilis*; the biocoenosis of detritic more or less muddy bottoms), 2 s. Transect 1 (depth: 15-20 m; bottom: muddy-sandy with *Vidalia volubilis*; the biocoenosis of detritic more or less muddy bottoms), 1 s.; KRK ISLAND AREA: transect 6 (depth: 25-30 m; bottom: sandy-muddy with *Posidonia oceanica*), 1 s. Trawl: station 2 (depth: 40 to 30 m; bottom: mud; the biocoenosis of coastal terrigeneous muds), 2 s. Station 23 (depth: 85 m; bottom: sandy; the biocoenosis of detritic bottoms of the open sea), 7 s. Station 21 (depth: 104 m; bottom: sandy; the biocoenosis of detritic bottoms of the open sea), 3 s. and 6 empty shells. Station 13 (depth: 52 m; bottom: mud; the biocoenosis of coastal terrigeneous muds), 2 s. "HVAR" EXPEDITION: "H" 47 (depth: 199 m; bottom: mud; the biocoenosis of muddy bottoms of the open sea), 1 s. "H" 48 (depth: 188 m; bottom: mud; the biocoenosis of muddy bottoms of the open sea), 8 empty shells. "H" 49 (depth: 240 m; bottom: mud; the biocoenosis of muddy bottoms of the open sea), 2 s. "H" 53 (depth: 181 m; bottom: mud; the biocoenosis of muddy bottoms of the open sea), 3 s. "H" 54 (depth: 172 m; bottom: mud; the biocoenosis of muddy bottoms of the open sea), 1 s. "H" 57 (depth: 157 m; bottom: mud; the biocoenosis of muddy bottoms of the open sea), 1 s. "H" 61 (depth: 150 m; bottom: mud; the biocoenosis of muddy bottoms of the open sea), 2 s. overgrown by the species *Suberites domuncula*. "H" 62 (depth: 157 m; bottom: mud; the biocoenosis of muddy bottoms of the open sea), 2 s. overgrown by the species *Suberites domuncula*. "H" 104 (depth: 128 m; bottom: mud; the biocoenosis of muddy bottoms of the open sea), 3 s. overgrown by the species *Suberites domuncula*. "H" 157 (depth: 30 m; bottom: mud; the biocoenosis of coastal terrigeneous muds), 1 s. "H" 164: (depth: 46 m; bottom: mud; the biocoenosis of coastal terrigeneous muds), 2 s.; "PIPETA" EXPEDITION: an average number of specimens per an hour trawl haul: A(4), 73 s. (depth: 32 m; bottom: sandy-muddy-rocky-stony; the biocoenosis of detritic more or less muddy bottoms). A(7), 62 specimens (depth: 30-32 m, bottom: sandy-muddy; the biocoenosis of detritic more or less muddy bottoms). A(8), 45 specimens (depth: 34 m; bottom: sandy-muddy; the biocoenosis of detritic more or less muddy bottoms). B(3), 49 specimens (depth: 33 m; boundary area between the biocoenosis of coastal terrigeneous muds and biocoenosis of detritic bottoms of the open sea. B(4), 56 specimens (depth: 40 m; bottom: sandy-muddy; the biocoenosis of detritic bottoms of the open sea), F(3), 15 s. (depth: 84 m; bottom: sandy-muddy; the biocoenosis of detritic bottoms of the open sea).

Discussion: The species *Fusinus rostratus* is a mobile bottom representative. GRAEFFE (1902) recorded it from the area of Trieste, ODHNER (1914) near Rovinj, and GRUBE (1861, 1864) near Cres and Veli Lošinj islands. ZAVODNIK (1971) reported it from the bio-

coenosis of terrigeneous muds, f. of viscous muds (Valdibora Bay near Rovinj, depth: 15 m) and from the biocoenosis of coastal detritic bottoms (near Rovinj, depth: 35 m). This author believed it to be a species characteristic of mixed bottoms. STJEPČEVIĆ (1967) recorded relatively small number of specimens from Bay of Boka kotorska, inhabiting mainly muddy-sandy bottoms overgrown with marine phanerogams down to 45 m depth. M. STOSSICH (1880) decribed it as frequent throughout the Adriatic (in shoals with algae), whereas, on the contrary, A. STOSSICH (1865) found it to be very rare in the northern Adriatic (recording it on only several occasions in shoals among algae). HELLER (1864) recorded it from 4 to 37 m depths in the central and southern Adriatic. RIEDL (1963) decribed it as inhabiting greater depths on secondarily stiffened substrates. In his paper published in 1983 this author reported it as a species of detritic bottoms of upper sublittoral. Its sculptured form this author frequently found on deep muddy bottoms. As I found it , the species *Fusinus rostratus* occurs in largest numbers in the upper part of the northern Adriatic, numerous to a certain extent in some parts of the central Adiatic, and occurring in very small numbers in the rest of the study area. It prefers mixed bottoms (sandy-muddy; muddy-sandy) where an hour trawl haul could give more than 70 specimens. Mainly 1 to 2 specimens are recorded from sand or mud. It is ditributed in the biocoenosis of detritic more or less muddy bottoms, biocoenosis of coastal detritic bottoms, biocoenosis of detritic bottoms of the open sea, biocoenosis of the meadows of *Posidonia oceanica*, biocoenosis of coastal terrigeneous muds, biocoenosis of muddy bottoms of the open sea.

Conclusion: The spcies *Fusinus rostratus* is a mobile bottom representative. It occurs in largest numbers in the upper part of the northern Adriatic, numerous to a certain extent in some parts of the central Adiatic, and occurs in very small numbers in the rest of the study area. It prefers mixed bottoms. It is ditributed in the biocoenosis of detritic more or less muddy bottoms, biocoenosis of coastal detritic bottoms, biocoenosis of detritic bottoms of the open sea, biocoenosis of the meadows of *Posidonia oceanica*, biocoenosis of coastal terrigeneous muds, biocoenosis of muddy bottoms of the open sea.

Mitra zonata MARRYAT, 1817

Syn.: *Mitra santangeli* MARAVIGNA, 1840

Previous reviews:
- Adriatic: A. STOSSICH, 1865; M. STOSSICH, 1880; CARUS, 1889-1893; VATOVA, 1935; COEN, 1937; ZAVODNIK; 1967; PARENZAN, 1970; RADIĆ, 1969; CERNOHORSKY, 1976.
- Mediterranean and Atlantic: WEINKAUFF, 1868; ARADAS and BENOIT, 1870; CARUS, 1889-1993; ODHNER, 1914; PRIOLO; 1966; NORDSIECK, 1968; CERNOHORSKY, 1976.

Distribution: Atlantic (coast of Mauritania and Cannaries), Mediterranean.

Results of studies:
Transects (dredge): KOLOČEP ISLAND AREA, 1 s. in 1972 (depth: 45 to 50 m; bottom: lithothamnium; coralline biocoenosis); SPLIT AREA: Marjan shoal, 1 s. in 1974 (depth: 12 m, bottom: rocky with sand patches; the biocoenosis of photophilic algae and biocoenosis of coastal detritic bottoms). On mobile bottoms the algae *Peyssonnelia polymorpha* and *Lythophillum racemus* were well developed; HVAR ISLAND AREA: Lukavci cliffs, 1 s. in 1975 (depth: 54-62 m; bottom: lithothamnium; coralline biocoenosis). Trawl: station 23 (depth: 85 m; bottom: sandy; the biocoenosis of detritic bottoms of the open sea), 1 s. in 1970, 1 s. in 1978, 1 s. in 1980, 1 s. in 1982.

Discussion: *Mitra zonata* belongs among rather rare Adriatc species. It is distributed all along the eastern Adriatic on hard and detritic bottoms. PARENZAN (1970) reported it as most frequently distributed on the bottoms with *Peyssonnelia polymorpha* between 50 and 70 m. PRIOLO (1966) brought out the information that it was not frequent in seawater around Sicily but neither too rare inhabiting the areas of coralline biocoenosis. During my studies I found eight specimens, of which five in the biocoenosis of detritic bottoms of the open sea (Šolta Island), two in coralline biocoenosis (Koločep and Hvars islands) and one in the biocoenosis of coastal detritic bottoms (Split). All eight specimens were found very close to the coast. After available literature for the Adriatic this species is closely bound to the coast. A. STOSSICH (1865) mentioned a specimen caught near Hvar Island and another near Split close to the coast. VATOVA (1935) described a specimen caught 1 Nm west of the Figarola Island (near Rovinj) at 30 m depth on sandy-muddy bottom. ZAVODNIK (1967) also recorded a specimen near Rovinj (1 Nm west of Banjola Island) on muddy-sandy bottom and also at 30 m depth. RADIĆ (1969) present abundant material on the sites wherefrom *Mitra zonata* was recorded in the Adriatic. This author separately worked out seven specimens which are presently the property of the Malacological museum. All the specimens were also caught in the vicinity of the coast (five in Brač and Hvar channels, one near Šolta Island and one near Cavtat, at depth from 20 to 80 m). No specimen has been recorded along the western Adriatic coast, so far. Juvenile form of this species is not known. That is why it is possible that one of the described species, maybe from Mitridae family, may , in fact, be the juvenile form of this species. This would not be the first case of describing juvenile and adult form of the same species as two separate species. Juvenile form of the species *Luria lurida* differs so much from the adult form that BRUSINA (1965) described it as separate species *Voluta pumilio*.

Conclusion: *Mitra zonata* belongs among rather rare Adriatc species. It is distributed all along the eastern Adriatic on hard and detritic bottoms. During my studies I found eight specimens, of which five in the biocoenosis of detritic bottoms of the open sea, two in coralline biocoenosis and one in the biocoenosis of coastal detritic bottoms. All so far recorded specimens (literature and my own data) were found very close to the coast. Juvenile form of this species is not known.

Raphitoma reticulata (RENIERI, 1804)

Syn.: *Murex reticulatus* RENIERI, 1804; *Pleurotoma reticulata* BRONN, 1831; *Cordieria reticulata* MONTEROSATO, 1884

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1861, 1864; A. STOSSICH, 1865; BRUSINA; 1866; JEFFREYS, 1867; WEINKAUFF, 1868; M. STOSSICH, 1880; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902;VATOVA, 1928; COEN, 1937; STJEPČEVIĆ and PARENZAN, 1980.
- Mediterranean and Atlantic: JEFFREYS, 1867; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; NORDSIECK, 1968; BOMBACE, 1970; PARENZAN, 1970.

Distribution: Atlantic (Norway, Shetland Islands, Great Britain, France, Spain, Portugal), Mediterranean.

Results of studies:
In the study area (Dubrovnik, Makarska, Split, Biograd, Šibenik, Zadar, Vir, Krk, Sestrunj, Silba, Hvar and Vis islands) I recorded specimens of *Raphitoma reticulata* from the material obtained from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and coralline biocoenosis as well as from samples of algae (*Cystoseira barbata, Cystoseira adriatica, Cystoseira adriatica* var.

spicata, Cystoseira corniculata, Cystoseira corniculata ssp. *laxior, Cystoseira ercegovicii, Cystoseira compressa, Sargassum salicifolium, Sargassum hornschuchi*) collected from an area of 1/16 sq m. The number of specimens was not high, mainly 1 to 2 s., primarily in sheltered shore parts in calm water. In the material taken from coralline biocoenosis (coralline plateau) at 45 to 85 m depth (Koločep, Hvar and Vis islands) I also recorded alive specimens. In grab samples from mobile bottoms (sand, mud) shells were rare.

Discussion: GRAEFFE (1902) recorded the species *Raphitoma reticulata* from the area of Trieste, WIMMER (1883) on mud (28 m depth) in the vicinity of Rovinj, GRUBE (1861, 1864) at different depths near Cres and Mali Lošinj islands. DANILO and SANDRI (1856) near Zadar, and STJEPČEVIĆ and PARENZAN (1980) in Bay of Boka kotorska. M. STOSSICH (1880) reported it as occurring in small numbers on algae and sand of the northern Adriatic. As I found it this species belongs to the group of common Adriatic gastropods. It is distributed all along the eastern coast. As to its habitats I believe that all or almost all species of *Raphitoma* genus inhabit the same type of habitat. They live on hard substrate overgrown with algae, in the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and coralline biocoenosis. On mobile substrate (sand, mud) shells of *Raphitoma reticulata* are rare. I recorded alive specimens between 45 and 85 m depth in coralline biocoenosis.

Conclusion: This species belongs to the group of common Adriatic gastropods. All or almost all species of *Raphitoma* genus inhabit the same type of habitat. They live on hard substrate overgrown with algae, in the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and coralline biocoenosis. It is common in sheltered shore parts in calm water. Mobile substrate is a limiting factor of its distribution.

Raphitoma bicolor (RISSO, 1826)

Syn.: *Pleurotoma bicolor* RISSO, 1826; *Pleurotoma philberti* MICHAUD 1829; *Pleurotoma variegatum* PHILIPPI, 1836; *Pleurotoma purpureum* ARADAS and BENOIT, 1870

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA; 1866; JEFFREYS, 1867; WEINKAUFF, 1868; M. STOSSICH, 1880; CARUS, 1889-1893; GRAEFFE, 1902; VATOVA, 1928; COEN, 1937; VIO *et al.*, 1979.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; JEFFREYS, 1867; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; CARUS, 1889-1893; PRIOLO, 1967; NORDSIECK, 1968; PARENZAN, 1970; RIEDL, 1983.

Distribution: Atlantic (Norway, Sweden, Shetland Islands, Great Britain, France, Spain, Portugal, Cannaries and Madeira), Mediterranean.

Results of studies:
In the study area, in the samples of algae collected from an area of 1/16 sq m, I recorded a greater number of specimens of *Raphitoma bicolor,* if compared to the previous species, from the material obtained from the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and coralline biocoenosis. The number of specimens mainly ranged from 2 to 5. Samples with a larger number of specimens were rare (Vir Island, t. 10, *Cystoseira barbata*; depth: 1 m, 16 s.). Between 20 and 85 m in coralline biocoenosis I also recorded several tenths of specimens. Grab samples from mobile substrate (sand, mud) contained from time to time several shells of this species.

Discussion: GRAEFFE (1902) recorded this species from the area of Trieste, GRUBE (1864) near Mali Lošinj Island, HELLER

(1864) near Korčula and DANILO and SANDRI (1856) from the vicinity of Zadar. M. STOSSICH (1880) reported it as numerous on algae in the northern Adriatic. RIEDL (1963), as well, believed it to be not a rare species among algae, whereas A. STOSSICH (1865) reported it as not numerous on algae in the northern Adriatic. As I found it, this species belongs to the group of common and frequent Adriatic gastropods. It is far more numerous than the preceding species. It inhabits the same habitats as the other species of *Raphitoma* genus.

Conclusion: The species *Raphitoma bicolor* belongs to the group of common and frequent Adriatic gastropods. It is far more numerous than the preceding species. It inhabits the same habitats as the other species of *Raphitoma.*

Raphitoma linearis (MONTAGU, 1803)

Syn. *Murex linearis* MONTAGU, 1803; *Murex elegans* DONOVAN, 1804; *Pleurotoma muricoidea* BLAINVILLE, 1826; *Defrancia linearis* ADAMS, 1858; *Cirillia linearis* MONTEROSATO, 1884; *Philbertia linearis* THIELE, 1929

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1861, 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA, 1865, 1866; JEFFREYS, 1867; WEINKAUFF, 1868; M. STOSSICH, 1880; CARUS, 1889-1893; GRAEFFE, 1902; VATOVA, 1928; COEN, 1937; TAVIANI, 1978, 1980.
- Mediterranean and Atlantic: FORBES and HALEY, 1848b; PHILIPPI, 1844; JEFFREYS, 1867; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; CARUS, 1889-1893; PRIOLO, 1967; NORDSIECK, 1968; PARENZAN, 1970; GRAHAM, 1971; RIEDL, 1983.

Distribution: Atlantic (Iceland, Norway, Great Britain, France, Spain, Portugal, Cannaries and Madeira), Mediterranean.

Results of studies:
In samples of algae collected from a 1/16 sq m the number of its specimens was similar to that of the species *Raphitoma bicolor*. It was very rare in parts of the shore exposed to waves action. Several tenths of specimens were collected from coralline biocoenosis at 20 to 85 m depth. Grab samples from mobile substrate frequently contained one to two shells of this species.

Discussion: GRAEFFE (1902) recorded this species from the area of Trieste, GRUBE (1864) near Cres and Mali Lošinj islands and DANILO and SANDRI (1856) in the vicinity of Zadar. M. STOSSICH (1880) reported it as rare in the northern Adriatic and HELLER (1864) in the central Adriatic. WEINKAUFF (1868) mentioned its records from 9-18 m depth and HELLER (1864) between 37 and 73 m. RIEDL (1983) described it as frequent and well spread species, which can be found on and below stones and on different sublittoral bottoms. As I found it this species lives on hard substrate overgrown with algae in the biocoenosis of photophilic algae, precoralline aspect of coralline biocoenosis and coralline biocoenosis. Mobile substrate is a limiting factor of its distribution.

Conclusion: The species *Raphitoma linearis* belongs to the group of common and frequent Adriatic gastropods. It lives on hard substrate overgrown with algae. Mobile substrate is a limiting factor of its distribution. By its presence in individual biocoenoses it is similar to the preceding species.

Raphitoma leufroyi (MICHAUD, 1828)

Syn.: *Pleurotoma leufroyi* MICHAUD, 1828; *Pleurotoma zonalis* DELLE CHIAJE, 1829;

Mangelia leufroyi FORBES & HANLEY, 1853; *Defrancia leufroyi* ADAMS, 1858; *Leufroyia leufroyi* MONTEROSATO, 1884; *Philbertia leufroyi* THIELE, 1929.

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1861; HELLER, 1864; A. STOSSICH, 1865; BRUSINA; 1866, 1870; JEFFREYS, 1867; WEINKAUFF, 1868; M. STOSSICH, 1880; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; VATOVA, 1928; COEN, 1937; ZAVODNIK; 1971; TAVIANI, 1980.
- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; FORBES and HANLEY, 1848b; JEFFREYS, 1867; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; MONTEROSATO, 1878; B.D.D., 1882-1886; CARUS, 1889-1993; PRIOLO; 1967; NORDSIECK, 1968; PARENZAN, 1970.

Distribution: Atlantic (Norway, Great Britain, France, Spain, Portugal, Cannaries), Mediterranean.

Results of studies:
In samples of algae collected from a surface of 1/16 sq m in the biocoenosis of photophilic algae and precoralline aspect of coralline biocoenosis, as well as in the material collected from coralline biocoenosis , I mainly recorded small number of specimens of this species, from 1 to 2. Samples with a larger number of specimens were rare (Vir Island, t. 1, depth: 5 m, *Cystoseira ercegovicii*, 7 s.; Silba Island, Pocukmarak cape, depth: 2.5 m, *Cystoseira barbata*, 5 s.). Grab samples from mobile bottoms rarely contained shells of this species.

Discussion: GRAEFFE(1902) recorded the specie *Raphitoma leufroyi* from the area of Trieste, GRUBE (1861) near Cres Island, DANILO and SANDRI (1856) near Zadar. HELLER (1864) reported it from the nearshore belt of the central Adriatic, and A. STOSSICH (1865) as rare on sands in the northern Adriatic. WIMMER (1883) mentioned it for muddy and sandy bottoms at 28 m depth of the vicinity of Rovinj. ZAVODNIK (1971) recorded it from the biocoenosis of coastal detritic bottom (wider area of Rovinj) at 35 m depth. This author stated that its ecological distribution was still poorly known. After my own studies, this species is common in the Adriatic, inhabiting the same habitat types as the other species of genus *Raphitoma*. According to workers who studied this species in the areas other than the Adriatic (Mediterranean, Atlantic) it does not inhabit either sand or mud. So JEFFREYS (1867) reported it from stony substrate from the low tide boundary, and FORBES and HANLEY (1848b) at a number of localities in the area of Isles (Great Britain) between 9 and 92 m. As to the substrate they stated that nice specimens could usually be found in the area of laminaria particularly among the stems. PRIOLO (1967) also reported it for the area of laminaria in the seawater around Sicily.

Conclusion: This species is common in the Adriatic, inhabiting the same habitat types as the other species of genus *Raphitoma*.

Conus ventricosus GMELIN, 1790

Syn.: *Conus mediterraneus* BRUGUIERRE, 1789

Previous reviews:
- Adriatic: DANILO and SANDRI, 1856; GRUBE, 1861, 1864; HELLER, 1864; A. STOSSICH, 1865; BRUSINA; 1866; WEINKAUFF, 1868; M. STOSSICH, 1880; WIMMER, 1883; CARUS, 1889-1893; GRAEFFE, 1902; ZIMMERMANN, 1905-1906; ODHNER, 1914; VATOVA, 1928; COEN, 1937; ZEI, 1955; RIEDL, 1963; HORVATH, 1963; STJEPČEVIĆ, 1967; ZAVODNIK; 1967a; ŠIMUNOVIĆ, 1970; VIO *et al.*, 1979; STJEPČEVIĆ and PARENZAN, 1980; RADIĆ, 1982.

- Mediterranean and Atlantic: PHILIPPI, 1836, 1844; WEINKAUFF, 1868; ARADAS and BENOIT, 1870; HIDALGO, 1870-1882; MONTEROSATO, 1878; B.D.D., 1882-1886; CARUS, 1889-1993; NORDSIECK, 1968; PARENZAN, 1970; DANCE, 1974; RIEDL, 1983.

Distribution: Atlantic (from the coast of Portugal to the coast of Senegal, including Cannaries), Mediterranean.

Results of studies:
Transects: DUBROVNIK AREA: transects 1, 2, 3, 4 (vertical rock), single specimens in shore fissures. In the area of Balkuni, Lokrum Island (rocky shore descends into the sea at an angle of 15^0). A continuous belt of the species *Cystoseira stricta* v. *spicata* reaches 0.3 m depth. The abundance of the species *Conus ventricosus* from 1 to 2 s. per 1/16 sq m. Going deeper empty shells are far more numerous and inhabited by the species of Paguridae family; MAKARSKA AREA: down to 2 m depth, single specimens; SPLIT AREA: recorded from all 19 transects (single s.); ŠIBENIK AREA: transect 1 (depth: 0.1 to 0.5 m), 0 to 1 s. per 1/16 sq m in sheltered shore parts on loose stones. At transects 2 and 3 (bottom rocky-stony and coastal part of the sea water shallow) it occurs with an abundance (depth: 0.1 to 0.5 m) of 1 to 2 s. per 1/16 sq m. It is rather uniformly represented on the bottom of low scattered rocks protruding from the sea surface; BIOGRAD AREA: recorded from all 4 transects (single s.); ZADAR AREA: transect 2 (depth: 0.1 to 0.5 m; bottom: plate rocks), single specimens; VIR ISLAND AREA: transect 5 (rocky shore sligtly sloping into the sea). Submarine compact rocks form bigger or smaller plateaus mostly overgrown with the species *Cystoseira compressa*. Abundance 1 to 2 s. per 1/16 sq m (depth: 0.1 to 0.5 m). At transect 3 this species occurs with an abundance of 0 to 1 s. per 1/16 sq m rather frequently down to 0.5 m depth. It occurs on rocky shore parts not directly wave exposed. At transects 6, 8 and 9 single specimens: KRK ISLAND AREA: at transect 1 and 3 on rocks and among stones its abundance was 0 to 1 s. per 1/16 sq m down to 0.5 m, and at transects 2 and 5 only single specimens.

Discussion: The species *Conus ventricosus* is a hard substrate representative. It is distributed on rocky and stony shore all along the Adriatic Sea. This species occurs in greatest numbers on low scattered rocks or loose stones down to 1 m depth on shore parts not directly wave exposed. Below 1 m depth it is suddenly thinned so that at 2 m depth live specimens are rare and a large number of empty shells, inhabited by the species of Paguridae faimly, could be found. The species *Conus ventricosus* have been worked out and reported by a number of earlier authors as to its horizontal and vertical distribution as well as habitat. So GRUBE (1861, 1864) reported it for the area of Cres Island, and ZIMMERMANN (1905-1906) and ODHNER (1914) for the area of Rovinj. WIMMER (1883) stated that this species lives close to the shore among algae between 2 and 4 m in the area of Rovinj, and VATOVA (1928) recorded it from the same area as frequent species on the shore parts covered by algae. DANILO and SANDRI (1856) reported it from the area of Zadar, and M. STOSSICH (1880) believed it to be common all along the Adriatic coast. GRAEFFE (1902) reported it from the area of Trieste. Describing this species from the area of Rovinj, ZEI (1955) believed it not to be a typical representative of the emersion zone where extreme variations in humidity and other life conditions are present and to live in the lower part of the emersion zone on and among algae and below stones, where there is enough humidity. RIEDL (1963) reported its as common and very frequent in the phytal of rocky shores of the vicinity of Rovinj. ZAVODNIK (1967a) also reported it from phytal of the area of Rovinj HORVATH (1963) stated that it was a species with a small foot so that it seeks shelter in fissures not to be wave washed into the sea. HELLER (1864) recorded it as a frequent species in the central and southern Adriatic on rocky bottoms. STJEPČEVIĆ (1967) reported it to be distributed throughout Bay of Boka ko-

torska occurring in relatively small numbers. This author recorded it from 3 to 10 m on sandy-muddy substrate. As indicated by everything reported on this species it is a hard substrate species. Vertically, it occurs in the uppermost part of infralittoral and inhabits the biocoenosis of photophilic algae.

Conclusion: The species *Conus ventricosus* is a hard substrate representative. It is distributed on rocky and stony shores all along the Adriatic Sea. It occurs in greatest numbers on low scattered rocks or loose stones down to 1 m depth on shore parts not directly wave exposed. Singles specimens were recorded in other places either due to the fact that they are strongly wave exposed or the angles of shore slope is too great. Vertically, it occurs in the uppermost part of infralittoral and inhabits the biocoenosis of photophilic algae.

GENERAL DISCUSSION

This paper is based on the critical review of the data on taxonomy, ecology and biocoenology of Prosobranchiata (Gastropoda) from the eastern Adriatic part.

As shown by the available data on gastropod occurrence on individual substrate types it may be said that, as distinct from molluscs, they mainly inhabit hard substrates overgrown with algae or clean hard substrates. The number of species inhabiting sandy substrates is far lower and of those inhabiting muddy bottoms even lower. In this sense HORVAT (1963) reported its observations on the number of species recorded down to 8 m depth: inhabitants of rocky bottoms: 15 gastropd species -(14 molluscs); inhabitants of algae on rocky bottoms, 17 gastropods -(1 mollusc); sand inhabitants, 2 gastropods permanently and 2 sporadically-(26 mollusc). BOMBACE (1970), as well, observed the relative abundance of gastropods and molluscs (expressed in percentages) in precoralline and coralline biocoenoses: precoralline biocoenosis (depth: 30 to 45 m), 75% of gastropods and 25% of molluscs; coralline biocoenosis (depth: to 60 m), 73% gastropods and 27% molluscs; coralline biocoenosis (depth: 80-100 m), 57% gastropods and 43% molluscs; degraded coralline biocoenosis covered with a sediment layer: 40% gastropods and 60% molluscs. Available scientific literature shows that some gastropod species occur in great numbers (or are rare) on rocks, stones, different concretions, and "among algae on hard substrate". I think that both factors: "hard substrate" and "algae" form a unique ecological and dynamic entity. Irrespective of the fact that on those (hard) bottoms different gastropod species were recorded among algae, they are species inhabiting hard substrate, and even more so, since the algae themselves, in relation to gastropds, have more-or-less the role of a hard substrate (ZAVODNIK, 1967a). The main factor to which the reduction in number and impoverishment of vegetation on some bottoms are due is, after ERCEGOVIĆ (1960a,b; 1964; 1966) missing of hard, particularly stony substrate. For Prosobranchiata, as well, the main cause of reduction in the number of species is very likely missing of hard substrate.

During my studies I established that the distribution of some gastropod species is related to salinity. This relationship was pointed to by some earlier authors, as well, (SABELLI and SPADA, 1971) . So, for the species *Epitonium clathrus* I established the presence of fresh water as a crucial factor of its distribution whereas depth, bottom type and biocoenosis it inhabits were less important. Similar applies to the species *Cyclope neritea* which in its distribution prefers beaches with reduced salinity. SABELLI and SPADA (1971) described this species for shallow bottoms in the biocoenosis of fine surficial sands, and particularly in slightly or significantly polluted waters, where salinity is below mean value.

I gave particular attention to the relationship between distribution of individual gastropod species and depth as an ecological factor. Table 2 depicts the whole spectre of vertical gastropod distribution, from stenobathic forms

(such as *Gibbula divaricata, Monodonta articulata, Pisania striata*), which inhabit several surface meters, to eurybathic forms (such as *Emarginula huzardi, Emarginula elongata, Diodora graeca*) the range of depth distribution of which extends from 0.5 to 100 m, or such species (as for example *Fusinus rostratus*) the depth distribution of which extends from 15 to as deep as below 200 m. My own data point to the errors in some of the depth distributions reported by earlier authors. For example, the species *Luria lurida*, RIEDL (1963) reported exclusively for great depths of the southern Adriatic, whereas I recorded it from small depth (between 5 and 12 m). In addition, *Murex brandaris* was reported by GRUBIŠIĆ (1967, 1982) for 3 to 100 m depths, whereas after my records the lower limit of their distribution does not exceed 50 m.

Light intensity was also found to affect the distribution of some species on a substrate. So the abundance of the species *Monodonta turbinata* in the mediolittoral step is highest during "calm" (bonaca) eraly in the morning. During the day, particularly during summer heats, it withdraws towards infralittoral, its abundance in the mediolittoral being considerably reduced, specimens which remain found exclusively in mediolittoral pools and fisssures filled with water. Similar was recorded from some other nearshore species such as *Columbella rustica* and *Pisania striata.*

Some of the gastropod species acquire some adaptation properties with respect to the substrate they inhabit, expressed as a combination such as: adaptation of shell edge to the microrelief of the shore as well as the form of the foot which allows firm attachment to the substrate. This is the case of the species of genus *Patela*. The spatial distinction between the species of this genus may also be taken as one of the ways of adaptation to specific ecological conditions. So the species *Patella aspera* is adapted to the ambient between prevalently dry zone, inhabited by the species *Patella rustica* and permanently submersed zone inhabited by *Patella caerulea*. Some littoral species, such as *Gibbula divaricata, Monodonta turbinata* and *Monodonta articulata* protect themselves from unfavourable life conditions due to water wuithdrawal during low tide, by following sea level movements.

My studies included the distribution of gastropods with respect to the shore and sea bottom slope angles, shore configuration and extent of wave exposure. So it was shown that *Patella rustica* prefers the parts with greater slope angle, that is steeper places wave exposed as distinct from the species such as *Gourmyra rupestris* which inhabits low rocks at the bottom of small angle slope. The studies of the physical structure of microhabitats show shore configuration to be a very important factor controlling the distribution and abundance of some species. So, for example, *Littorina neritoides* is most numerous in places on the shores which are very rough and full of all kinds of fisures and crevices. On the other hand, *Capulus hungaricus* and *Calyptraea chinensis* inhabit all types of hard bottoms, provided that hard substrate, to which they are attached, is smooth. With respect to shore exposure there are some species, such as *Patella aspera* which prefers exposed localities as distinct from the species such as *Bittium reticulatum* which may be found mainly in calmer and sheltered areas. It occurs below infalittoral boundary on the parts of the shore directly wave exposed.

Anthropogenetic influence on the structure of the Adriatic gastropod fauna has also been recorded, particularly as far as intensity of fishing for some species is concerned. So, for example, the biomass of non-edible species *Hinia reticulata* has been increased in relation to the biomass of the commercial species *Sphaeronassa mutabilis* along the western Adriatic coast. There is another case when some rarer species such as *Luria lurida, Charonia tritonis seguenza, Tonna galea, Mitra zonata,* have been overfished owing to their beauty and have been put in jeopardy to become extinct. Even though this paper did not deal directly with the gastropods as pollution indicators, some correlation between the numbers of some species and level of sea pollution were noticed, such as for the species *Truncu-*

lariopsis trunculus, Murex brandaris and *Monodonta turbinata*.

Earlier literature gives sufficient data on the presence of small number of gastropod species in individual biocoenose of the Adriatic Sea (GAMULIN-BRIDA, 1962, 1967a,b, 1974; ZAVODNIK, 1967, 1967a, 1971). The data on the presence of majority of gastropods in individual biocoenoses are very poor or ecological distribution of some species is still almost unknown (BOMBACE, 1969; GAMULIN-BRIDA, 1962, 1967a,b, 1974; PARENZAN, 1970; PÉRÈS and GAMULIN-BRIDA, 1973; SABELLI and SPADA, 1978, 1979, 1980; ZAVODNIK, 1967, 1967a, 1971). Therefore one of the principal goals of this paper was the study of these relations in the study area.

The numbers of each individual species established make possible the distinction between generally rare Adriatic gastropods (such as *Erato voluta, Zonaria pyrum*) and seemingly rare ones (such as *Emarginula huzardi, Emarginula cancellata, Emarginula elongata*), those occurring in small numbers (such as *Buccinum corneum, Fusinus syracusanus, Fasciolaria lignaria*) and those occurring in large numbers (such as *Littorina neritoides; Rissoa variabilis, Turritella communis, Bittium reticulatum*) as well as the differences in their numbers as affected by different bottom types (such as *Capulus hungaricus, Calyptraea chinensis*).

The extent to which the Adriatic Prosobrachiata group has been studied so far is still rather moderate as to their taxonomy and zoogeography as well as to their ecology, physiology, etc. Since no revision of all Adriatic records has been made, it is not known how many Prosobranchiata species inhabit the Adriatic Sea. The range of variation of individual morphological characters or detailed distribution are not known, either. Therefore, future investigations should aim at studying these problems.

CONCLUSIONS

This study includes taxonomy, autecology and synecology of the group Prosobranchiata of Gastropoda order in different benthic biocoenoses of the eastern Adriatic Sea. Material was collected from the bionomic steps of supralittoral, mediolittoral, infralittoral, circalittoral and bathyal. Obtained results point to the following:

1. With respect to substrate type most of the worked out species were collected from hard substrate, far less from sandy substrate and a small number from muddy substrate.

2. The relationship between individual species distribution and salinity, light intensity and depth was established. Depth distribution earlier reported for some species was corrected.

3. As to the adaptation to the substrated they inhabit, some species show a defined degree of morphological changes such as that of shell edge and structure or foot functioning.

4. The distribution of some gastropod species is closely related to shore slope angle, shore configuration and wave exposure as well as to the microrelief of the substrate.

5. Anthropogenic factors are reflected upon characteristic structure of malacofauna and distribution of individual species in zones of influence.

6. Data on distribution of all worked out gastropod species in individual Adriatic benthic biocoenoses point to the importance of those species in those biocoenoses.

7. On the basis of the numbers of individual species it is possible to determine their frequency in the Adriatic and to make distinction between generally rare species, seemingly rare ones, those occurring in smaller numbers as well as between the difference in their numbers in relation to different substrate types.

8. Since no revision of all taxa of Prosobranchiata group was made, the exact number of species and their detailed distribution in the Adriatic are still unknown.

9. Future investigations of the Adriatic malacofauna, particularly that of gastropods, should aim at establishing the total number of species of this group in the Adriatic as well as their detailed distribution. Other characteristics such as physiology, embryology, genetics, anatomy etc. should be studied in greater detail.

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Ekološka istraživanja Prosobranchiata (Gastropoda) u istočnom dijelu Jadranskog mora i njihov odnos prema bentoskim biocenozama

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KRATKI SADRŽAJ

Cilj ovog rada bio je na osnovu vlastitih opažanja, kritičkom analizom literaturnih navoda i obradom muzejskih zbirki utvrditi taksonomske i ekološke značajke obrađenih vrsta puževa skupine Prosobranchiata (Gastropoda) istočnog dijela Jadranskog mora koje nalazimo u bionomskim stepenicama supralitorala, mediolitorala, infralitorala, cirkalitorala i batiala u različitim biocenozama na čvrstom i pomičnom supstratu.

U radu su obrađene slijedeće vrste puževa: *Haliotis tuberculata, Emarginula huzadi, Emarginula cancellata, Emarginula elongata, Diodora italica, Diodora graeca, Diodora gibberula, Patella caerulea, Patella aspera, Patella rustica, Calliostoma conulum, Calliostoma zizyphinus, Calliostoma granulatum, Gibbula magus, Gibbula adansoni, Gibbula divaricata, Monodonta turbinata, Monodonta articulata, Jujubinus striatus, Jujubinus exasperatus, Clanculus cruciatus, Clanculus corallinus, Astraea rugosa, Littorina neritoides, Alvania cimex, Alvania montagui, Rissoa variabilis, Rissoa violacea, Rissoa splendida, Rissoa decorata, Rissoa auriscalpium, Rissoa lineolata, Archimediella triplicata, Turritella communis, Bivonia triquetra, Lemintina arenaria, Bittium reticulatum, Gourmya vulgata, Gourmya rupestritis, Triphora perversa, Epitonium clathrus, Epitonium tenuicostatum, Capulus hungaricus, Calyptraea chinensis, Crepidula unguiformis, Aporrhais pespelecani, Erato voluta, Trivia europaea, Trivia pulex, Luria lurida, Zonaria pyrum, Pseudosimnia adriatica, Simnia spelta, Lunatia alderi, Lunatia fusca, Lunatia guillemini, Naticarius stercusmuscarum, Naticarius maculatus, Ranella gigantea, Charonia tritonis seguenza, Tonna galea, Truncullariopsis trunculus, Murex brandaris, Muricopsis cristatus, Ocinebrina aciculata, Ceratostoma erinaceum, Columbella rustica, Buccinulum corneum, Pisania striata, Sphaeronassa mutabilis, Cyclope neritea, Hinia reticulata, Hinia incrassata, Fasciolaria lignaria, Fusinus rostratus, Fusinus syracusanus, Mitra zonata, Raphitoma reticulata, Raphitoma bicolor, Raphitoma linearis, Raphitoma leufroyi, Conus ventricosus.*

Sinonimija obađenih vrsta puževa ograničena je na najvažnije autore, a za svaku se vrstu navode prethodni zapisi, ekološki i zoogeogafski podaci.

Na osnovu podataka o rasprostranjenosti puževa u odnosu na pojedine tipove podloge, općenito se može kazati da najveći broj vrsta iz skupine Prosobranchiata obitava na tvrdoj podlozi obrasloj algama i na neporaslom tvrdom dnu. Neusporedivo manji broj vrsta obitava na pješćanoj i mali broj vsta na muljevitoj podlozi. Mulj je za mnoge vrste eliminirajući faktor rasprostranjenja.

Utvrđena je povezanost rasprostranjenja pojedinih vrsta i nekih značajnih ekoloških faktora kao saliniteta, intenziteta svjetlosti i dubine. Izvršena je i korekcija dubinske rasprostranjenosti nekoliko vrsta.

U nekih vrsta su uočene određene morfološke prilagodbe na podlogu, dok kod dugih vrsta rasprostranjenje uveliko ovisi o kutu nagiba i konfiguraciji obale, ili stupnju izloženosti obale snazi valova. Dotaknut je i antropogeni utjecaj koji se kod nekih vsta očituje u vidu intenziteta izlovljavanja, a kod drugih u osjetljivosti na onečišćenje mora.

U radu se daju detaljni podaci o prisutnosti obrađenih vrsta puževa u pojedinim bentoskim biocenozama, a temeljem brojčanih vrijednosti, vrste su razlučene na općenito rijetke vrste u Jadranu, od prividno rijetkih i brojnih vrsta.

Table 1. Depth distribution of studied Prosobranchiata species

Legend: + - above 0
0 - the point of the lowest tide
---- - depth distribution
m - metres
> - more than

Species	Depth (m)
	+ 0 1 2 3 4 5 10 20 30 40 50 60 70 80 90 100 130 160 190 >200
Haliotis tuberculata	
Emarginula huzardi	
Emarginula cancellata	
Emarginula elongata	
Diodora italica	
Diodora graeca	
Diodora gibberula	
Patella caerulea	
Patella aspera	
Patella rustica	
Calliostoma conulum	
Calliostoma zizyphinus	
Calliostoma granulatum	

Species	+	0	1	2	3	4	5	10	20	30	40	50	60	70	80	90	100	130	160	190	>200
Gibbula magus																					
Gibbula adansoni																					
Gibbula divaricata																					
Monodonta turbinata																					
Monodonta articulata																					
Jujubinus striatus																					
Jujubinus exasperatus																					
Clanculus cruciatus																					
Clanculus corallinus																					
Astraea rugosa																					
Littorina neritoides																					
Alvania cimex																					
Alvania montagui																					
Rissoa variabilis																					
Rissoa violacea																					
Rissoa splendida																					
Rissoa decorata																					
Rissoa auriscalpium																					
Rissoa lineolata																					
Archimediella triplicata																					

Species	+ 0 1 2 3 4 5 10 20 30 40 50 60 70 80 90 100 130 160 190 >200
Turritella communis	
Bivonia triquetra	
Lemintina arenaria	
Bittium reticulatum	
Gourmya vulgata	
Gourmya rupestris	
Triphora perversa	
Epitonium clathrus	
Epitonium tenuicostatum	
Capulus hungaricus	
Calyptraea chinensis	
Crepidula unguiformis	
Aporrhais pespelecani	
Erato voluta	
Trivia europaea	
Trivia pulex	
Luria lurida	
Zonaria pyrum	
Pseudosimnia adriatica	
Simnia spelta	

Species	+ 0 1 2 3 4 5 10 20 30 40 50 60 70 80 90 100 130 160 190 >200
Lunatia alderi	
Lunatia fusca	
Lunatia guillemini	
Naticarius stercusmuscarum	
Naticarius maculatus	
Ranella gigantea	
Charonia tritonis seguenza	
Tonna galea	
Truncullariopsis trunculus	
Murex brandaris	
Muricopsis cristatus	
Ocinebrina aciculata	
Ceratostoma erinaceum	
Columbella rustica	
Buccinulum corneum	
Pisania striata	
Sphaeronassa mutabilis	
Cyclope neritea	
Hinia reticulata	
Hinia incrassata	

Species	+ 0 1 2 3 4 5 10 20 30 40 50 60 70 80 90 100 130 160 190 >200
Fasciolaria lignaria	
Fusinus syracusanas	
Fusinus rostratus	
Mitra zonata	
Raphitoma reticulata	
Raphitoma bicolor	
Raphitoma linearis	
Raphitoma leufroyi	
Conus ventricosus	

Table 2. List of studied Prosobranchiata species recorded from different benthic biocoenoses

Legend:

Bss - b. of supralittoral rocks
Bms - b. of mediolittoral rocks
Bfa - b. of photophilic algae
Bmc - b. of marine phanerogams
Bsup - b. of fine uniform sands
Bspp - b. of fine surficial sands
Bmp - b. of fine muddy sands
Bkpš - b. of coarse sands and fine gravel, affected by bottom currents
Bpšv - b. of coarse sands and fine gravel wave exposed
Pakb - precoralline aspect of coralline biocoenosis
Kb - coralline biocoenosis
Bodd - b. of coastal detritic bottoms
Bddo - b. of detritic bottoms of the open sea
Bmdm - b. of muddy bottoms of the open sea
Bdzd - b. of detritic, more or less muddy bottoms
Botm - b. of coastal terrigeneous muds
Bbm - b. of bathyal muds
b - biocoenosis
x - presence of a species in a biocoenosis

Species	Biocoenoses																
	Bss	Bms	Bfa	Bmc	Bsup	Bspp	Bmp	Bkpš	Bpšv	Pakb	Kb	Bodd	Bddo	Bmdm	Bdzd	Botm	Bbm
Haliotis tuberculata			x							x	x	x			x		
Emarginula huzardi			x							x	x	x	x		x		
Emarginula cancellata			x							x	x	x	x		x		
Diodora italica			x	x	x			x		x	x	x	x		x	x	
Diodora graeca			x	x	x			x		x	x	x	x		x	x	
Diodora gibberula			x	x						x	x	x			x		
Pattela caerulea			x														
Pattela aspera		x															
Pattela rustica	x	x															
Calliostoma conulum			x	x					x	x	x	x			x		
Calliostoma zizyphinus			x	x						x	x	x	x		x		
Calliostoma granulatum												x	x				

Species	Bss	Bms	Bfa	Bmc	Bsup	Bspp	Bmp	Bkpš	Bpšv	Pakb	Kb	Bodd	Bddo	Bmdm	Bdzd	Botm	Bbm
Gibbula magus			x	x				x	x	x	x				x		
Gibbula adansoni			x							x	x						
Gibbula divaricata		x	x														
Monodonta turbinata		x	x														
Monodonta articulata		x	x														
Jujubinus striatus			x	x						x	x						
Jujubinus exasperatus			x	x						x	x						
Clanculus cruciatus			x	x						x	x						
Clanculus corallinus			x	x						x	x						
Astraea rugosa				x						x	x				x		
Littorina neritoides	x	x															
Alvania cimex			x							x	x						
Alvania montagui			x							x	x						
Rissoa variabilis			x							x	x						
Rissoa violacea			x							x	x						
Rissoa splendida			x							x	x						
Rissoa decorata			x							x	x						
Rissoa auriscalpium			x							x	x						
Rissoa lineolata			x							x	x						
Archimediella triplicata				x				x				x	x		x		
Turritella communis							x										
Bivonia triquetra			x							x							

Species	Bss	Bms	Bfa	Bmc	Bsup	Bspp	Bmp	Bkpš	Bpšv	Pakb	Kb	Bodd	Bddo	Bmdm	Bdzd	Botm	Bbm
Lemintina arenaria			x	x						x	x	x					
Bittium reticulatum			x							x	x						
Gourmya vulgata			x	x	x							x			x		
Gourmya rupestris			x														
Triphora perversa			x							x	x						
Epitonium clathrus			x					x		x				x			
Epitonium tenicostatum							x			x					x		
Capulus hungaricus			x	x				x		x	x	x	x	x	x	x	
Calyptraea chinensis			x	x				x		x	x	x	x	x	x	x	
Crepidula unguiformis			x	x				x		x	x	x	x	x	x	x	
Aporrhais pespelecani				x			x					x	x	x	x	x	
Erato voluta													x				
Trivia europaea			x	x					x	x	x	x	x				
Trivia pulex								x			x	x	x				
Luria lurida										x							
Zonaria pyrum										x	x		x				
Pseudosimnia adriatica											x		x				
Simnia spelta										x	x		x				
Lunatia alderi				x								x	x	x	x	x	
Lunatia fusca													x	x			
Lunatia guillemini				x								x			x	x	
Naticarius stercusmuscarum							x										
Naticarius maculatus							x										

Species	Bss	Bms	Bfa	Bmc	Bsup	Bspp	Bmp	Bkpš	Bpšv	Pakb	Kb	Bodd	Bddo	Bmdm	Bdzd	Botm	Bbm
Ranella gigantea																	x
Charonia tritonis seguenza										x	x						
Tonna galea												x	x				
Trunculariopsis trunculus			x	x	x			x		x	x	x	x		x	x	
Murex brandaris			x	x	x			x		x	x	x	x		x	x	
Muricopsis cristatus			x	x						x	x						
Ocinebrina aciculata			x	x					x	x	x	x					
Ceratostoma erinaceum			x	x						x	x	x					
Culumbella rustica		x	x														
Buccinulum corneum			x							x							
Pisania striata		x	x														
Sphaeronassa mutabillis					x	x	x										
Cyclope neritea						x											
Hinia reticulata					x	x	x										
Hinia incrassata			x	x	x					x		x					
Fasciolaria lignaria			x							x							
Fusinus syracusans			x					x		x							
Fusinus rostratus				x								x	x	x	x	x	
Mitra zonata											x	x	x				
Raphitoma reticulata			x							x	x						
Raphitoma bicolor			x							x	x						
Raphitoma linearis			x							x	x						
Raphitoma leufroyi			x							x	x						
Conus ventricosus			x														

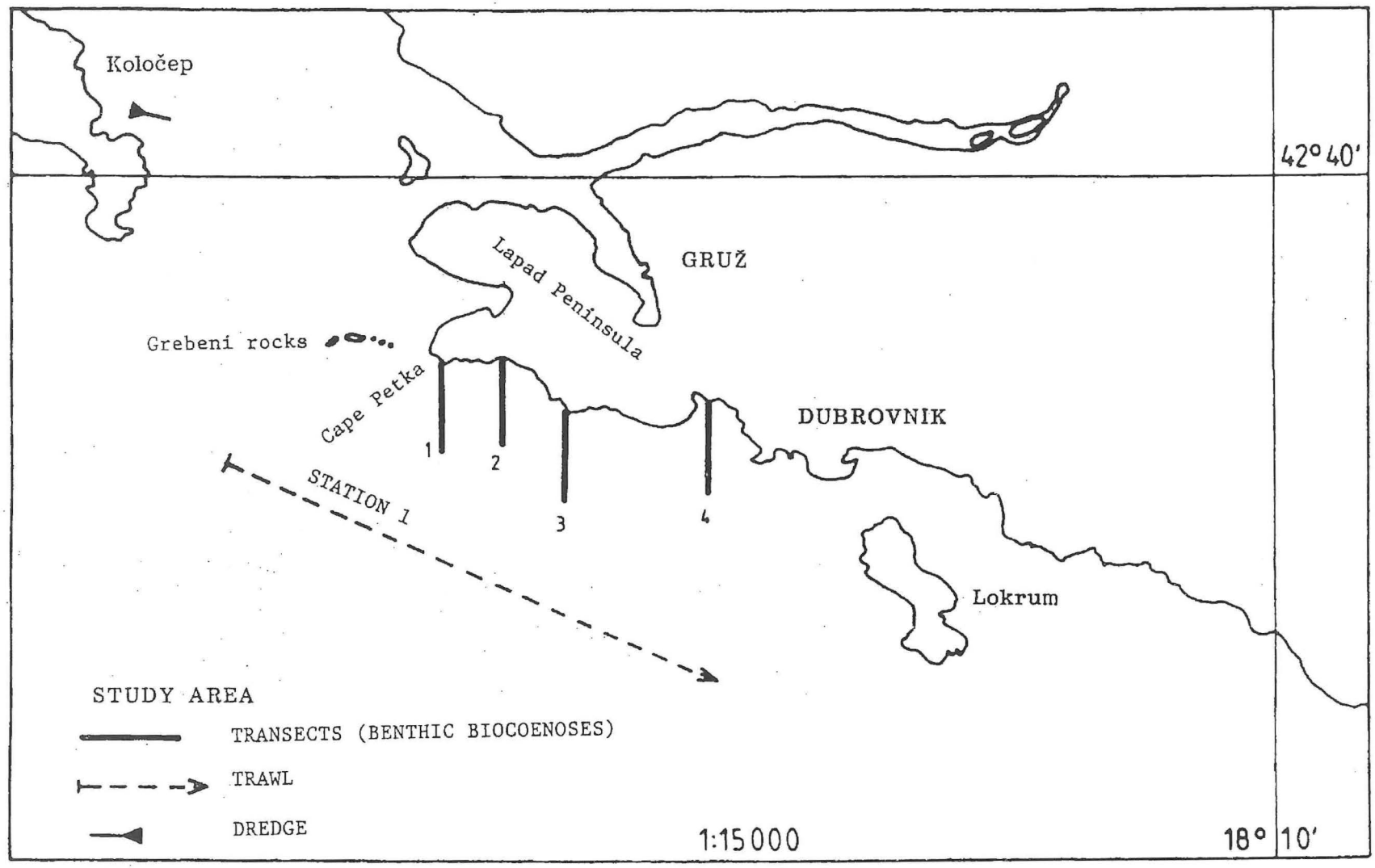


Fig. 1. Dubrovnik area

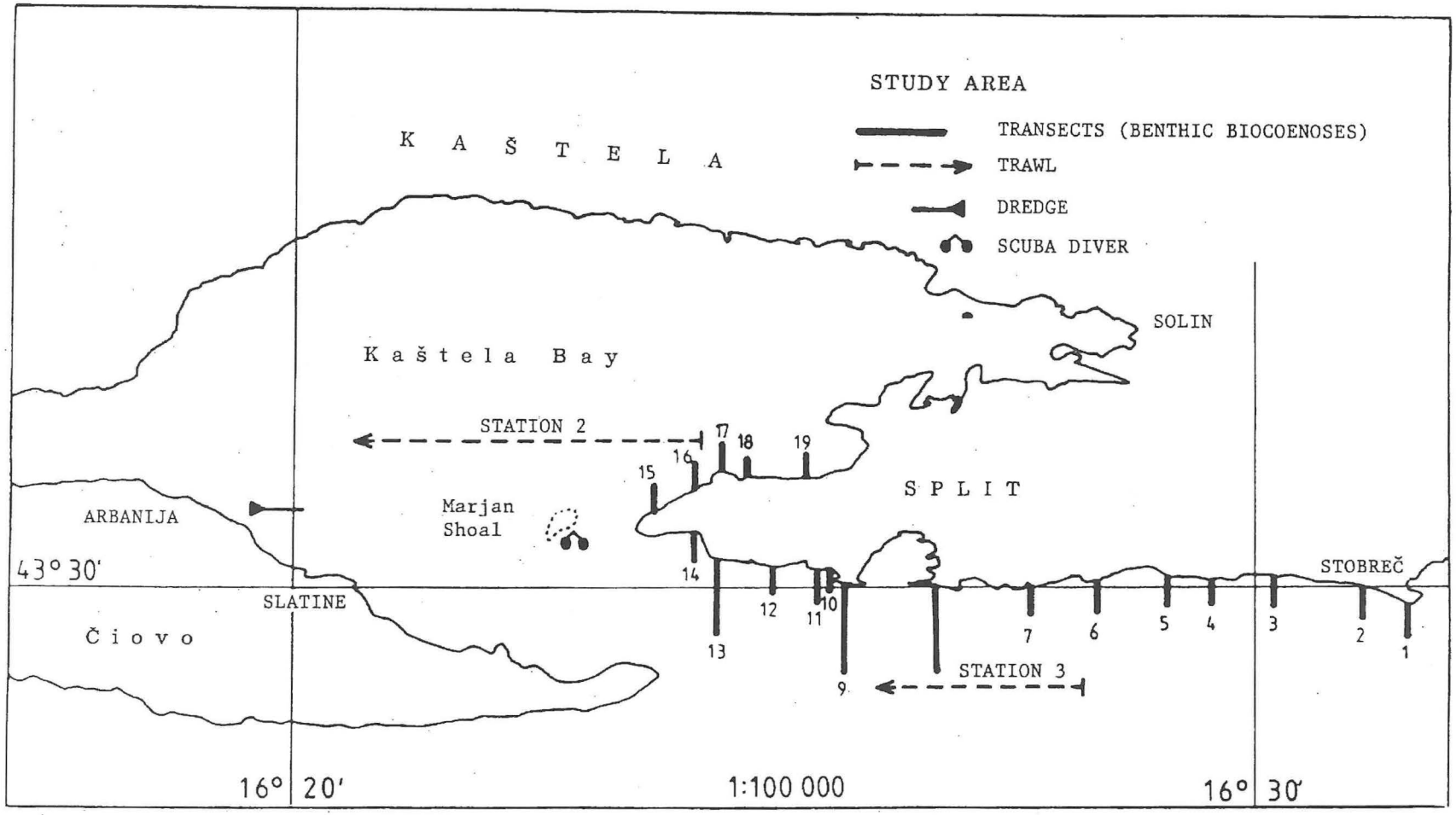


Fig. 2. Split area

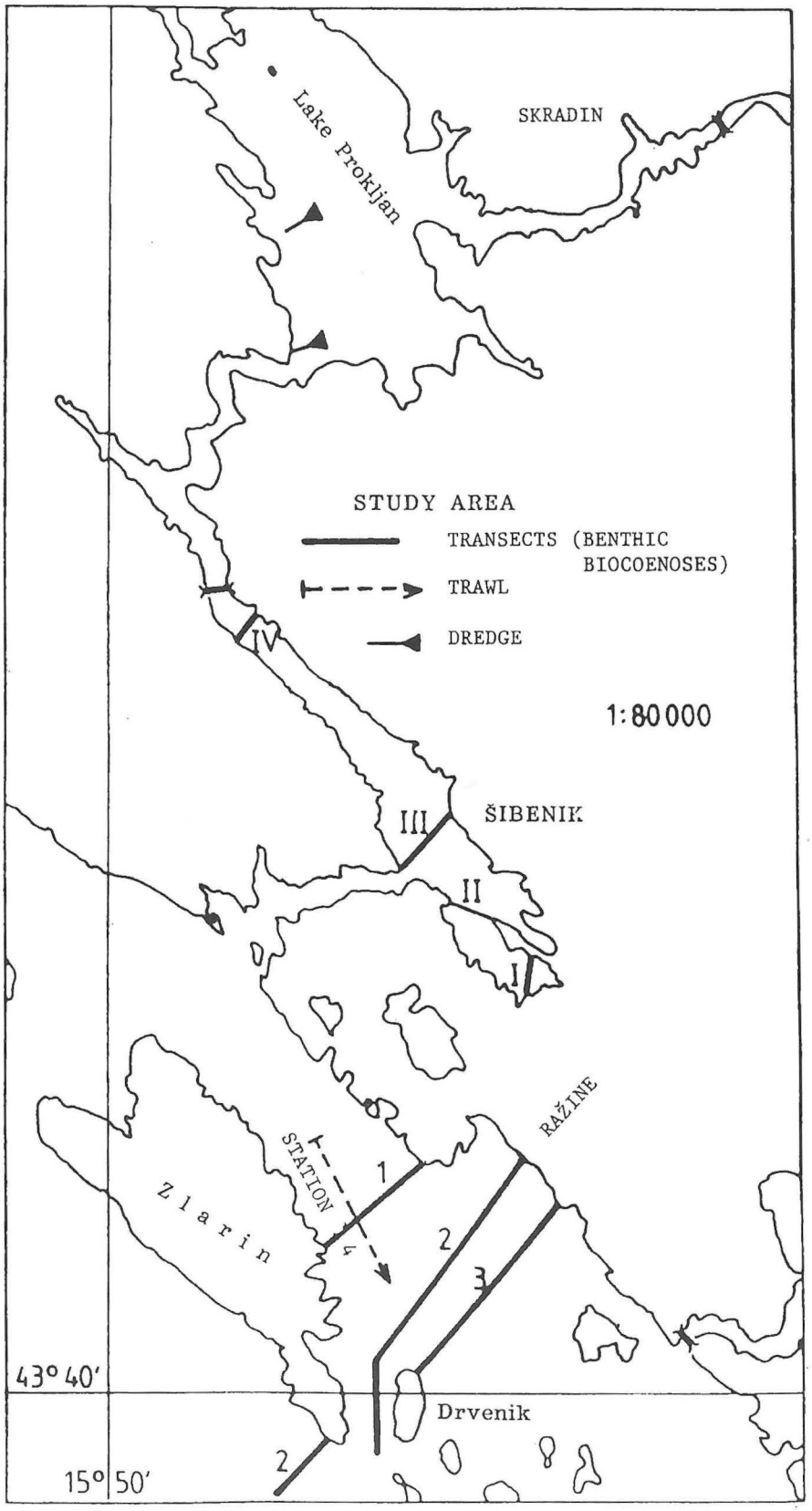


Fig. 3. Šibenik area

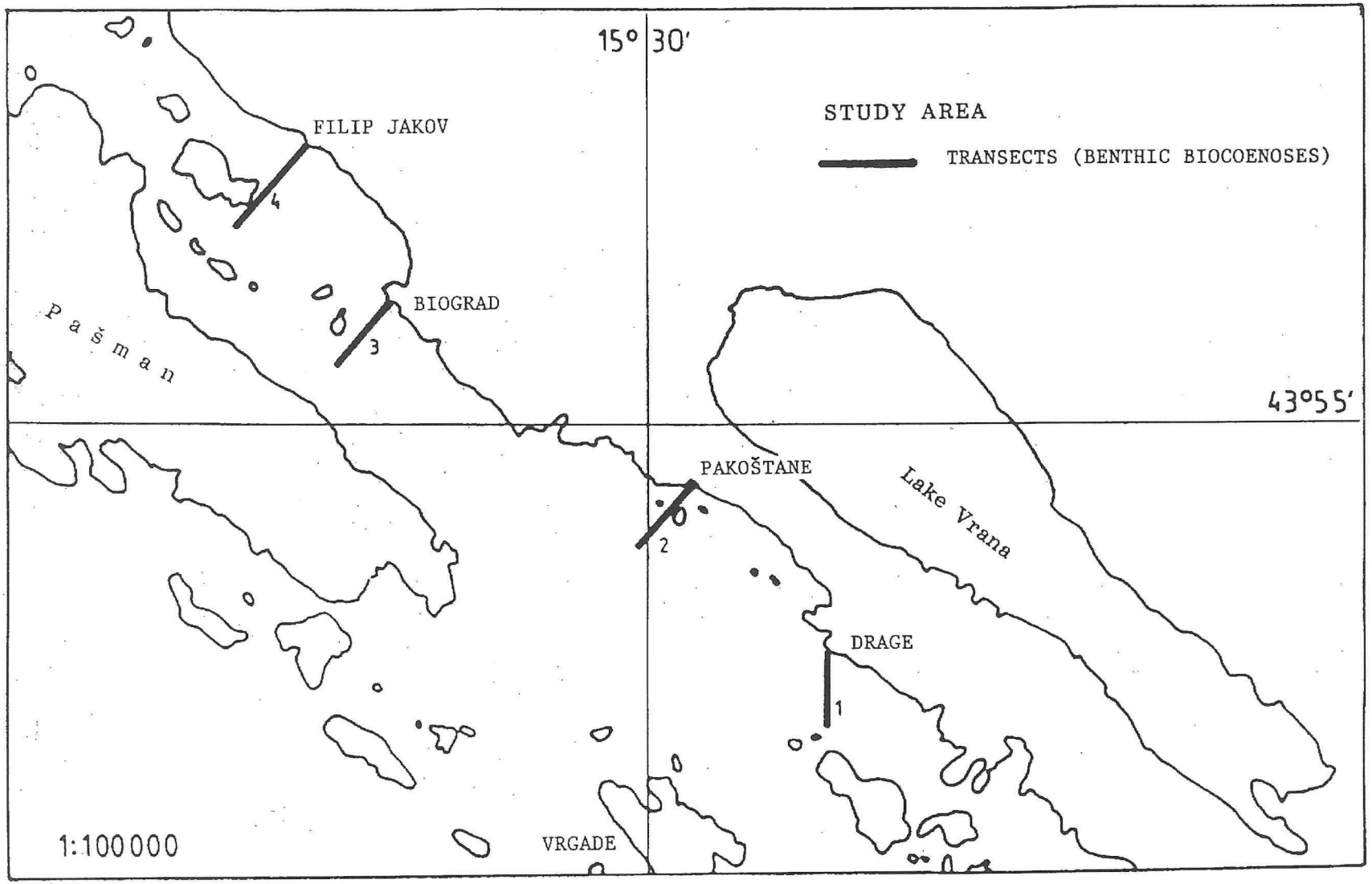


Fig. 4. Biograd area

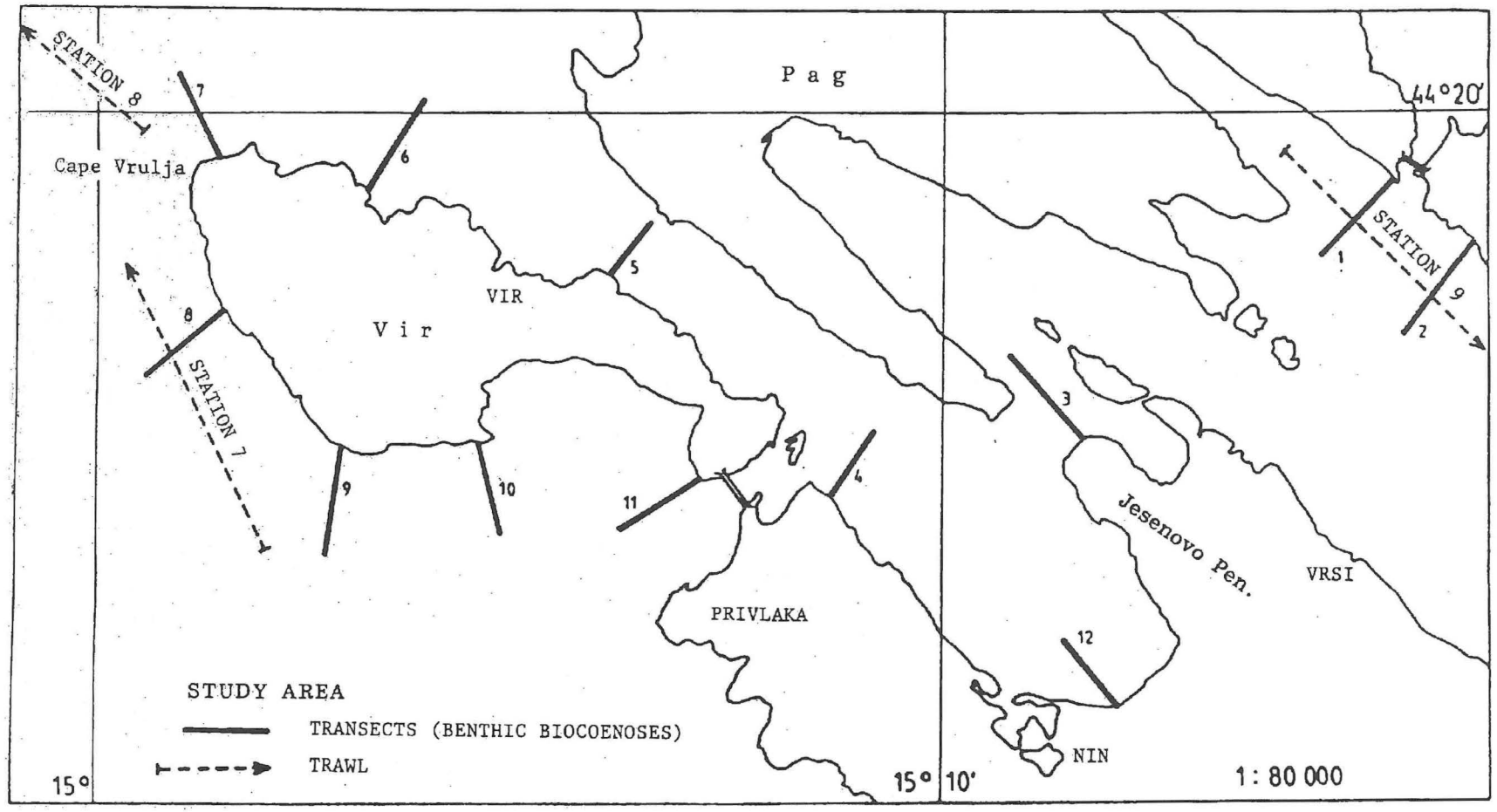


Fig. 5. Vir Island area

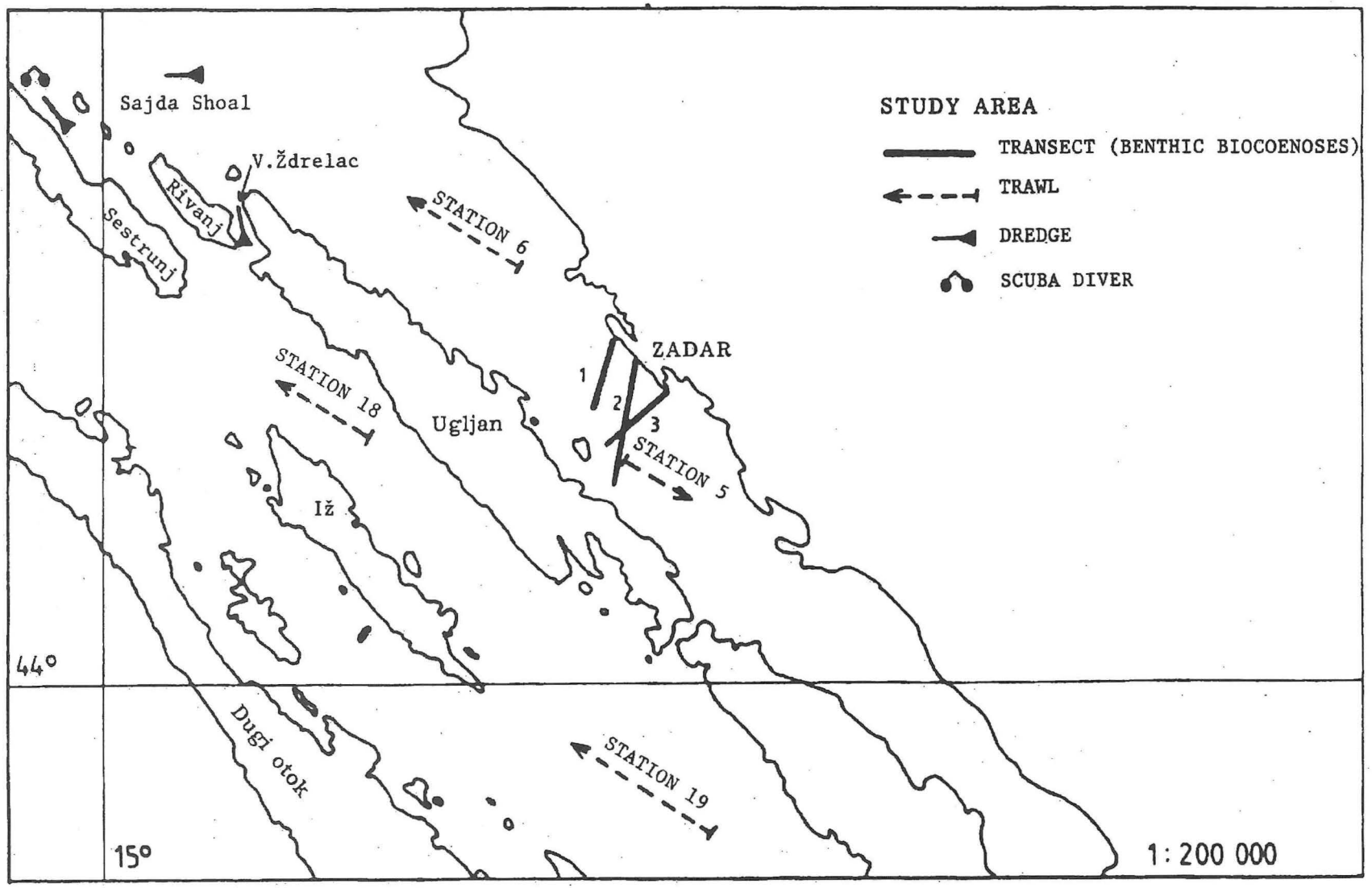


Fig. 6. Zadar area

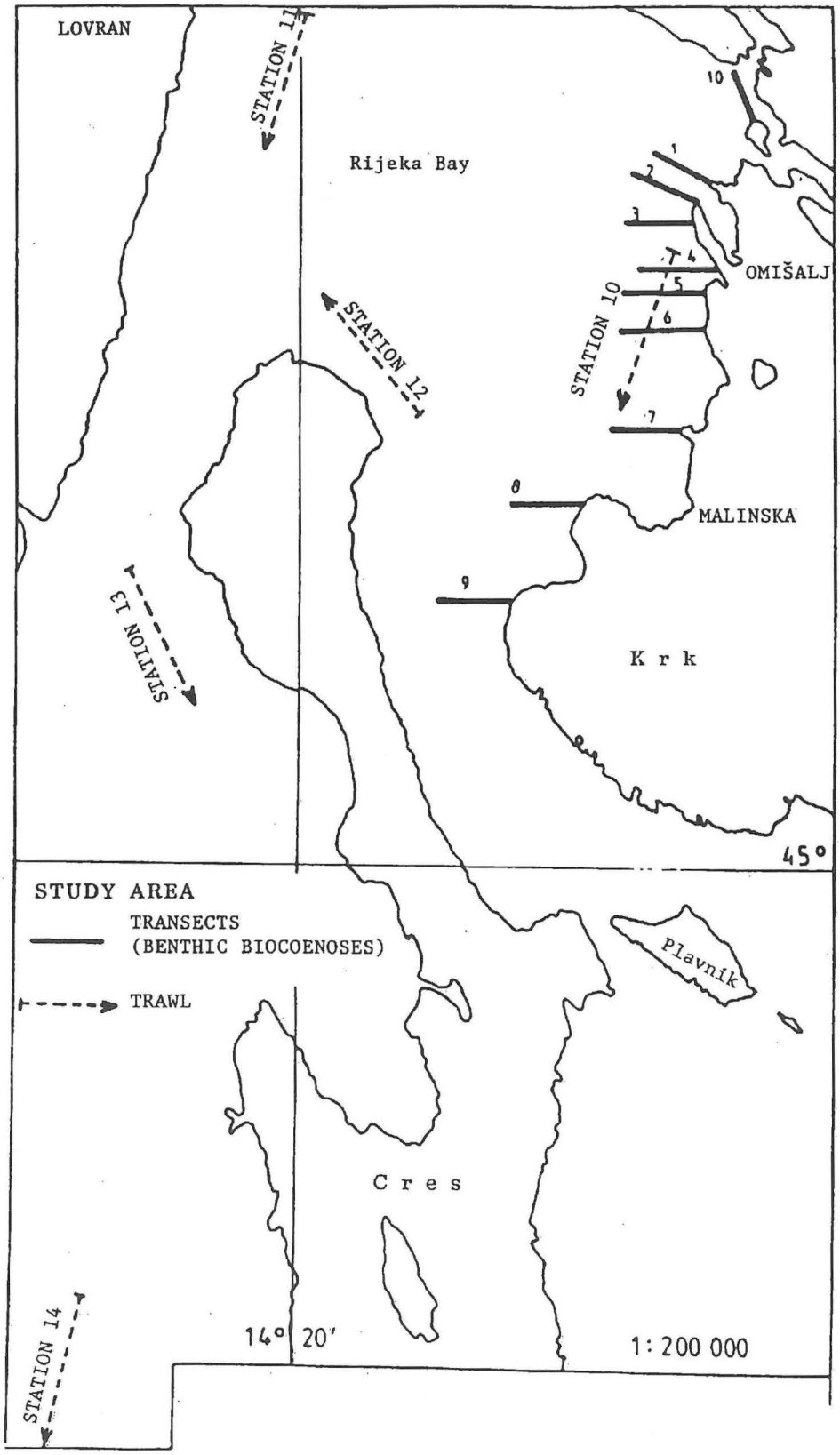


Fig. 7. The area of Krk and Cres islands

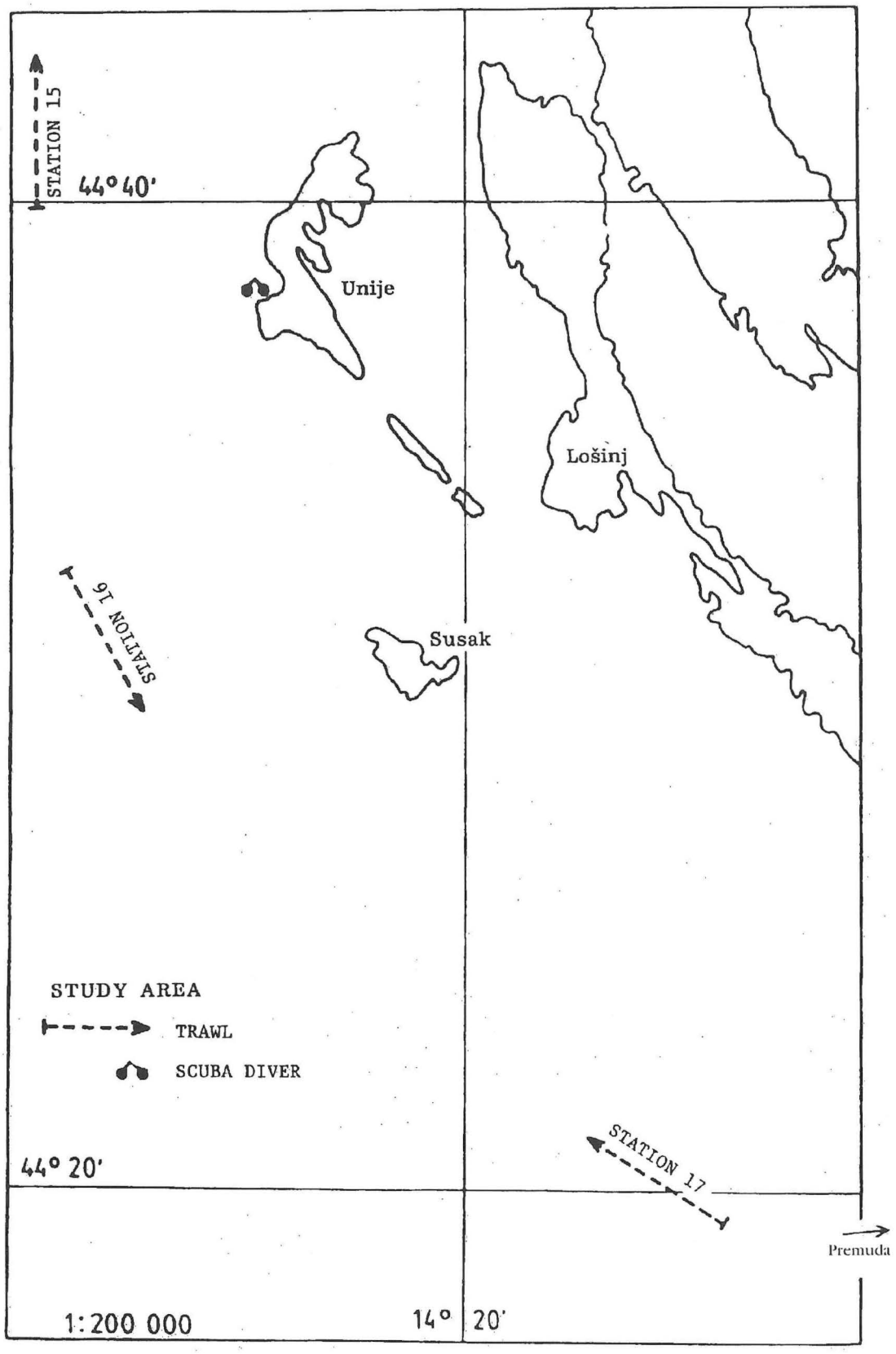


Fig. 8. Trawling stations, Unije, Susak and Premuda islands

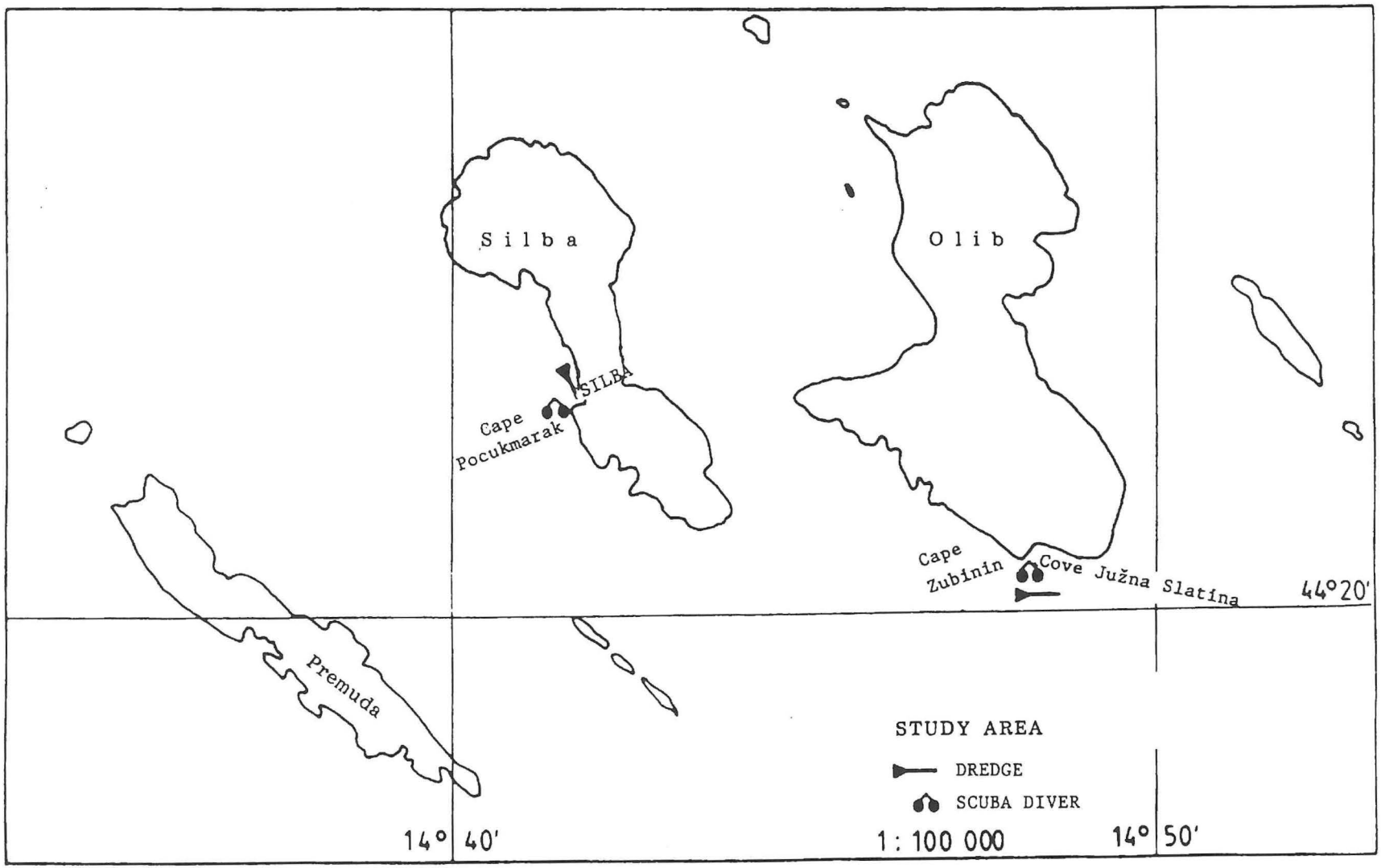


Fig. 9. The area of Silba and Olib islands

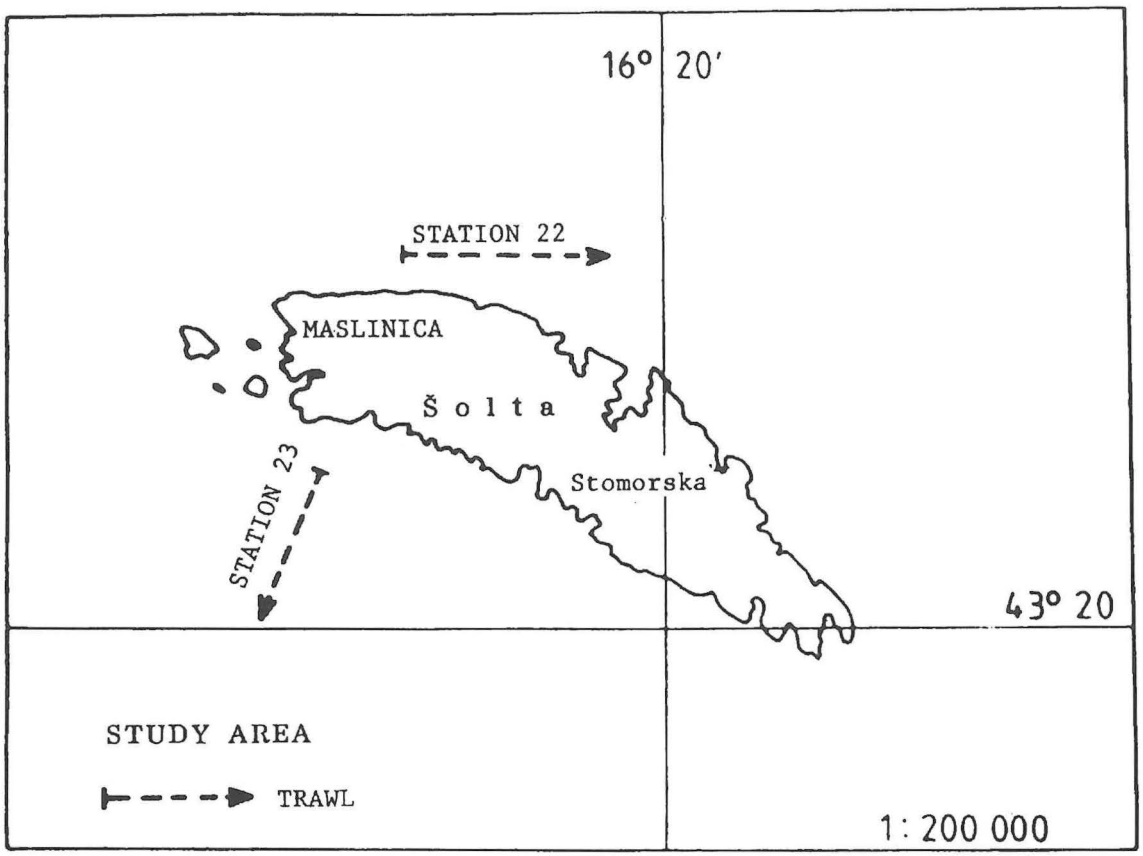


Fig. 10. The area of Šolta island

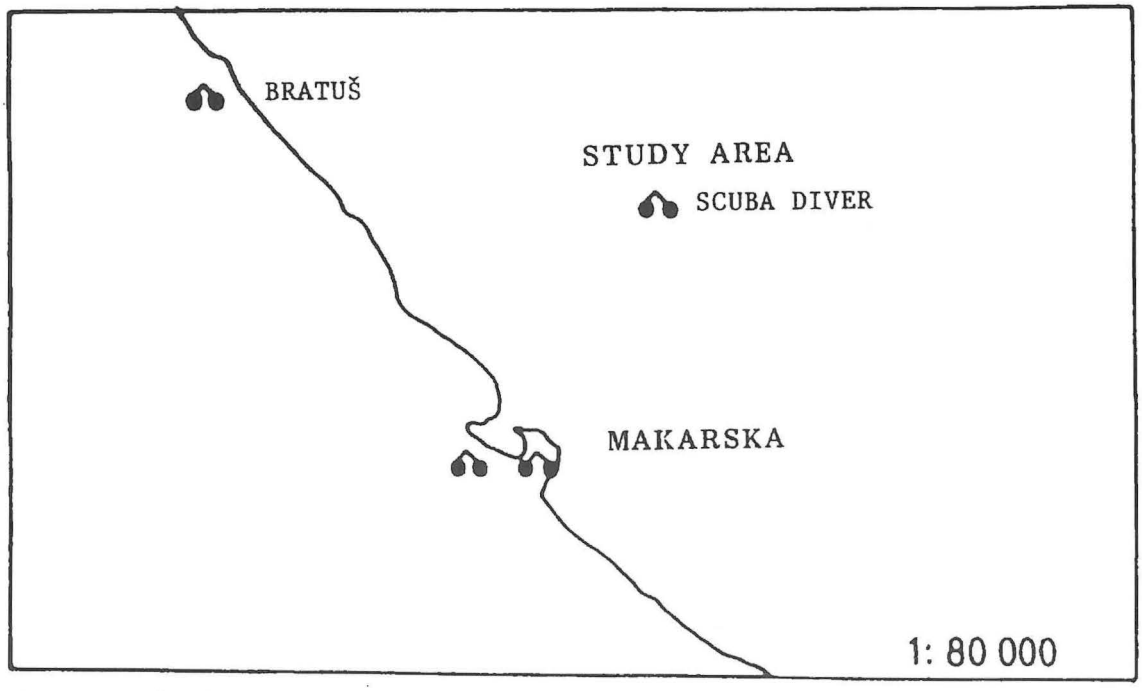


Fig. 11. Makarska area

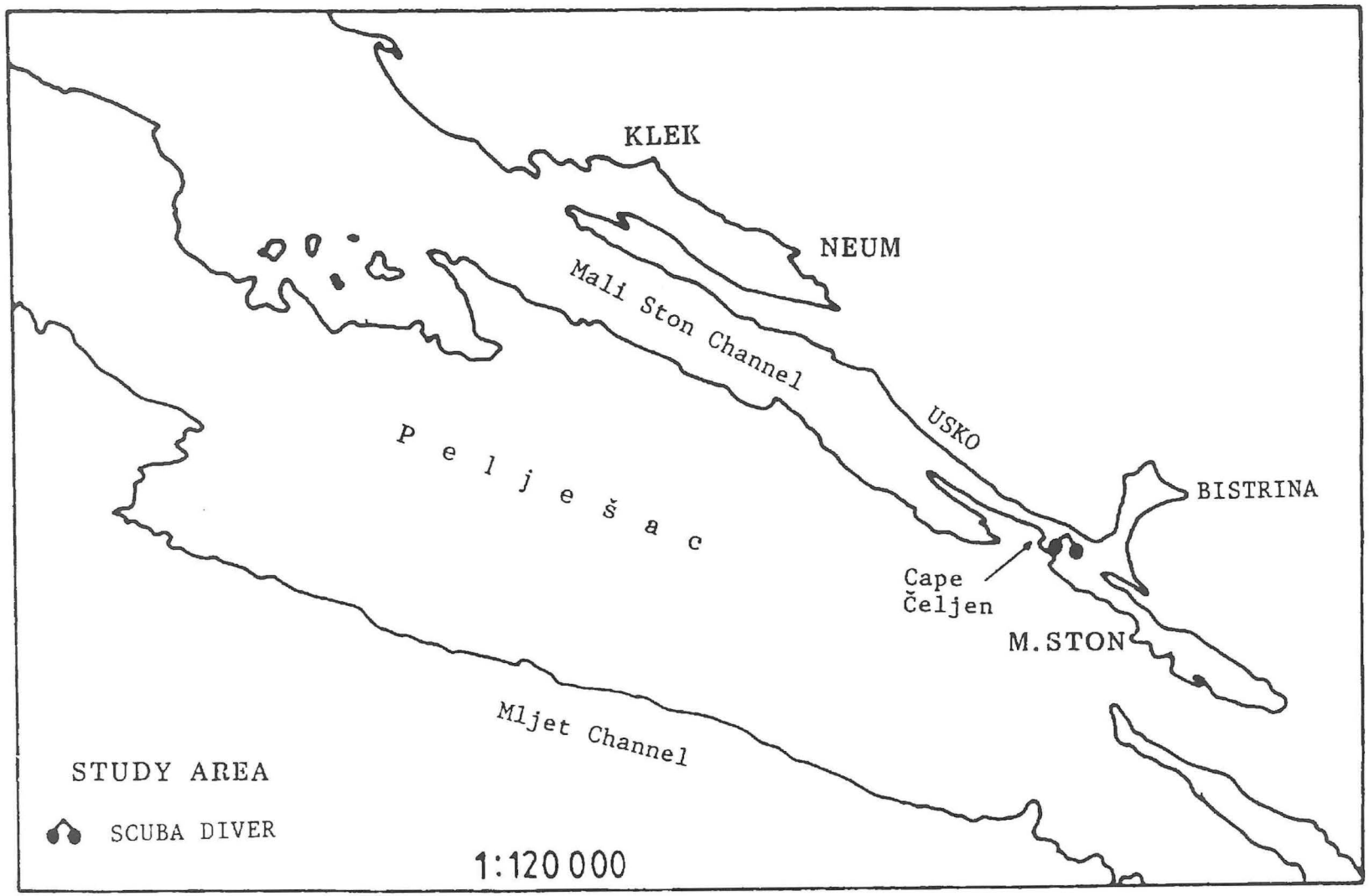


Fig. 12. Pelješac area

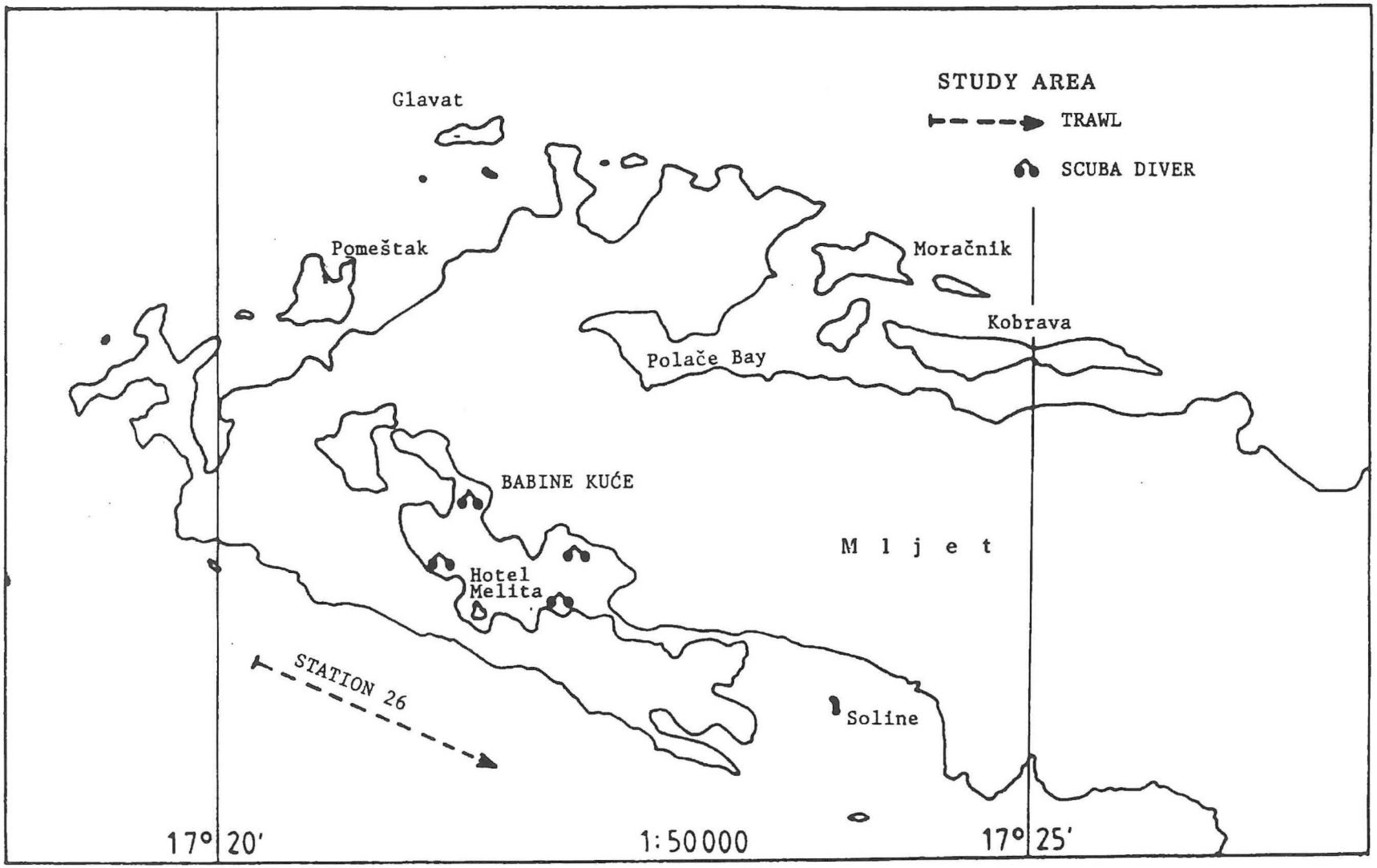


Fig. 13. The area of Mljet island

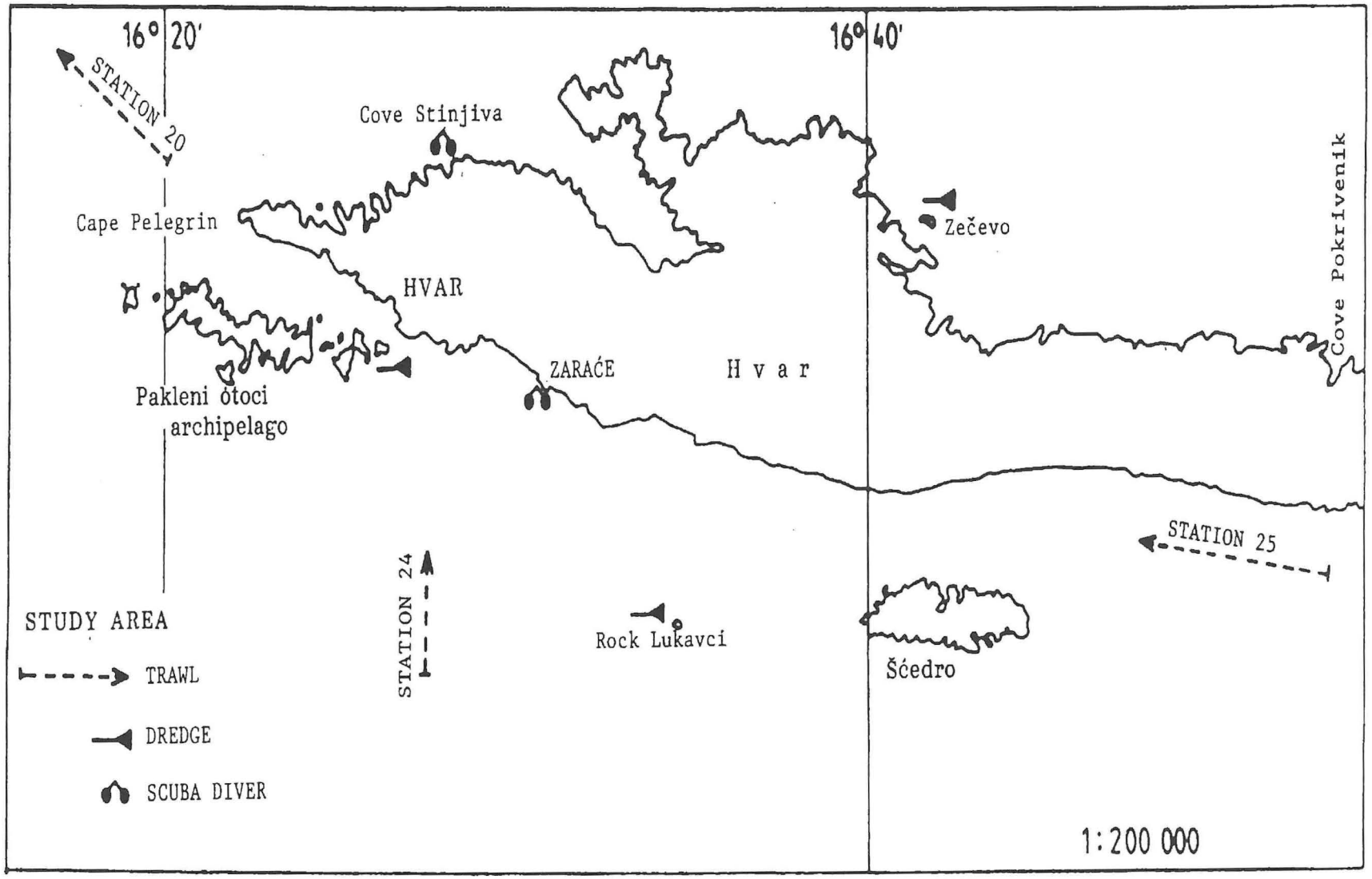


Fig. 14. Hvar Island area

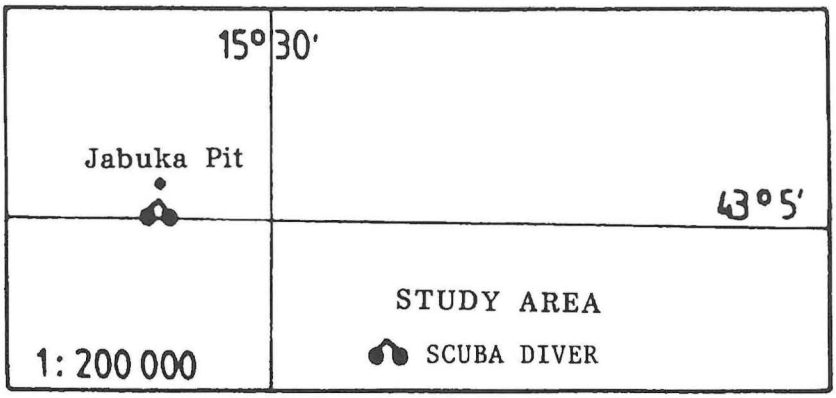


Fig. 15. Jabuka Pit area

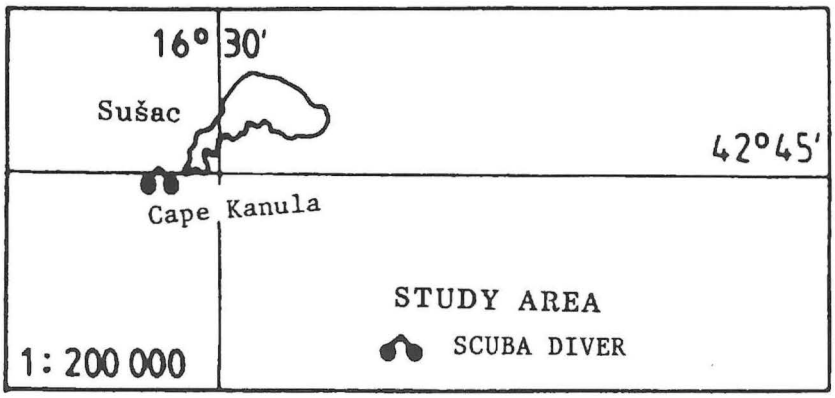


Fig. 16. Sušac Island area

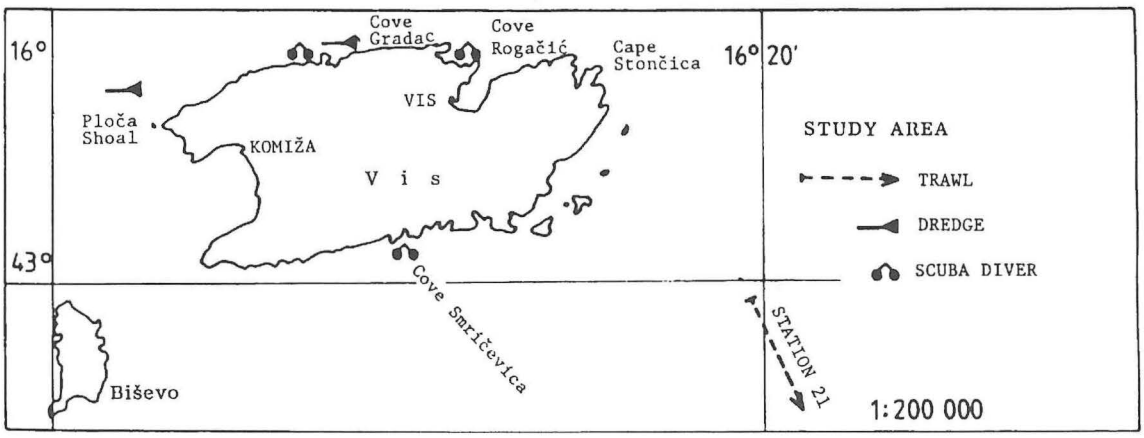


Fig. 17. Vis Island area

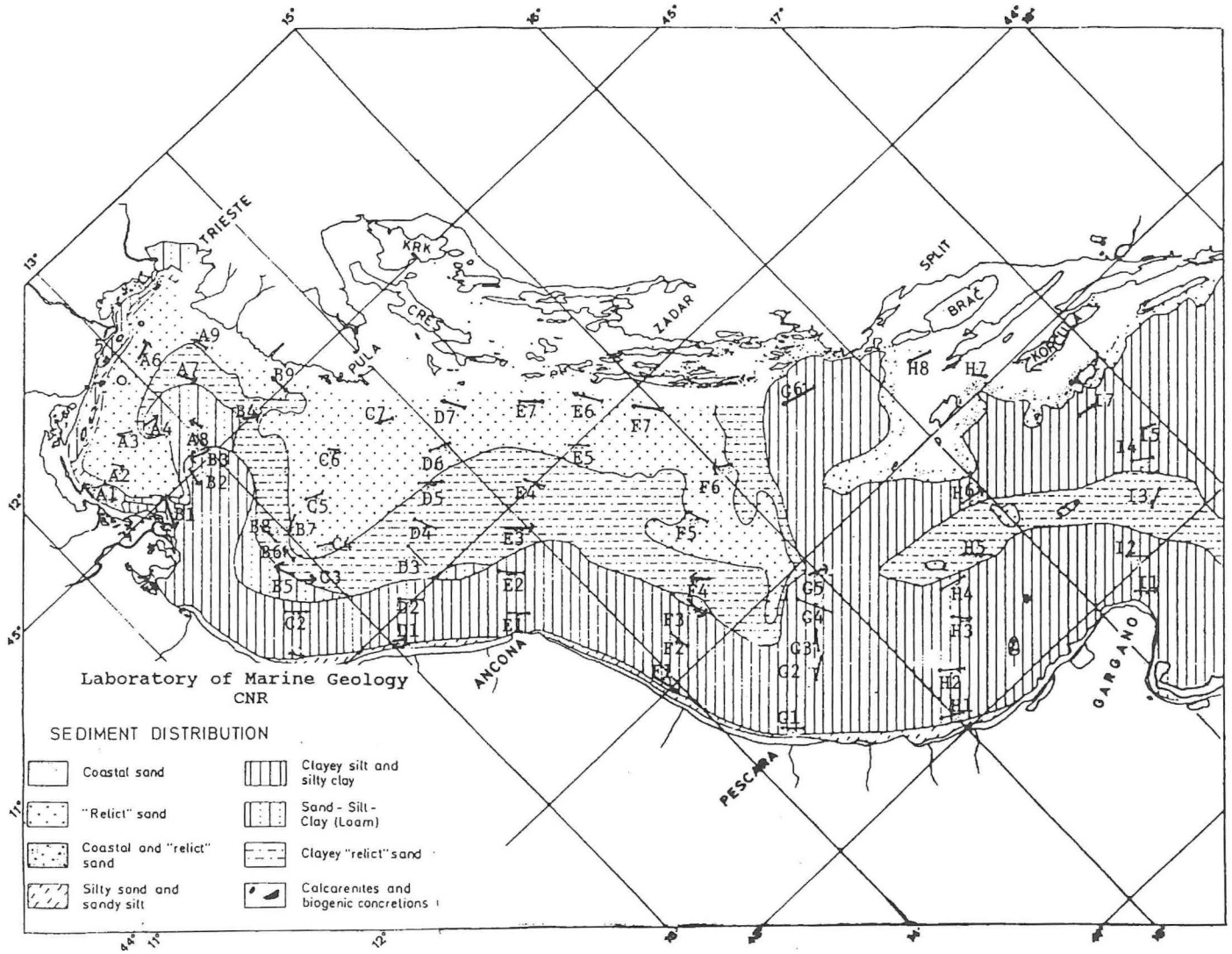


Fig. 18. Stations of "PIPETA" Expedition 1982/83

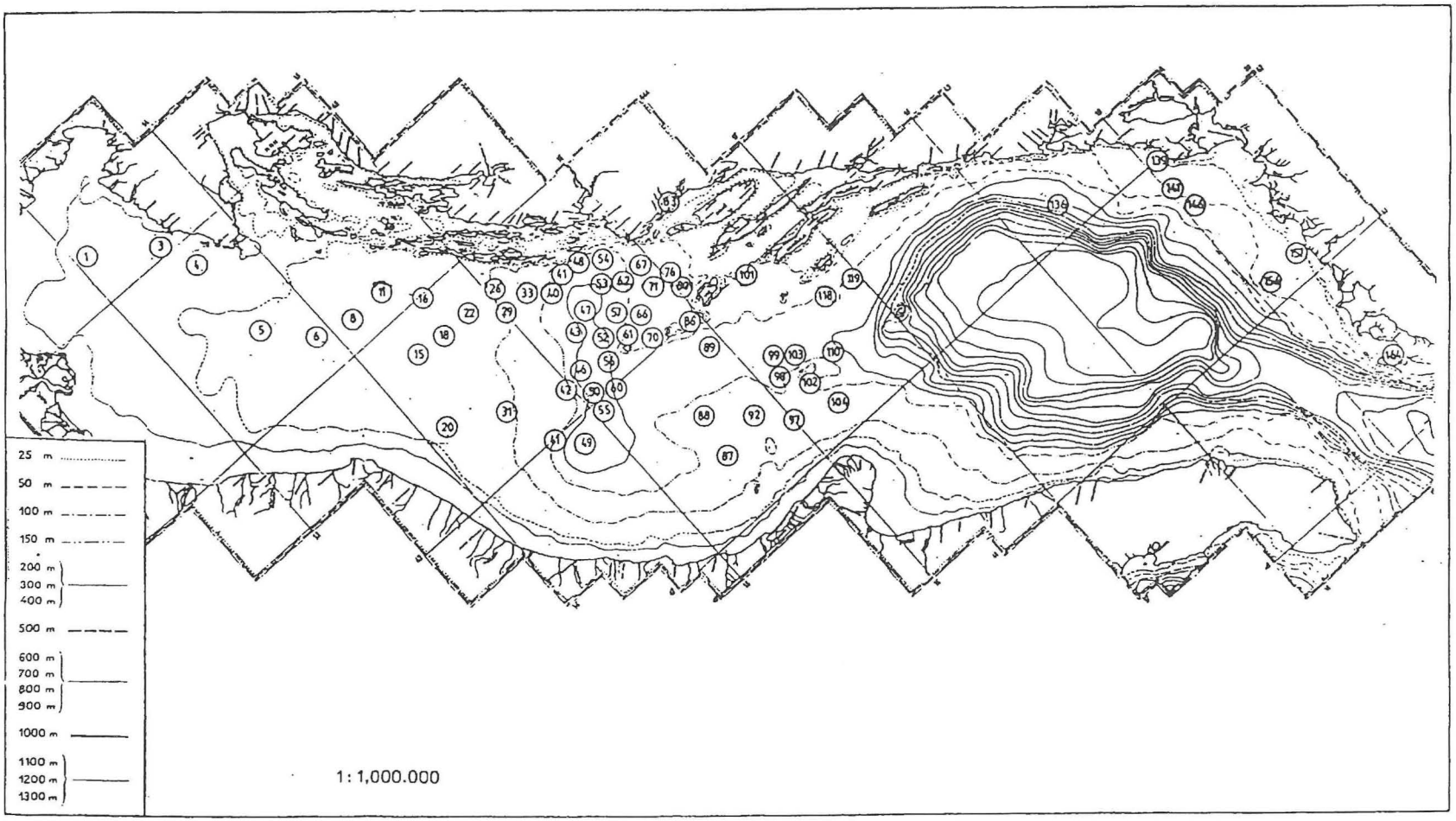


Fig. 19. "HVAR" Expedition, 1948/49, stations wherefrom the material contained live specimens of Gastropoda group