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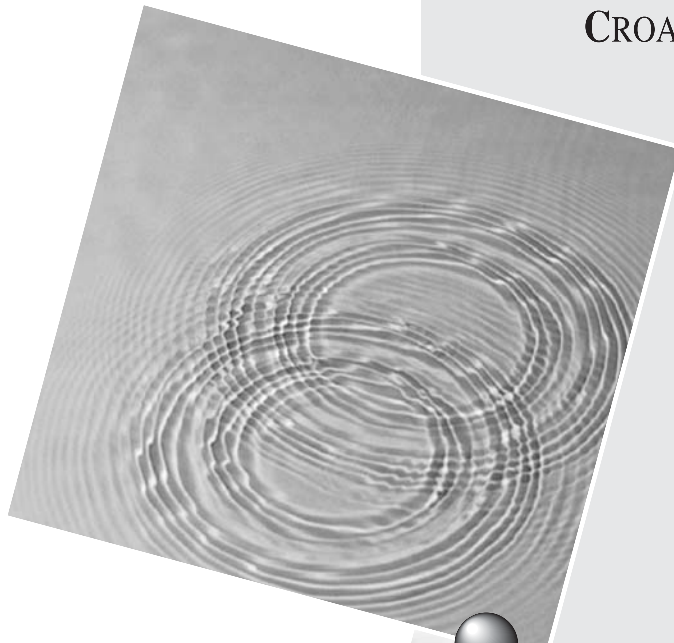

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A benthos survey of the Senj Archipelago (North Adriatic Sea, Croatia)

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The coastal seabed around the northern Adriatic islands of Prvić, Sv. Grgur, and Goli have remained little researched until recently. Therefore, we compiled here results of our studies on macroflora, fauna, and bottom communities. The benthos was surveyed by scuba diving at 26 sites and a fish census taken at 14 of them. Bottom trammel nets were used at 15 sites to document the structure and status of fish populations. Deep deposits were sampled by bottom grabs at 27 sites.

Fifty-six species of macroalgae, two marine phanerogams, 218 invertebrates, and 96 fish species were recorded. The most significant hard bottom communities were the biocoenosis of infralittoral seaweeds and the coralligenous biocoenosis. Deep deposits were characterized by elements of the biocoenoses of coastal terrigenous ooze and bathyal silts. Due to hydrodynamic conditions, there was a spatial mixture of populations peculiar to various communities. Scuba diving is a very suitable method for rapid identification and evaluation of infralittoral benthos. However, fish assemblages can be satisfactorily estimated only by compiling diving records and analyzing fishing gear catches.

Although results of our research reflect the study methods, it is evident that the benthic communities and fish assemblages in this area are very diverse and well preserved. Therefore, we again propose protecting the Senj Archipelago coastal seabed within the category of a special marine reserve, i.e. marine park.

Key words: benthos, ecology, fauna, flora, Adriatic Sea

INTRODUCTION

There are three small islands named Prvić, Sv. Grgur, and Goli, and a dozen nearby islets, reefs, and rocks between the large Krk and Rab Islands in the Kvarner region of the northeastern Adriatic Sea (44°49'-44°56'N, 14°46'-14°51'E). This group of islands is named Senj Archipelago after a small nearby town on the shore of the mainland at the base of the Velebit mountain ridge. The largest island is Prvić, about 14.3 km^2. Although these islands are small, they were mapped but usually unnamed in the northern Adriatic charts by VAVASSORI, GASTALDI, BARTELLI, ORTELLIO, SGROOTEN, De JODE & BARENTSZ as long as 300 years ago (LAGO & ROSSIT, 1981). Because of their importance in navigation and maritime traffic, these islands have always been depicted as larger than the nearby Krk and Rab Islands. By the end of the Middle Ages, the sheltered southwestern part of Prvić Island was inhabited (LOVRIĆ *et al.*, 1998). Presently, there are no residents on Prvić Island but it is a well-known summer pasture for sheep owned by Krk Island breeders. Prison buildings were erected after World War II on Sv. Grgur and Goli Islands. By the mid-1980s, both campuses were abandoned.

The land and marine vegetation of this area belong to a submediterranean biogeographic region rich in Atlantic-boreal elements (LOVRIĆ, 1975). The Senj Archipelago is one of the Adriatic's most exposed areas to the stormy northeastern bora (in Croatian: bura) wind that blows about 200 days per year in this area (LOVRIĆ, 1971a). Bora gusts can reach 47.5 m/s (MAKJANIĆ, 1956). The other side of the archipelago is exposed to waves generated by the scirocco (in Croatian: jugo) wind. The continuous interaction of meteorological and hydrological agents in such a small area is reflected in a unique distribution of land and marine organisms and communities (LOVRIĆ, 1971b,c, 1979, 1985, 1997; LOVRIĆ *et al.*, 1998).

Environmental and biological conditions in the Senj environs began to attract scientists 150 years ago. The history of research in the archipelago area was reviewed by LOVRIĆ *et al.* (1998) and NOVOSEL *et al.* (2002). The first scientific research in the area was carried out by LORENZ, a teacher at the Rijeka grammar school (TVRTKOVIĆ, 1996) whose famous book on hydrographical conditions, organisms, and benthic communities in the Kvarner region appeared in 1863. LORENZ dredged at four stations in Baška Bay on Krk Island, facing Prvić Island. The precise location of his environmental and biological data was not published although the sea bottom type, depth, and surface currents in the wide area of interest were roughly indicated in Lorenz's chart.

More than fifty years later, the nearby areas of Kvarnerić and Velebit Channel were surveyed by the German RV Rudolf Virchow (ZAVODNIK, 1990), the Austrian HMS Najade borrowed by Hungarians (LEIDENFROST, 1914; STILLER-RÜDIGER & ZAVODNIK, 1990), and the Croatian vessels Margita (HOIĆ, 1896) and Vila Velebita (CAR & HADŽI, 1914; BULJAN & ZORE-ARMANDA, 1968; MOROVIĆ, 1968). Sixty years later, jubilee Vila Velebita seasonal cruises were repeated (ZAVODNIK, 1979a). Regrettably, during all these cruises, none of the stations for sampling benthos was located in the Senj Archipelago. Similarly, it was not visited by bottom trawl surveys or coastal fisheries research projects that operated in this part of the northern Adriatic (KOTTHAUS & ZEI, 1938; ZEI, 1949; ALFIREVIĆ *et al.*, 1969; CRNKOVIĆ, 1970; JARDAS, 1986; CETINIĆ & PALLAORO, 1993; JARDAS *et al.*, 1998).

Until the middle of the last century, there were no diving reports in the Senj Archipelago. ZALOKAR (1942) researched the nearby mainland coast between Senj and Lukovo Šugarje. A diving expedition was undertaken by KUŠČER in 1949 (KUŠČER, 1963a) in the northern part of Velebit Channel, along the eastern coast of Krk Island, and in Vela Luka cove near Baška. Apparently, the first scientific underwater photographic surveys in the Prvić area were undertaken by Ljubljana University students in 1957 (ŠTOVIČEK-ŠTIRN, 1991) and by SVOBODA a few years later (RIEDL, 1966; MONNIOT & MONNIOT, 1970; SVOBODA, 1979; ŠTIRN, pers. comm.). VELKOVRH (1975) studied molluscan thanatocoenoses in deposits sampled by diving in the strait between Sv. Grgur and Rab Islands in the end of 1960s.

From 1970 to 1989, the Senj Archipelago was a restricted area in which commercial navigation, fishing, and scientific research were not allowed. However, by 1964, LOVRIĆ had undertaken extensive algological and zoological research by skin diving around all the islands and islets of the archipelago and along the adjacent Krk and Rab Islands (LOVRIĆ & LOVRIĆ, 1983). During two decades of research, about 430 sites were visited. Most of LOVRIĆ's results became accessible to the scientific community only in a very condensed form (LOVRIĆ, 1976b; LOVRIĆ & VOLARIĆ, 1976; LOVRIĆ *et al.*, 1989) that does not allow comparative study at any station. Simultaneous studies of onomastics of marine habitats and vernacular names of land and marine flora and fauna were carried out by LOVRIĆ (1997), HORVAT-MILEKOVIĆ & LOVRIĆ (1998) and LOVRIĆ *et al.* (2002).

Mrs. M. LEGAC made samplings by skin diving at 16 stations around Sv. Grgur Island (LEGAC, pers. comm.) in 1973 and 1980, but only results on bivalve mollusks were published (LEGAC & HRS-BRENKO, 1982; HRS-BRENKO & LEGAC, 1996). During this period, I. LEGAC produced photographs of benthic communities in deep areas around Sv. Grgur Island (LEGAC & LEGAC, 1986; ZAVODNIK & ŠIMUNOVIĆ, 1997; M. LEGAC, pers. comm.). Fouling assemblages on antique amphoras from this area were analyzed (LEGAC & LEGAC, 1989).

As part of its Norwegian lobster (*Nephrops norvegicus*) project in 1968-1972, the Institute of Oceanography and Fisheries, Split, undertook an extensive survey of the sea bottom and benthos in the entire Kvarner region of the Adriatic Sea, i.e., from the Istrian Peninsula and Rijeka Bay in the north, to the Zadar area and islands in the south (ALFIREVIĆ, 1968; GAMULIN-BRIDA *et al.*, 1971; BELLAN, 1976). The RV Bios made 15 grab stations in the Senj Archipelago but only four samples were processed on board for biological study. Results on some taxonomic groups of sediment-living macrofauna were published (ZAVODNIK & MURINA, 1975; BELLAN, 1976; ZAVODNIK, 1980, 1994; LEGAC & HRS-BRENKO, 1982; MURINA & ZAVODNIK, 1985/86; ŠTEVČIĆ, 1998). All sedimentological data, earlier (ALFIREVIĆ, 1968, 1980) and recent, were compiled by JURAČIĆ *et al.* (1999) and BENAC *et al.* (2000). BAKRAN-PETRICIOLI *et al.* (2005) presented a spatial distribution of infralittoral and circalittoral habitats around Goli Island and a part of Sv. Grgur Island, yielded by modeling.

Special interest was paid by scuba divers to Prvić Island, its cliffs, and submarine cave fauna. In 1971, ZIBROWIUS collected scleractinians and brachiopods in the Stražica Cape cave area (ZIBROWIUS & GRIESHABER, 1977; LOGAN, 1979; ZIBROWIUS, 1980). SILÉN & HARMELIN (1976) described a new cave dwelling bryozoan (*Haplopoma sciaphilum*). FESSER (1980) studied the cave goby (*Speleogobius trigloides*) at Prvić Island. CHRISTIAN (1989) reported on intertidal Collembola collected at the same site and recorded species new to the Adriatic Sea. KOVAČIĆ (1997, 1998) reported on benthic fish from the area. In 1997-2002, NOVOSEL *et al.* (2002) studied the benthos of Prvić Island at the Stražica, Samonjin, and Šilo Capes. *Cladocora caespitosa* bioherms were studied by KRUŽIĆ (2001). Scleractinians in the archipelago area that are rarely noted in the Adriatic were discussed by KRUŽIĆ *et al.* (2002). DELL'ANGELO & ZAVODNIK (2004) recorded polyplacophoran mollusks.

Because of the biological interest indicated by previous studies, the Senj Archipelago has been the subject of protection and coastal management proposals. In 1972, Prvić Island, its coastal sea, and the Sv. Grgur Channel were proclaimed a botanical and zoological reserve by the Krk Community Assembly (HRILJAC, 1972). LOVRIĆ (1976b) and LEGAC & LEGAC (1986) proposed protecting the sea environment. Recent suggestions on the protection and coastal management of the Senj Archipelago have been compiled by POŽAR-DOMAC & BAKRAN-PETRICIOLI (1996), POŽAR-DOMAC *et al.* (2000a), and RANDIĆ (2003).

The present research was undertaken to assess the biodiversity of the benthos to enable evaluation by the state and eventual monitoring by scuba divers after the area is protected by law. Because of the slow and unclear dynamics of benthic communities, especially in infralittoral and circalittoral areas, it was decided that one survey at each station in late spring or summer would be sufficient. Consequently, analysis included visual census by divers of common well-known macroflora and macrofauna. Time consuming and difficult to identify taxa, such as many sponges, turbellarians, hydrozoans, small mollusks, polychaetes, crustaceans, bryozoans, tiny algae, microflora, and micro and meiofauna, were not surveyed.

MATERIALS AND METHODS

Research sites were chosen according to exposure to wave action and geomorphological features (Figs. 1, 2). Benthos collection stations were arbitrarily coded GR to differentiate them from research sites in other Adriatic Sea areas (Table 1). Station GR-3 was identical to LEGAC's station 3 (LEGAC & HRS-BRENKO, 1982). Since LEGAC worked at 16 stations at Grgur Island, we continued her numbering by starting with GR-17. Bottom trammel net stations were coded by the acronym T (Table 2). Bottom grab stations were not coded.

The principal working methods were visual recording and hand collection by skin and scuba divers along line intercept transects (BIANCHI *et al.*, 2004) perpendicular to the shore line, from sea level to a depth of 40-50 m. Whenever possible, species abundance was visually estimated within a range from rare (r) to dominant (d). Analysis of supralittoral and mediolittoral communities was

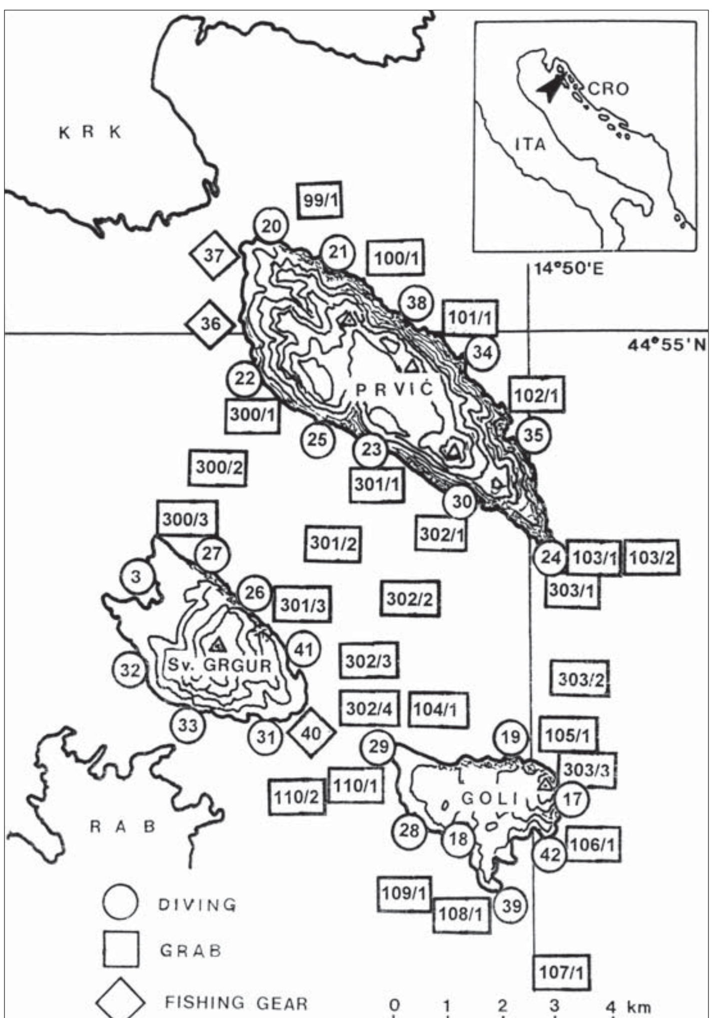

Fig. 1. Research area and sampling stations

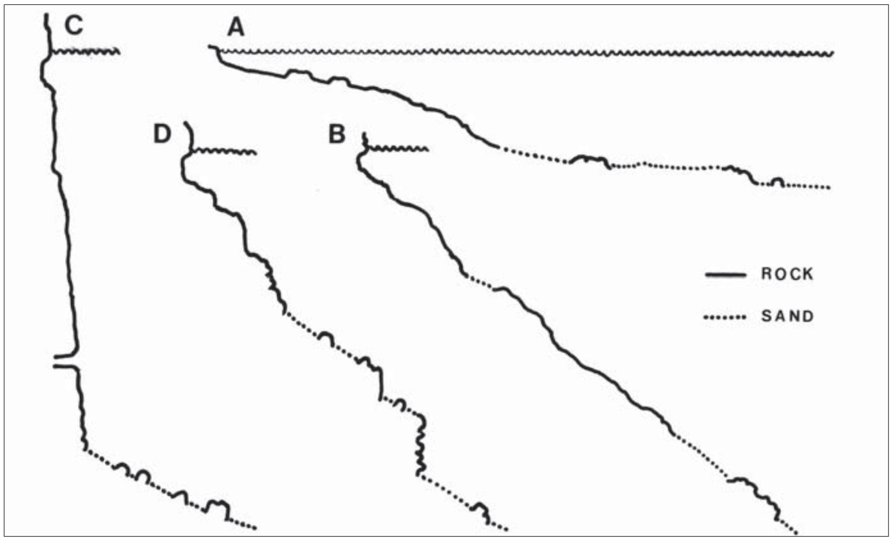

Fig. 2. Slope types in the Senj archipelago: A = gentle inclined slope (example, station GR-33); B = steep slope (GR-26); C = vertical cliff (GR-17); D = slope+walls (GR-27)

Table 1. Description of benthos research stations (GR). Alg = photophilous algae; Cav = semi-dark cave; Cor = coralligenous; Cym = Cymodocea meadow; Det = coastal detrital; Pos = Posidonia bed

Station (GR)	Island	Locality	Slope type *	Bottom type	Method	Depth (m)	Dominant communities
03	Grgur	Port	gentle incline	rock, sand	Scuba	0-5	Alg, Pos
17	Goli	Markonj cape	vertical cliff, wall	rock, sand	Scuba	0-46	Alg, Cor
18	Goli	Vela Draga cove	gentle incline	gravel, rock, sand, silt, mud	Scuba	0-31	Alg, Cor, Det
19	Goli	E Macinj rock	slope + walls	rock, sand	Scuba	0-49	Alg, Cor
20	Prvić	Stražica cape	slope + walls	rock, sand	Scuba	0-47	Alg, Cav, Cor, Pos
21	Prvić	Kita cove	slope + walls	rock, sand	Scuba	0-50	Alg, Cor
22	Prvić	Samotvorac cape	steep	rock, sand	Scuba	1-45	Alg, Cor, Det
23	Prvić	Fazanas cape	slope + walls	gravel, rock, sand	Scuba	0-36	Alg, Cor
24	Prvić	Šilo cape	slope + walls	rock, sand	Scuba	0-42	Alg, Cor
25	Prvić	Njivica cove	gentle incline	rock, sand	Scuba	0-40	Alg, Cor, Det
26	Grgur	Strančarac	steep	rock, sand	Scuba	0-55	Alg, Cor
27	Grgur	Pod siku	slope + walls	mud, rock, sand	Scuba	0-47	Alg, Cor
28	Goli	Tatinja cove (port)	gentle incline	rock, sand	Scuba	0-6	Alg
29	Goli	Sajalo cape	slope + walls	rock, sand	Scuba	0-32	Alg, Cor
30	Prvić	Opadna cove	steep	mud, silt, rock	Scuba	0-40	Alg, Cor, Det
31	Grgur	Tesne dražice	slope + walls	rock, sand	Scuba	0-40	Alg, Cor, Det
32	Grgur	Ilo cove	steep	mud, silt, rock, sand	Scuba	0-50	Alg, Cor, Cym, Det
33	Grgur	Veli Samotorac cove	gentle incline	rock, sand	Scuba	0-17	Alg, Cor
34	Prvić	Samonjin cape	slope + walls	rock, sand	Scuba	0-34	Alg, Cor
35	Prvić	Pećna cove	steep	rock, sand	Scuba	0-30	Alg, Cor, Det
36	Prvić	Dubac cove		rock, sand	bottom trammel nets	5-30	Alg, Pos

Table 1. Cont'd

37	Prvić	Stražica cape		mud, sand	bottom trammel nets	5-20	Alg, Pos
38	Prvić	Straža	slope + walls	mud, rock, sand	Scuba	0-48	Alg, Cor
39	Goli	Veli galebov islet	steep	rock, sand	Scuba, bottom trammel nets	0-51	Alg, Cor, Pos
40	Grgur	Smokova cape		mud, rock, sand	bottom trammel nets	5-30	Alg, Pos
41	Grgur	Zadbadnja cove	slope + walls	rock, sand	Scuba	0-29	Alg, Cor
42	Goli	Senjska Vela cape	slope + walls	mud, rock, sand	Scuba	0-53	Alg, Cor, Det

* See Fig. 2 for illustrations.

Table 2. Bottom trammel set stations (T)

Station						
Trammel (T)	Same as GR	Island	Locality	No. nets used	Mesh (mm)	Depth (m)
1	37	Prvić	Stražica cape	10	28	5-20
2	36	Prvić	Dubac cove	10	28	5-30
3	22	Prvić	Samotvorac cape	15	32	5-20
4	-	Prvić	W Njivica rock	13	32	3-15
5	25	Prvić	Njivica rock	15	32	4-20
6	23	Prvić	Fazanas cape	10	28	3-18
7	30	Prvić	Opadna cove	10	28	5-25
8	24	Prvić	Šilo cape	10	28	8-39
9	-	Grgur	Plitvac cape	10	28	5-20
10	32	Grgur	SE Plitvac cape	10	28	3-25
11	40	Goli	Smokova cape	10	28	5-30
12	29	Goli	Sajalo cape	10	28	3-15
13	28	Goli	Tatinja cape	10	28	5-35
14	-	Goli	Mali Goli rock	10	28	10-28
15	-	Goli	Senjska cove	10	28	7-35

based on standard phytocoenological methods (PÉRÈS, 1961; BRAUN-BLANQUET, 1964; PÉRÈS & PICARD, 1964; BOUDOURESQUE, 1971). Deposit granulometry was established according to FOLK (1954).

Easily recognized fishes were recorded by divers. An ichthyological visual census was performed along transects GR-3, 17-21, 23, 25-27, 29-32. Fish specimens were recorded at a distance of 5 m, left and right of the transect line.

Fish were sampled by bottom trammel nets at 15 sites (Fig. 3). The nets were 32 m long, 1.6-1.8 m high, had external netting panels (Croatian: "popon") of 112-116 mm mesh, and internal netting panels ("maha") of 28 and 32 mm mesh (NÉDÉLEC, 1975). The average operating net surface was 54 m^2. Experimental fishing was carried out with nets tied together, frequently 10 (in 80% of cases), but also 13 and 15. Nets were usually set on the bottom at a depth of 5-25 m, occasionally deeper, on various types of sea bottom, i.e., rocky, sandy, muddy, barren, overgrown by algae and eelgrass *Posidonia oceanica*, etc. Nets were set in the evening and hauled up the following morning, meaning that fishing was carried out exclusively at night.

A modified classification of fish species spatial organization (HARMELIN, 1990) was applied where category 1 indicates benthopelagic species, categories 2-5 hyperbenthic species, and category 6 epibenthic species including pelagic and cryptobenthic species, as per PATZNER

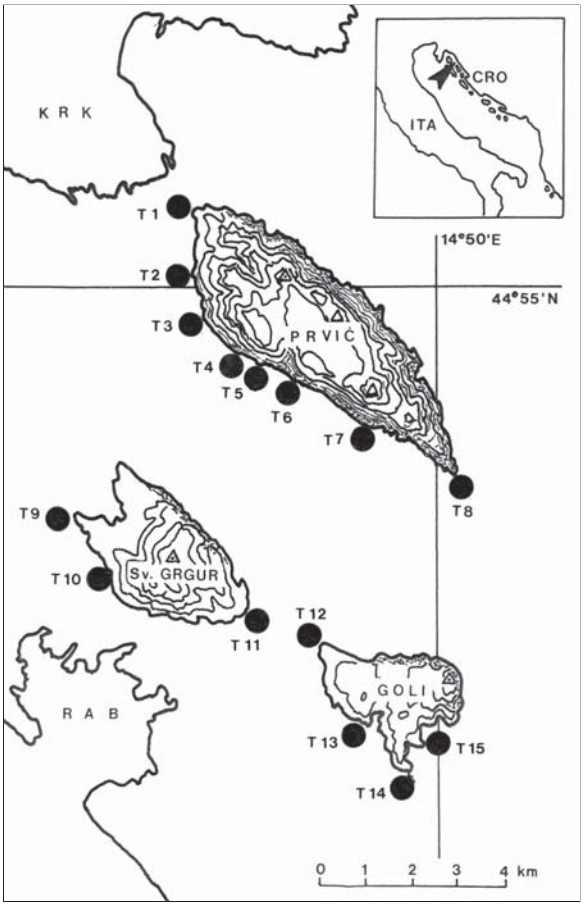

Fig. 3. Research area and surveyed bottom trammel set stations.

(1999). Trophic categories of fish species were determined according to BELL & HARMELIN-VIVIEN (1983) and FRANCOUR (1997) and data on trophic categories of blennies were taken from GOLDSCHMIDT *et al.* (1984).

Sampling of benthos of deep deposits was performed by Petersen 0.2 m^2 and Van Veen 0.1 m^2 bottom grabs (Table 3). Van Veen samplings were replicated 2-3 times. The sediment was processed through a 2 mm mesh sieve. Specimens were preserved in 70% alcohol or a 4% buffered formol solution. Some specimens were lost.

Easily recognized taxa were identified in the field. Further processing and final taxonomic studies were performed in the Laboratory for Ecology and Systematics of the Center for Marine Research at the 'Ruđer Bošković' Institute in Rovinj (CMRR), in the Natural History Museum of Rijeka (NHMR), and in the Ecological Laboratory of the Institute for Oceanography and Fisheries in Split (IOF), Croatia. Selected specimens were deposited in the reference collections of these establishments. Taxonomic nomenclature was based on ERMS (COSTELLO *et al.*, 2001), www.algaebase.org, and

Table 3. Taxa collected at bottom grab stations. D = detrital deposits; G = gravel; M = mud; S = sand; PT = Petersen grab 0.2 m^2; VV = Van Veen grab 0.1 m^2

Station	99/1	103/1	109/1	110/2	300/1	300/2	300/3	301/1	301/2	301/3	302/1	302/2	302/3	302/4	303/1	303/2	303/3
Depth (m)	72	78	70	65	75	100	80	65	86	73	75	82	78	78	85	88	86
Deposit	M	SM	M	M	SM	M	SM	DM	M	GM	M	M	M	GM	DMS	M	DMS
Gear	PT	PT	PT	PT	VV	VV	VV	VV	VV	VV	VV	VV	VV	VV	VV	VV	VV
Surface (m2)	0,2	0,2	0,2	0,2	0,3	0,3	0,3	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
Volume (l)	25	30	30	30	55	90	80	52	48	53	50	51	51	53	30	60	42
Nemertina indet.	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Turritella communis Risso, 1826	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Aspidosiphon muelleri Diesing, 1851	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
Golfingia elongata (Keferstein, 1826)	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-
Onchnesoma steenstrupi Kor.&Dan., 1875	-	-	-	-	-	-	-	-	1	-	-	2	-	-	-	-	-
Phascolion strombus (Montagu, 1804)	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-

Table 3. Cont'd

Glycera rouxii Aud. & M.Edw., 1833	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Marphysa kinbergi McInthosh, 1910	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Nephthys incisa Malmgren, 1865	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Scoletoma impatiens (Claparède, 1868)	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sternaspis scutata (Ranzani, 1817)	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Polychaeta indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Alpheus glaber (Olivi, 1792)	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	1
Callianassa subterranea (Montagu, 1808)	-	-	-	-	2	-	-	10	11	9	8	11	-	11	-	6	1
Callianassa sp.juv.	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
Calocaris macandreae Bell, 1846	-	-	-	-	1	-	-	1	3	-	1	-	1	-	-	-	2
Jaxea nocturna Nardo, 1847	-	-	-	-	1	1	-	1	1	1	-	-	-	1	-	-	-
Processa nouveli Al-Adhub&Will., 1975	-	-	-	-	-	-	-	1	-	-	-	-	-	-	2	-	-
Mysidacea indet.	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Amphipoda indet.	-	-	-	-	-	-	1	-	-	1	1	-	-	-	-	1	-
Gnathia sp.	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-
Isopoda indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Amphiura filiformis (O.F.Müller, 1776)	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brissopsis lyrifera (Forbes, 1841)	-	-	-	1	-	-	-	1	-	-	-	-	2	1	1	2	-

www.fishbase.org. Benthic communities were identified according to PÉRÈS & PICARD (1964), PÉRÈS (1967), and BELLAN-SANTINI *et al.* (1994).

In addition to data collected during the present study, this paper includes unpublished data on Petersen grab collections from 1968 (ZAVODNIK, unpubl.) and from coastal surveys conducted in 1971-1995 (M. LEGAC, pers. comm.), principal field research from the 1995-1997 cruises of the RV Vila Velebita, and ichthyological research performed in 1997 within the framework of the RV Hidra.

RESULTS

Ecological analysis of surveyed locations

Transect GR-3. The transect is located in the port of Sv. Grgur Island. The site is sheltered from destructive waves. At the time of this research, June 1995, the sea water was turbid because of a local phytoplankton bloom. Patches of the pelagosite were found in the supralittoral zone. From a depth of about 1 m, the rocky shore continues as a gently inclined slope of round loose stones and boulders and, at about 4 m, coarse sand appears. Here and there, the bottom was covered by a thin film of silt. A small patch of *Posidonia oceanica* was recorded. The ichthyofauna was moderately diverse, 27 species were recorded (see Annex).

Transect GR-17 (Fig. 2C). The site is exposed to waves generated by the bora wind. A littoral *Lithophyllum tortuosum* belt was about 15-20 cm wide. Extremely dense populations of limestone boring shellfish *Lithophaga lithophaga* and *Gastrochaena dubia* occurred at depths up to 1 m. A precoralligenous community with abundant calcareous algae, *Parazoanthus axinellae*, and some *Axinella* and *Eunicella* species, was present on a vertical cliff. At 37 m, the wall was replaced by a moderately steep slope of coarse sand rich in organogenic debris.

Transect GR-18. A well-sheltered cove previously used for dumping construction materials. Large *Actinia equina* individuals occurred along the infralittoral fringe. Compact bedrock was completely covered by an algal carpet of *Corallina officinalis*, *Valonia utricularis*, species of the genus *Dictyota*, and a small *Halopteris* sp. in the upper infralittoral zone. Below 1.5 m, *Padina pavonica* and *Cladophora* sp. dominated giving support to myriads of small *Bittium reticulatum*. Boring clionid sponges and *Gastrochaena dubia* were abundant. Precoralligenous algae *Halimeda tuna, Amphiroa rigida*, and *Peyssonnelia* sp., and epiphytic *Parazoanthus axinellae* colonies also were recorded. Below 5 m, there were patches of coarse sand and pebbles and two small eelgrass meadows. At the lower part of a bedrock slope, about 10 m deep, large photophilic seaweeds such as *Cystoseira* and *Sargassum* were abundant; they covered about 80% of the substratum. At 13 m, a bedrock slope altered to a talus consisting of pebbles and coarse sand. Soon the slope incline increased and the deposit changed to a coarse sand with shells. Finally, it changed to sand mixed with ooze. Species common to the coastal detritical sand community, such as *Codium bursa, Astropecten aranciacus, Microcosmus savignyi, Phallusia mammilata,* and *Ascidia virginea*, were recorded. The most diverse fish families were Blenniidae and Gobiidae.

Transect GR-19. A high energy site characterized by extremely rugged littoral rocks and a great impact of fresh water during rainy periods. Limpets, *Patella rustica*, and beadlet anemones, *Actinia equina*, were outstanding in size. The trunk diameter reached over 5 cm in live *Actinia*! A *Phymatolithon lenormandii* belt dominated the tidal area. The dominant algae in the upper infralittoral zone were *Corallina* sp. and *Cystoseira compressa*. *Halimeda tuna* was dominant in shadowed habitats such as beneath overhangs and in large crevices. A carpet of photophilic algae extended to the wall edge at a depth of 17 m. The 20 m vertical wall was rich in hydrozoans, *Eunicella cavolinii*, some *Axinella* species, *Leptopsammia pruvoti*, and many other species characteristic of a typical coralligenous biocoenosis. Grottoes in the lower part of the wall, at 20-37 m, were inhabited by conger eels (*Conger conger*). Deeper, a moderately inclined slope of coarse detrital sand extended to the deepest explored point, 49 m, where the red alga, *Phyllophora nodosa*, and sponge, *Tethya aurantium*, were common.

Transect GR-20. This small ridge facing Stražica Cape is pierced by a tunnel-like underwater passage 28 m long with entrances at depths of 5.5, 9, and 15 m. The area is extremely exposed to bora winds. Due to inaccessibility, the upper limit of the supralittoral rock was not reached during the study. At low tide and along the infralittoral fringe, the endolithic *Cliona viridis* and *Gastrochaena dubia* were abundant. A bit deeper, the date shell (*Lithophaga lithophaga*) was the dominant boring species. At 6 m, two dense patches of *Posidonia oceanica* were recorded. At 5-17 m, the bedrock was completely covered by a *Cystoseira* association. The tunnel-like passage was mostly inhabited by organisms common to the biocoenosis of semi-dark caves. A coralligenous community was well developed on vertical walls. Large horny corals such as *Paramuricea clavata* and *Eunicella* *cavolinii*, hosting *Alcyonium coralloides*, and *Alcyonium acaule* were abundant. Below the base of the wall, at 46 m, there is a moderately inclined deposit slope of coarse sand rich in shell debris.

Transect GR-21. The geomorphologic and hydrographic conditions of this site are similar to those of GR-20. There was a discontinued belt about 10 cm wide of encrusting *Phymatolithon lenormandii* in the midlittoral zone. Small bioclumps of *Lithophyllum tortuosum* were scattered all around. *Actinia equina* was abundant. The infralittoral fringe was distinguished by a dense corallinacean belt below which the cliff was overgrown with turf of the *Peyssonnelia* and *Cladophora* species. *Lithophaga lithophaga* and *Gastrochaena dubia* were extremely abundant in the substrate. *Codium bursa* and *Codium adherens* prevailed on a steep shelf at 4-6 m. Deeper, the vegetation consisted of *Peyssonnelia* sp., *Halimeda tuna, Flabellia petiolata*, and, finally, *Mesophyllum expansum* assemblages. At 34 m, the vertical wall changed to a steep rocky slope occupied by a typical facies of the coralligenous biocoenosis. Only at 50 m, was the bedrock replaced by very coarse sand mixed with shells and loose stones which gave support to sponges of the genus *Axinella*, ascidians, and similar. Patches of secondary hard bottom formed in this area.

Transect GR-22 (Station T-3). Because of strong wind and unfavorable sea conditions, this transect was not surveyed in detail. A very steep rocky slope extending to a depth of about 20 m was poorly covered by sedentary organisms, in contrast to most of the other sites. Deeper, there was a moderately inclined slope of sandy detrital deposits. At about 45 m, the slope incline gradually diminished and the silty fraction increased. The abundance of red alga, *Osmundaria volubilis*, suggested the presence of a biocoenosis of detrital bottom mixed with ooze. However, scattered large rocks and boulders supported many species of the coralligenous biocoenosis, especially erect sponges and horny corals (see Annex).

Transect GR-23 (Station T-6). Littoral rocks were extremely rugged while the submerged bedrock was full of date shell borings and small caves and cracks. There were large patches of *Catenella caespitosa* in the lowest part of the supralittoral zone, beneath overhangs and in shadowed rock depressions, and *Corallina* sp., *Phymatolithon lenormandii*, and *Balanus perforatus* in the infralittoral fringe. Associations of photophilic algae were depressed in shallow areas. Some precoralligenous species, including *Halimeda tuna, Flabellia petiolata, Peyssonnelia* sp., *Alcyonium acaule*, and *Parazoanthus axinellae*, were common only in the upper infralittoral zone, at depths of only 1-2 m! The dominant algae at 2-4 m was *Codium bursa*. Deeper and approaching the edge of a vertical wall, *Codium* was replaced by *Cystoseira.* Its clusters were also recorded on isolated large stones and boulders at 30 m. The vertical wall, extending from 8 to 22 m, was characterized by a typical coralligenous biocoenosis. Below the wall, there was a steep slope of coarse sand and pebbles. The silty fraction increased at about 35 m. The most diverse fish fauna noted during the visual census was recorded at this site.

Transect GR-24 (Station T-8). This high energy site with a vertical cliff just below the sea surface was characterized by a corallinacean belt. At 2 m, there was an overhang rich in rock boring *Gastrochaena dubia,* the sponge *Chondrilla nucula*, and algae common to a precoralligenous community. At about 3-5 m, at a moderately inclined narrow rocky slope, there were well-developed associations of photophilous algae such as *Dictyota dichotoma, Padina pavonica,* and various species of the genus *Laurentia*. *Cystoseira corniculata* var. *laxior* was dominant and a large *Cladocora caespitosa* bioherm was recorded at 5-13 m. A wall extending 13-39 m was occupied by a climax variety of coralligenous biocoenosis represented by *Peyssonnelia* spp., *Eunicella cavolinii, Paramuricea clavata, Parazoanthus axinellae, Leptopsammia pruvoti,* three species of the genus *Axinella, Alcyonium acaule*, and many others. At about 40 m, there was a moderately inclined slope of coarse sand rich in shells. Well-developed associations of photophilous algae resulted in ichthyofauna especially rich in hyperbenthic species (Labridae and Sparidae).

Transect GR-25 (Station T-5). The shore and sea bottom were gently inclined. The tidal zone was peculiar for a *Phymatolithon lenormandii* belt and the abundance of the beadlet anemone (*Actinia equina*). On the contrary, the barnacle *Chthamalus stellatus* occurred rarely. *Cystoseira compressa* was a dominant seaweed in the infralittoral fringe and upper infralittoral zone. At about 5 m and deeper, it was replaced by dense settlements of *Cystoseira crinita, C. spicata*, and *C. corniculata* var. *laxior.* Rock boring shellfish *Gastrochaena dubia* and *Lithophaga lithophaga* were abundant. Large sea urchins, *Paracentrotus lividus*, about 5 specimens/m^2, were found at clearings deprived of vegetation. Crabs, *Xantho hydrophilus*, were common below loose stones. The echiuroid worm *Bonellia viridis* also was abundant. The gently inclined slope did not become steep until 27-32 m. It was formed by large boulders, 1 m in diameter, which supported many species characteristic of a coralligenous biocoenosis, such as *Mesophyllum expansum, Axinella verrucosa, Eunicella cavolinii, Alcyonium acaule,* erect bryozoans, etc. A large *Cladocora caespitosa* bank occurred here. From 35 m downwards there was a bottom of detrital sand and large stones covered by a carpet of *Osmundaria volubilis*.

Transect GR-26 (Fig. 2B). A peculiar feature of this high energy site is the midlittoral zone with two belts of calcareous algae. The upper belt was characterized by *Lithophyllum tortuosum* bioclasts and the lower consisted of *Phymatolithon lenormandii.* An overhang just below sea level shaded a 2 m high wall fully overgrown by a carpet of algae typical of a precoralligenous community, such as *Flabellia petiolata, Halimeda tuna,* and *Peyssonnelia* spp. At 2-9 m, there was a steep rocky slope supporting the biocoenosis of photophilous algae. *Laurencia obtusa, Cladophora* sp., *Codium bursa*, and *Acetabularia acetabulum* were abundant. *Gastrochaena dubia* and *Lithophaga lithophaga* were dominant boring organisms in the bedrock. Horny coral *Eunicella singularis* individuals were recorded in the area. A tiny *Eunicella cavolinii* colony was collected in a small cave at only 4 m. This species increased in abundance below 20 m where *Eunicella* was accompanied by *Flabellia petiolata, Peyssonnelia* sp. (dominant), *Mesophyllum expansum, Axinella cannabina, A. verrucosa, Petrosia ficiformis, Aplysina aerophoba, Leptopsammia pruvoti, Parazoanthus axinellae, Alcyonium acaule, Myriapora truncata*, etc. The bedrock was replaced by a continuous slope of coarse detrital sand at 40 m.

Transect GR-27 (Fig. 2D). The vertical rock was abundantly perforated, cheese-like, from sea level to a depth of 7 m as a result of karstification in the geological past and recent biogenic erosion. A continuous carpet of *Catenella caespitosa* occurred in a small shore cave to about 2 m above sea level. *Lithophyllum tortuosum* and *Actinia equina* were abundant in the tidal zone. A small wall below the littoral overhang was completely covered by *Peyssonnelia* spp., *Cladophora* sp., *Flabellia petiolata*, and *Codium bursa*. At about 7-15 m, small *Cystoseira spicata* clumps occurred. Both *Eunicella cavolinii* and *E. singularis* were recorded. Below 20 m, there was a steep slope consisting of coarse sand partly mixed with ooze, a few step-like bedrock crags, and a red alga, *Osmundaria volubilis*, appeared. The deepest rocky wall, at 37-44 m, was occupied by a climax coralligenous biocoenosis: *Peyssonnelia* spp., *Mesophyllum expansum, Axinella verrucosa* with *Parazoanthus axinellae, Eunicella cavolinii, Paramuricea clavata, Leptopsammia pruvoti, Porella cervicornis, Myriapora truncata*, and others. The transect end was marked at 47 m on a muddy detrital sand.

Transect GR-28 (Station T-13). The sheltered position of this site in the Goli Island port was apparent by the presence of *Fucus virsoides, Osilinus articulata*, and *O. mutabilis*. The shallow bedrock was occupied by a well-developed biocoenosis of photophilous algae. The most abundant species were *Cystoseira compressa, Padina pavonica, Acetabularia acetabulum*, and *Jania* sp. The lower infralittoral and circalittoral zones were not analyzed. Nearby, a trammel net was set on the sandy and muddy deposit at 30-50 m (Table 4).

Transect GR-29 (Station T-12). The site is exposed to the scirocco (jugo) wind. On the west side of the cape, bedrock gently slopes to 10 m where it is replaced by a moderately inclined slope of bare coarse sand populated by *Holothuria tubulosa, H. forskali, Condylactis aurantiaca*, and others. Shallow water bedrock and large boulders were abundantly settled by *Cystoseira spicata* and *C. corniculata* var. *laxior* and single associated *Osmundaria volubilis* thalli. On the east side of the cape facing Prvić Island, species typical of a precoralligenous facies of the coralligenous biocoenosis were abundant: *Peyssonnelia squamaria, Halimeda tuna* and *Flabellia petiolata, Eunicella cavolinii, Parazoanthus axinellae*, and *Alcyonium acaule*. Clumps of *Mesophyllum expansum* and *Leptopsammia pruvoti* individuals were noticed. Some forty fish species were recorded by divers or collected by trammel.

Transect GR-30 (Station T-7). The bedrock and deposits incline continuously at about 45° to the greatest depth explored (40 m). Many *Patella rustica* and *P. caerulea* shells were entirely settled by a *Chthamalus stellatus* population in the tidal zone. From the shallow littoral rocks near the sea surface to a depth of about 12 m, photophilous seaweeds such as *Cystoseira, Laurencia*, and *Padina* species cohabitated with typical sciaphilous algae common in the area. At 12 m, the bedrock was substituted by a slope of coarse detrital sand and scattered loose stones. The endolithic *Gastrochaena dubia* was very abundant. The most attractive representatives of the coralligenous biocoenosis were horny corals (*Eunicella* species), settled on large boulders. At about 27 m, an increased amount of silty fraction favored the establishment of a dense *Osmundaria volubilis* carpet indicating the biocoenosis of detrital sand mixed with ooze. No invertebrates were noted in the trammel bottom set catch.

Transect GR-31. The site is exposed to waves generated by the sirocco wind. The supralittoral zone was about 2 m in height. There was a littoral overhang and a small wall that, at a depth of 6 m, continued as a steep bedrock slope. Below the 20 m depth mark the wall was substituted by a sandy deposit rich in shells. A typical littoral *Cystoseiretum* extended deepwards to the edge of a small wall at a depth of 11 m. The wall and large rock boulders heaped here and there were occupied by typical coralligenous organisms such as *Axinella, Eunicella, Leptopsammia, Porella, Myriapora*, and others. *Cystoseira corniculata* var. *laxior*, accompanied by a few photophilous algae, occurred on the boulders and large stones. *Osmundaria volubilis, Serpula vermicularis,* and *Phallusia mammilata* were abundant on sand, at a depth of about 40 m.

Transect GR-32 (Station T-10). A precoralligenous community, well represented by the algae *Halimeda tuna, Flabellia petiolata,* and *Peyssonnelia* sp., were found below an overhang in a shadowed habitat along the shore. *Microcosmus sabatieri* and *Halocynthia papillosa* were recorded at only 1 m depth! Deeper, in the biocoenosis of photophilous algae, *Dasycladus vermilare* was the most abundant species. There was a *Cymodocea nodosa* meadow in a restricted sandy deposit at 5-10 m. The seagrass covered 75% of the bottom. A zone of *Osmundaria volubilis* settlement occupied 30-80% of the bottom at 19-26 m. Below 30 m, the deposit slope consisted of fine muddy sand and, at 36-50 m, there was an area of large rocky boulders. Boulders offered excellent support to species common in the climax stage of a coralligenous biocoenosis such as *Mesophyllum expansum,* three *Axinella* species, *Porella cervicornis, Myriapora truncata,* etc. *Osmundaria volubilis* was abundant on hard substrates. Deeper than the boulders, there was a plain of a slightly muddy detrital deposit.

Transect GR-33 (Fig. 2A). The sheltered location of this site was evident by the narrow supralittoral zone, only 100 cm high, and the presence of *Fucus virsoides* and *Osilinus articulata* at the tidal level. The shore rocks appeared rugged and the slope was gently inclined. At a depth of 13 m, the compact bedrock was replaced by coarse detrital sand. The rocky bottom was well covered by photophilous algae, *Cystoseira* and *Sargassum* in particular. *Microcosmus* sp. and *Scyllarus arctus* were collected at a depth of only 4 m. *Eunicella singularis* colonies were common on small bedrock ridges and large loose stones scattered in the detrital sediment. Rock boring clionid sponges and *Gastrochaena dubia* were abundant in a limestone supports along the entire transect.

Transect GR-34. The locality is extremely exposed to bora wind effects. The supralittoral zone is about 250 cm high and there were traces of physical abrasion on many limpet (*Patella*) shells in the mediolittoral zone. There was a well-developed settlement of *Fucus virsoides* in the nearby small beach protected by large rock boulders. There were two belts of epilithic organisms in the upper infralittoral zone; the upper was occupied by photophilous algae and the lower was peculiar for its precoralligenous aspect of a coralligenous biocoenosis. A very steep rocky slope and vertical wall reached a depth of 40 m. From about 15 m downwards, the area was occupied by a climax aspect of the coralligenous biocoenosis. Erect bryozoans, *Axinella cannabina* and *A. verrucosa, Paramuricea clavata, Leptopsammia pruvoti,* etc., were abundant. At a greater depth, the rocky slope was replaced by a detrital sandy deposit. Large stones and boulders, accumulated here and there, were settled by common coralligenous organisms.

Transect GR-35. This is a high energy site similar to transect GR-34. Below a small overhang and a 3 m wall, fairly steep bedrock continues downwards to detrital sand covered by an *Osmundaria volubilis* canopy at 24 m. Shaded habitats in shallow water were occupied by a dense *Peyssonnelia* sp. association. Rock boring shellfish were abundant. Photophilous algae occupied the bedrock to about 15 m with dominant species such as *Laurencia obtusa, Dictyota dichotoma, Cladophora, Codium, etc*., covering some 80% of the rock. *Aplysina cavernicola, Leptopsammia pruvoti, Porella cervicornis*, and small *Eunicella cavolinii* were recorded in a wide horizontal crevice at 12 m.

Station GR-36 (Station T-2). This site was not surveyed by divers. Benthic organisms were collected by trammel bottom set at 5-30 m. The net was set on the rocky and sandy-muddy bottom and passed a *Posidonia oceanica* bed. Fronds of *Osmundaria volubilis, Cystoseira corniculata* ssp. *laxior* and *C. spicata, Sargassum vulgare,* and *Codium bursa* were extracted. Several decapod crustaceans and cephalopods and 16 fish species were recorded.

Station GR-37 (Station T-1). The trammel gear was set on a deposit of sand and mud at 5-20 m. The vegetation component in the catch was represented by *Posidonia oceanica* leaves and a few *Sargassum vulgare* fronds. The fish fauna conformed to that of eelgrass beds; *Scorpaena porcus, Symphodus tinca,* and *Serranus scriba* were the most abundant species.

Transect GR-38. This site is fully exposed to the effects of the bora wind. Some small rock-pools on a vertical cliff in the supralittoral zone were inhabited by juvenile periwinkles (*Melaraphe neritoides*). Mosquito larvae were detected 250 cm above sea level. Extremely dense settlements of *Catenella caespitosa* were found high in the supralittoral zone in habitats shaded by overhangs and in cracks. *Chthamalus stellatus, C. montagui*, and *Balanus perforatus* populations were thoroughly intermixed at the infralittoral fringe. Similarly, there was a dense algal carpet composed of sciaphilous *Peyssonnelia* sp. and photophilous species, *Dictyota dichotoma, Padina pavonica, Cladophora* sp., and others, in the upper infralittoral zone. Here and there, patches of very coarse sandy and gravely deposit accumulated on steep bedrock to a depth of 28 m. An escarpment built of large consolidated stones and boulders and a vertical wall from 29 to 45 m were characterized by the climax stage of the coralligenous biocoenosis described above. The octocoral, *Alcyonium acaule*, and *Chromis chromis* were abundant in the area. Fish diversity was low.

Transect GR-39. Sheltered from the bora wind but exposed to waves generated by the scirocco, the supralittoral zone is some 180 cm in height. *Fucus virsoides* and *Nemalion helminthoides* were patchily distributed in the tidal zone. *Laurencia obtusa* and various *Cystoseira* species dominated the infralittoral assemblage of photophilous algae, covering about 70% of the area. The slope inclined constantly at about 45°. At 15 m, the coastal bedrock was replaced by coarse detrital sand. The presence of *Cerianthus membranaceus* and *Echinocyamus pusillus* indicated a constant water current along the deposit slope. At 41-48 m, there was a steep bedrock ridge occupied by corals and other organisms common to a coralligenous biocoenosis. *Peyssonnelia* spp. were the dominant red algae but *Cladophora* sp., *Flabelia petiolata*, and *Osmundaria volubilis* were also recorded. There was a *Posidonia oceanica* meadow in the area surveyed, but not along the transect line.

Transect GR-40 (Station T-11). Limited information on the benthos was collected by a trammel bottom set. The gear was laid on bedrock, sand, and muddy deposit. Apparently, it passed a *Posidonia oceanica* bed and a *Cystoseira corniculata* ssp. *laxior* settlement. The decapod crustacean *Scyllarus arctus* (10 specimens), peacock wrass (*Symphodus tinca;* 30 specimens), and black scorpionfish (*Scorpaena porcus;* 17 specimens) were most abundant.

Transect GR-41. The site is fully exposed to the bora wind. The shore cliff is very rugged and almost inaccessible. The supralittoral zone is about 180 cm high. *Lithophyllum tortuosum* clusters in the mediolittoral zone did not surpass 5 cm in diameter. There were a few mussels (*Mytilus galloprovincialis*) and one specimen of the European oyster (*Ostrea edulis*) in a rock pool. The infralittoral fringe was marked by a *Corallina* belt. The rocky slope was occupied by a dense carpet of photophilous algae. *Cystoseira compressa, Laurencia* sp. and *Dictyota* species dominated but *Amphiroa rigida* was also abundant. Deeper, precoralligenous algae such as *Peyssonnelia* sp., *Halimeda tuna*, and *Flabellia petiolata* increased in importance. At 6 m, a semi-dark fissure was inhabited by various sponges, *Axinella verrucosa* hosting *Parazoanthus axinellae, Leptopsammia pruvoti, Myriapora truncata*, etc. At 12-23 m, there was a vertical wall occupied by a typical coralligenous biocoenosis. From the base of the wall, loose stones accumulated to a depth of 29 m at which the rock was replaced by fine well-sorted sand. At the time of research (June 1997), about 75% of the deposit bottom was covered by sedimented mucilaginous aggregations generated by a phytoplankton bloom. Rock boring sponges (*Clionidae*) and shellfish (*Gastrochaena dubia* in particular) appeared very active at all depths from the infralittoral fringe to the base of the wall.

Transect GR-42. A high energy site. Due to a cliff-like inaccessible shore the height of the supralittoral zone could not be established. Mussels (*Mytilus galloprovincialis*) and barnacles (*Balanus perforatus*) were abundant at the infralittoral fringe. In shallow waters, steep bedrock was completely (100%) covered by photophilous algae, *Cystoseira* spp. in particular. *Peyssonnelia* sp. dominated shaded habitats. Two walls, at 22-32 m and 36-43 m, were settled by typical coralligenous fauna. A small plain at 32-36 m and a gently inclined slope from 43 m to over 53 m consisted of sand rich in silty fraction. *Osmundaria volubilis* was abundant. At 49-51 m, a ridge built of large consolidated stones formed an enclave of coralligenous biocoenosis within the biocoenosis of detrital sand mixed with ooze.

Bottom grab stations. Collections were made at depths of 65-100 m (Fig. 1; Table 3). The deposit texture ranged from muddy gravel and detrital sand to sandy mud. The extracted fauna was low in both diversity and abundance. Only a small amount of the collected polychaete worms was identified. Therefore, precise identification of soft bottom communities was impossible at most of the surveyed stations. However, many species exclusive or preferential of peculiar well-defined biocoenoses were identified: *Turritella communis, Sternaspis scutata, Jaxea nocturna,* and *Processa nouveli* of the biocoenosis of coastal terrigenous ooze; *Golfingia elongata* of silty-sandy detrital deposit; *Onchnesoma steenstrupi, Calocaris macandreae*, and *Brissopsis lyrifera* of the community of bathyal silt (Table 3). Subfossil skeleton debris of a species exclusive to bathyal silt, the gorgonarian *Funiculina quadrangularis*, was found at stations 301/2 and 301/3 (Table 4). A macruran decapod crustacean, *Callianassa subterranea*, was the most frequent and abundant live fauna species processed in our grab collections.

Table 4. Subfossil Turritella communis shells (no. specimens) and Funiculina quadrangularis axial skeleton fragments extracted from bottom grab deposit collections (0.2 m^2)

Station	*Turritela communis*	*Funiculina quadrangularis*
301/1	23	-
301/2	88	+
301/3	65	+
302/1	24	-
302/2	74	-
302/3	34	-
303/2	87	-
303/3	48	-

Taxonomical account

About 160 species of marine flora and fauna were recorded *in situ* by divers. After processing algae fronds, phanerogam stems, biogenic aggregations, and sediment samples, and analysis of bottom trammel net catches, a total of 56 algae, 2 marine phanerogams, 225 invertebrates, and 96 fish were identified to the species level.

Flora. LOVRIĆ (1971a, 1976a, 1978) recorded only the most conspicuous elements of the marine flora and vegetation. *Catenella caespitosa* was common everywhere in the supralittoral zone, in shaded cracks, and below large rock boulders. At some sites, e.g., stations GR-23 and 27, large *Codium bursa* specimens dominated on shaded walls and below overhangs at only 2-4 m. At station GR-24, a shade seeking *Cystoseira corniculata* var. *laxior* occurred at only 5 m. On deeper walls and bedrock some species of the genera *Peyssonnelia*, *Halimeda tuna,* and *Flabellia petiolata* were common everywhere. *Osmundaria volubilis* dominated sandy and mixed deposits, usually below 30 m. The ecological importance of several calcifying algae was specifically recognized, especially that of *Phymatolithon lenormandii* and *Lithophyllum tortuosum* which constructed cushion-shaped hemispherical swellings and pavements in the lower mediolittoral zone, *Corallina* species arranged in dense belt-like settlements in the infralittoral fringe, and *Peyssonnelia polymorpha* and *Mesophyllum expansum* that contributed significantly to the formation of a secondary hard bottom. Only two seagrass species were recorded: *Cymodocea nodosa* and *Posidonia oceanica*. Their shallowest limits were 2 and 3 m, respectively.

Porifera. Twenty-six sponge species were identified. Some of them, such as *Aplysina aerophoba, Petrosia ficiformis* and *Chondrilla nucula*, were common and distributed everywhere, especially in the upper infralittoral zone. At some sites, endolithic clionids were abundant. Three *Axinella* species characteristic to the coralligenous biocoenosis occurred in the circalittoral zone: *A. cannabina; A. damicornis,* and *A. polypoides*. Most *Geodia cydonium* specimens were small and did not exceed about 10 cm in diameter but the largest reached 40 cm (GR-25, 30 m). Apparently, *Spongia agaricina* and *S. virgultosa* were not previously recorded in this part of the Adriatic.

Cnidaria. Only the Anthozoa class was considered. Of 24 species, six were scleractinians. *Actinia equina, Anemonia viridis*, and *Parazoanthus axinellae* occurred almost everywhere. Adult *A. equina* specimens were very large in the tidal zone at stations GR-18 and 19, their basal holds being 5 cm and more in diameter. *Actinia cari* specimens were collected only in Pećna cove (station GR-35). Colonial *Parazoanthus axinellae* and *Alcyonium acaule* commonly occurred together in shaded habitats of the upper infralittoral zone at 1-2 m at station GR-23. At the same depth at station GR-18, small *Parazoanthus* colonies settled on *Peyssonnelia squamaria, Codium bursa*, and *Codium adherens* thalli, and *Microcosmus* sp. (probably *M. sabatieri*) specimens. A similar epiphytic mode of life in *Parazoanthus* was previously recorded at the entrance of the surface cave at Banjole Islet near Rovinj where it settled on basal parts of *Cystoseira compressa* thalli (ZAVODNIK, 1967). Common scleractinians in the upper infralittoral zone were *Balanophyllia europaea* and *Cladocora caespitosa*. A small bank of the latter at Šilo Cape (station GR-24) was described by KRUŽIĆ (2001). Another large bank, about 1 m high, was found at station GR-25. The most characteristic species in the circalittoral zone, i.e., in the coralligenous biocoenosis, were *Eunicella cavolinii, Eunicella stricta, Paramuricea clavata,* and *Leptopsammia pruvoti*. The shallowest record of *E. stricta* was at only 4 m (station GR-17). Subfossil debris of an *Funiculina quadrangularis* axial skeleton was the only evidence of this species exclusive to the biocoenosis of bathyal silt.

Mollusca. Seventy species were listed. Small gastropods such as Rissoidae were not considered by divers. Some well-known species were recorded rarely, for example, *Lepidochitona caprearum, Bolinus brandaris, Hexaples trunculus, Muricopsis cristatus,* several *Gibbula* and *Chama* species, etc. On the other hand, rock boring shellfish *Lithophaga lithophaga* and *Gastrochaena dubia* were abundant everywhere in the upper infralittoral zone. Of species protected by law, only the date mussel (*Lithophaga*) and fan shellfish (*Pinna nobilis*) were recorded. Many *Osilinus articulatus* specimens in the infralittoral fringe at the high energy station GR-34 were concealed in empty *Lithophaga* borings that provided excellent shelter to this gastropod that generally occupies low energy environments.

Annelida Polychaeta. From various reasons, in the area of record, this remained the least known group of benthic macrofauna. Obviously divers have paid much interest to large tube living specimens but missed collection of mobile creatures (Annex). Grab sampling was successful but, unfortunately, worm collections were lost before taxonomic analysis was finished.

Crustacea. Four species of Cirripeds and 29 species of decapod crustaceans were identified. The crab *Pilumnus vilosissimus* was recorded for the first time in this part of the Adriatic. The European lobster, *Homarus gammarus*, was noted by divers. At station GR-33 *Scyllarus arctus* was collected at only 4 m depth, in the biocoenosis of infralittoral algae dominated by *Cystoseira* and *Peyssonnelia* species. The abundance of a silt-tolerant species *Callianassa subterranea* and the continual presence in our grab collections of *Calocaris macandreae,* a species exclusive of the biocoenosis of bathyal silt, suggest the community complexity in muddy and mixed deposits in this area.

Echinodermata. Twenty-four species were identified, the most frequently recorded by divers being *Echinaster sepositus, Holothuria tubulosa,* and *H. forskali.* The presence of sediment-living irregular echinoids was established by tests. From the zoogeographical point of view, the most important finding was *Echinocardium mortenseni* in the coarse detrital sand of Sv. Grgur Island (station GR-33), already reported by ZAVODNIK (2003). Collections of live *Brissopsis lyrifera* individuals suggest the presence of bathyal fauna in a rather shallow and small area of the Senj Archipelago.

Tunicata. Most underwater records concerned large solitary ascidians. Quite unexpected, *Halocynthia papillosa* and *Microcosmus sabatieri* occurred at only 1 m below overhangs in shaded areas of station GR-32. Colonies of an unidentified *Clavelina* species were common in upper parts of large *Cystoseira* stems at some stations.

Fish. Four cartilagineous and 92 teleostean species were listed (Table 5). Most are well distributed along the eastern part of the Adriatic,

Table 5. Fish taxa recorded in present study including method of recording specimen (D = diving; T = trammel bottom set), habitat (bpl = benthopelagic; crypt = cryptobenthic; epi = epibenthic; hyp = hyperbenthic; pel = pelagic), type of feeder (car = carnivore; det = detritivore; herb = herbivore; omn = omnivore), and prey size (macro = macrophagic; meso = mesophagic; micro = microphagic).

Taxon	Method	Occurrence	Feeding	Prey size
SCYLIORHYNIDAE				
Scyliorhinus canicula (Linnaeus, 1758)	T	epi	car	macr
TORPEDINIDAE				
Torpedo marmorata (Risso, 1810)	T	epi	car	macr
RAJIDAE				
Raja montagui Fowler, 1910	T	epi	car	macr
MYLIOBATIDAE				
Myliobatis aquilla (Linnaeus, 1758)	T	epi	car	macr
CONGRIDAE				
Conger conger ([Artedi, 1738] Linnaeus, 1758)	D	crypt	car	macr
SYNGNATHIDAE				
Syngnathus sp. – juv.	D	epi	car	macr
MERLUCIIDAE				
Merluccius merluccius (Linnaeus, 1758)	T	hyp	car	macr
GADIDAE				
Trisopterus minutus (Linnaeus, 1758)	T	hyp	car	macr
ZEIDAE				
Zeus faber Linnaeus, 1758	T	hyp	car	macr
SERRANIDAE				
Serranus cabrilla (Linnaeus, 1758)	DT	hyp	car	macr
Serranus hepatus (Linnaeus, 1758)	DT	hyp	car	macr
Serranus scriba (Linnaeus, 1758)	DT	hyp	car	macr
CARANGIDAE				
Trachurus mediterraneus (Steindachner, 1868)	T	pel	car	micr
Trachurus trachurus (Linnaeus, 1758)	T	pel	car	micr
SCIAENIDAE				
Sciaena umbra Linnaeus, 1758	D	hyp	car	macr
MULLIDAE				
Mullus barbatus Linnaeus, 1758	T	hyp	car	meso
Mullus surmuletus Linnaeus, 1758	DT	hyp	car	meso
SPARIDAE				
Boops boops (Linnaeus, 1758)	DT	hyp	car	micr
Dentex dentex (Linnaeus, 1758)	DT	hyp	car	macr
Diplodus annularis (Linnaeus, 1758)	DT	hyp	car	meso
Diplodus puntazzo (Cetti, 1777)	D	hyp	car	meso
Diplodus sargus (Linnaeus, 1758)	D	hyp	car	meso

Table 5. Cont'd

Diplodus vulgaris (E. Geoffroy Saint-Hilaire, 1817)	DT	hyp	car	meso
Oblada melanura (Linnaeus, 1758)	DT	hyp	car	micr
Pagellus acarne (Risso, 1826)	T	hyp	car	meso
Pagellus erythrinus (Linnaeus, 1758)	T	hyp	car	meso
Pagrus pagrus (Linnaeus, 1758)	T	hyp	car	macr
Sarpa salpa (Linnaeus, 1758)	D	hyp	herb	
Sparus aurata Linnaeus, 1758	D	hyp	car	meso
CENTRACANTHIDAE				
Spicara maena (Linnaeus, 1758)	DT	bpl	car	micr
Spicara smaris (Linnaues, 1758)	DT	bpl	car	micr
POMACENTRIDAE				
Chromis chromis (Linnaeus, 1758)	DT	hyp	car	micr
LABRIDAE				
Acantholabrus palloni (Risso, 1810)	T	hyp	car	meso
Coris julis (Linnaeus, 1758)	DT	hyp	car	meso
Labrus merula Linnaeus, 1758	DT	hyp	car	meso
Symphodus doderleini Jordan, 1891	D	hyp	car	meso
Symphodus cinereus (Bonnaterre, 1788)	DT	hyp	car	meso
Symphodus mediterraneus (Linnaeus, 1758)	DT	hyp	car	meso
Symphodus melanocercus (Risso, 1810)	D	hyp	car	meso
Symphodus ocellatus (Forsskål, 1775)	DT	hyp	car	meso
Symphodus roissali (Risso, 1810)	D	hyp	car	meso
Symphodus rostratus (Bloch, 1797)	D	hyp	car	meso
Symphodus tinca (Linnaeus, 1758)	DT	hyp	car	meso
TRACHINIDAE				
Trachinus araneus Cuvier, 1829	D	crypt	car	macr
Trachinus draco Linnaeus,1758	DT	crypt	car	macr
Trachinus radiatus Cuvier, 1829	DT	crypt	car	macr
URANOSCOPIDAE				
Uranoscopus scaber Linnaeus, 1758	T	crypt	car	macr
SCOMBRIDAE				
Sarda sarda (Bloch, 1793)	T	pel	car	micr
Scomber japonicus Houttuyn, 1782	T	pel	car	micr
GOBIIDAE				
Buenia affinis Iljin, 1930	D	epi	car	meso
Chromogobius zebratus (Kolombatović, 1891)	D	crypt	car	meso
Gobius auratus Risso, 1810	D	epi	car	meso
Gobius bucchichi Steindachner, 1870	D	epi	omn	
Gobius cobitis Pallas, 1811	D	epi	omn	
Gobius cruentatus Gmelin, 1789	D	epi	car	meso
Gobius fallax Sarato, 1889	D	epi	car	meso
Gobius geniporus Valenciennes, 1837	D	epi	car	meso
Gobius niger Linnaeus, 1758	D	epi	car	meso
Gobius paganellus Linnaeus, 1758	D	epi	car	meso
Gobius roulei De Buen, 1928	D	epi	car	meso
Gobius vittatus Vinciguerra, 1883	D	epi	car	meso
Speleogobius trigloides Zander & Jelinek, 1976	D	epi	car	meso
Thorogobius ephippiatus (Lowe, 1839)	D	epi	car	meso

Table 5. Cont'd

Thorogobius macrolepis (Kolombatović, 1891)	D	epi	car	meso
Zebrus zebrus (Risso, 1826)	D	crypt	car	meso
BLENNIIDAE				
Aidablennius sphynx (Valenciennes, 1836)	D	epi	omn	
Coryphoblennius galerita (Linnaeus, 1758)	D	epi	herb	
Lipophrys canevai (Vinciguerra, 1880)	D	epi	herb	
Lipophrys dalmatinus (Steindach. & Kolomb., 1883)	D	epi	car	meso
Lipophrys nigriceps (Vinciguerra, 1883)	D	crypt	omn	
Parablennius gattorugine (Linnaeus, 1758)	D	epi	omn	
Parablennius incognitus (Bath, 1968)	D	epi	omn	
Parablennius rouxi (Cocco, 1833)	D	epi	omn	
Parablennius sanguinolentus (Pallas, 1811)	D	epi	herb	
Parablennius tentacularis (Brünnich, 1768)	D	epi	omn	
Parablennius zvonimiri (Kolombatović, 1892)	D	crypt	omn	
Paralipophrys trigloides (Valenciennes, 1836)	D	epi	car	meso
TRIPTERYGIIDAE				
Tripterygion delaisi (Cadenat & Blache, 1971)	D	epi	car	meso
Tripterygion melanurus Guichenot, 1845	D	crypt	car	meso
Tripterygion tripteronotus (Risso, 1810)	D	epi	car	meso
MUGILIDAE				
Oedalechilus labeo (Cuvier, 1829)	D	hyp	det	
ATHERINIDAE				
Atherina boyeri Risso, 1810	D	bpl	car	micr
Atherina hepsetus Linnaeus, 1758	D	bpl	car	micr
SCORPAENIDAE				
Scorpaena notata Rafinesque, 1810	T	epi	car	macr
Scorpaena porcus Linnaeus, 1758	DT	epi	car	macr
Scorpaena scrofa Linnaeus, 1758	DT	epi	car	macr
TRIGLIDAE				
Chelidonichthys lastoviza (Bonnaterre, 1788)	T	epi	car	macr
SCOPHTHALMIDAE				
Zeugopterus regius (Bonnaterre, 1788)	T	crypt	car	meso
BOTHIDAE				
Arnoglossus laterna (Walbaum, 1792)	T	crypt	car	meso
Arnoglossus thori Kyle, 1913	T	crypt	car	meso
SOLEIDAE				
Buglossidium luteum (Risso, 1810)	T	crypt	car	meso
Monochirus hispidus Rafinesque, 1814	DT	crypt	car	meso
Synapturichthys kleinii (Risso, 1827)	T	crypt	car	meso
GOBIESOCIDAE				
Lepadogaster candollii Risso, 1810	D	crypt	car	meso
Lepadogaster lepadogaster (Bonnaterre, 1788)	D	crypt	car	meso
LOPHIIDAE				
Lophius piscatorius Linnaeus, 1758	D	epi	car	macr

except *Acantholabrus palloni* which is typical to coralligenous environments (HARMELIN, 1990) and *Raja montagui* which inhabits fine fraction deposits (JARDAS, 1996). Both species were rarely recorded in the northern Adriatic. Divers' records of a dotted yellow *Gobius* remain uncertain since positive identification is possible only on collected specimens (HEYMER & ZANDER, 1992). Therefore, only records of *G. fallax* at station GR-34 and a north Adriatic color morph of *G. auratus* (HERLER *et al.*, 2005) at stations GR-18 and GR-25 were recognized. The conger eel (*Conger conger*), red scorpionfish (*Scorpaena scrofa*), and comber (*Serranus cabrilla*) were observed in spaces within large *Cladocora caespitosa* colonies. In bottom trammel net catches, a few specimens of four pelagic fishes were recorded: *Trachurus mediterraneus, T. trachurus, Sarda sarda*, and *Scomber japonicus*, in addition to the benthic fish.

Benthic communities

Several benthic communities well-known in the Mediterranean (PÉRÈS & PICARD, 1964; BELLAN-SANTINI *et al.*, 1994; CORMACI *et al.*, 2004) and Adriatic (GAMULIN-BRIDA 1967, 1979; ŠIMUNOVIĆ, 1970; ZAVODNIK *et al.*, 1981; JAKLIN & ARKO-PIJEVAC, 1997) were identified. As a consequence of the coastal and sea bottom topography, some communities were distributed belt-like around Prvić, Sv. Grgur, and Goli Islands. Local variations occurred, depending on other climatic and edaphic agents such as habitat isolation, hydrodynamics, and turbidity.

Biocoenosis of supralittoral rocks. (Tables 6, 7). As throughout the Adriatic Sea, characteristic organisms included the epilithic Cyanophyta, periwinkle *Melaraphe neritoides*, barnacle *Eraphia depressa*, and isopod *Ligia italica*. The supralittoral zone rose 4 m or more above sea level at high energy sites, on vertical cliffs, and on steep coastal rocky slopes. There were supralittoral rock pools up to 2.5 m above sea level. Common rock pool inhabitants were unidentified *Ochthebius* bugs and mosquito larvae. Once, a few juvenile *Melaraphe neritoides* specimens were recorded. The red alga *Catenella caespitosa* commonly occurred like patches in shadowed cracks and niches at the lower horizon of supralittoral zone.

Biocoenosis of mediolittoral rocks. There were two belt-like population zones or horizons: the upper was characterized by dense *Chthamalus*

Table 6. Abundance (c = abundant) and sociability estimation of the supralittoral rock community at low energy sites

Station GR -	18	33	39
Surface (m^2)	1	0,5	1,5
Zone height (cm)	?	100	180
Inclination	45 - 90º	30 - 45º	45º
Exclusive species			
Melaraphe neritoides	+ . 2	1 . 2	-
Euraphia depressa	1 . 2	+ . 1	+ . 1
Ligia italica	c	-	-
Preferential species			
Catenella caespitosa	1 . 2	-	1 . 2
Companion species			
Patella rustica	1 . 1	-	+ . 1
Chthamalus montagui	-	-	1 . 1
Chthamalus stellatus	-	1 . 1	1 . 1

Table 7. Abundance (+ = present, abundance not assessed; r = rare) and sociability estimation of the supralittoral rock community at high energy sites

Station GR -	21	30	31	34	35	38	41
Surface (m^2)	2	0,5	1	2	2	1	1
Zone height (cm)	> 200	260	200	250	240	400	> 180
Inclination	90º	90º	30 - 90º	0 - 90º	70 - 90º	90º	0 - 90º
Exclusive species							
Melaraphe neritoides	1 . 1	1 . 1	1 . 2	1 . 2	1 . 1	-	1 . 1
Euraphia depressa	-	1 . 2	+ . 2	1 . 2	1 . 2	2 . 2	1 . 2
Ligia italica	r	-	-	+	-	+	-
Preferential species							
Catenella caespitosa	1 . 2	2 . 2	-	+ . 2	-	+ . 2	+ . 2
Companion species							
Patella rustica	1 . 1	-	+ . 1	1 . 1	+ . 1	+ . 1	+ . 1
Chthamalus stellatus	-	1 . 2	+ . 1	-	-	1 . 2	-
Accidental species							
Pachygrapsus marmoratus	-	-	-	-	+	-	-
Verrucaria adriatica	-	-	-	-	-	1 . 2	1 . 2

stellatus populations accompanied by the limpet *Patella rustica*, and *Melaraphe neritoides*; the lower by the beadlet anemone *Actinia equina*, corallinacean algae *Lithothamnion lenormandii*, *Phymatolithon tortuosum*, and, at a few low energy sites, *Fucus virsoides* associations. Common accompanying species were *Patella aspera* and *P. caerulea* (Tables 8, 9). Most of the taxa were distributed patchily and fairly intermixed throughout the intertidal zone. Consequently, it was impossible to define the boundary-lines between the upper and lower horizons of the zone. The situation was similar in Rijeka Bay (ZAVODNIK *et al.*, 1981).

Biocoenosis of infralittoral seaweeds. This biocoenosis was represented by a number of algal associations and facies. *Corallina* spp. and *Cystoseira amentacea* associations were noted in well-agitated sites. *Cystoseira crinita* and *Padina pavonica* were dominant in sheltered locations with slightly inclined bedrock. A *Cystoseira compressa* association occupied similar environments under various exposures to waves. A *Cystoseira barbata* association was recorded at the only well-sheltered stations, GR-3 and 39, with patches covering 80-100%. A few *Sargassum* thalli were recorded within *Cystoseira* associations at many sites but *Sargassum vulgare* was abundant in a dense *Cystoseira amentacea* var. *spicata* settlement at Njivice rock (station GR-25). *Dasycladus vermicularis* grew patchily at some sheltered environments and at sites moderately exposed to wave action. Only a few facies of this biocoenosis were well distributed in the entire research area, such as *Padina pavonica, Dictyota* spp., *Acetabularia acetabulum*, *Laurencia obtusa*, and *Halimeda tuna* + *Flabellia petiolata* which is characteristic of less insolated or partly shaded steep and vertical rocky environments. *Peyssonnelia* species associated constantly beneath overhangs. In the upper infralittoral zone characterized by photophilous algae, two facies dominated by the mussel (*Mytilus galloprovincialis*) and the stone coral (*Cladocora caespitosa*) were recorded, both in moderately turbid to well-agitated sites.

Table 8. Abundance (c = abundant; r = rare; + = present, abundance not assessed) and sociability estimation of the mediolittoral rock community at low energy sites. Species marked with an asterisk (*) appeared during high tide

Station GR -	18	33	39
Surface (m^2)	1	1	1
Zone height (cm)	?	40	35
Inclination	0 - 45º	0 - 90º	45º
Exclusive species			
Rivularia atra	1 . 2	1 . 1	1 . 1
Rivularia mesenterica	+ . 1	-	-
Fucus virsoides	-	1 . 2	2 . 2
Actinia equina	1 . 1	1 . 1	1 . 2
Lepidochitona caprearum	-	-	+ . 1
Patella ulyssiponensis	1 . 1	-	-
Mytilaster minimus	1 . 2	1 . 2	1 . 2
Preferential species			
Phymatolithon lenormandii	2 . 2	3 . 3	1 . 2
Nemalion helminthoides	-	-	1 . 2
Patella caerulea	1 . 1	1 . 1	1 . 1
Patella rustica	+ . 1	+ . 1	+ . 1
Chthamalus montagui	+ . 2	2 . 2	2 . 3
Chthamalus stellatus	1 . 2	2 . 2	2 . 2
Companion species			
Osilinus articulatus	-	-	+ . 1
Osilinus turbinatus	+ . 1	-	+ . 1
Mytilus galloprovincialis	-	-	+ . 1
Accidental species			
Cereus pedunculatus	-	-	1 . 2
Melaraphe neritoides	-	1 . 1	-
Ostrea edulis	+ . 1	-	-
Palaemon elegans *	+	-	-
Ligia italica	c	-	-
Aidablennius sphynx *	r	-	-
Tripterygion tripteronotus *	+	-	-

Coralligenous biocoenosis. There were two aspects. A precoralligenous aspect was characterized by non-calcified moderately sciaphilous algae such as *Cystoseira corniculata* var. *laxior, Flabellia petiolata,* and various *Peyssonnelia*, *Codium* (especially *Codium bursa*), and *Cladophora* species. Seaweed associations were accompanied by a number of sponges, including clionids, *Chondrosia reniformis*, and especially *Petrosia ficiformis*, tube worms, bryozoans (*Schizobrachiella sanguinea*) and, occasionally, solitary ascidians *Microcosmus sabatieri* and *Halocynthia papillosa*. *Alcyonium acaule* was recorded in shallow water in some high energy sites. This community occurred, in general, under ledges along rocky shores at all

Table 9. Abundance (+ = present, abundance not assessed) and sociability estimation of the mediolittoral rock community at high energy sites. Species marked with an asterisk (*) appeared during high tide

Station GR -	21	30	31	34	35	38	41
Surface (m^2)	1,5	0,3	1	3,5	1	1	0,5
Zone height (cm)	45	40	?	40	40	45	40
Inclination	90º	90º	30 - 90º	0 - 90º	70 - 90º	90º	0 - 90º
Exclusive species							
Rivularia atra	-	1 . 1	1 . 1	1 . 1	-	-	1 . 2
Rivularia mesenterica	-	-	-	+ . 1	-	-	-
Fucus virsoides	-	-	-	+ . 2	-	-	-
Lithophyllum tortuosum	1 . 2	-	-	-	-	-	1 . 2
Hildenbrandia prototypus	-	+ . 2	-	-	1 . 2	-	-
Actinia cari	-	-	-	-	1 . 2	-	-
Actinia equina	1 . 1	1 . 1	1 . 1	+ . 1	+ . 1	1 . 1	1 . 1
Patella ulyssiponensis	+ . 1	+ . 1	-	+ . 1	-	-	-
Mytilaster minimus	1 . 2	1 . 2	1 . 2	+ . 2	+ . 2	+ . 2	1 . 2
Pachygrapsus marmoratus	-	+	-	-	-	-	-
Preferential species							
Phymatolithon lenormandii	4 . 5	-	-	-	-	2 . 3	-
Nemalion helminthoides	-	+ . 1	-	-	-	2 . 3	-
Catenella caespitosa	-	1 . 2	2 . 2	+ . 2	1 . 2	2 . 2	3 . 4
Patella caerulea	+ . 1	1 . 1	+ . 1	1 . 1	1 . 1	+ . 1	+ . 1
Patella rustica	1 . 1	1 . 1	+ . 1	1 . 1	+ . 1	1 . 2	1 . 1
Chthamalus montagui	-	1 . 2	2 . 2	1 . 1	1 . 1	+ . 1	2 . 2
Chthamalus stellatus	3 . 3	1 . 2	2 . 2	+ . 1	+ . 1	1 . 1	2 . 2
Companion species							
Osilinus articulatus	-	-	-	+ . 1	-	-	-
Osilinus turbinatus	-	1 . 1	1 . 1	1 . 1	+ . 1	-	1 . 1
Mytilus galloprovincialis	-	1 . 1	+ . 1	-	-	-	-
Accidental species							
Gibbula sp.	-	-	-	1 . 1	-	-	-
Melaraphe neritoides	+ . 1	1 . 1	-	-	+ . 1	+ . 1	-
Palaemon elegans *	-	+	-	-	+	-	-
Euraphia depressa	-	-	+ . 1	-	-	-	-
Ligia italica	-	-	-	-	-	+	-
Lipophrys canevai *	+	-	-	-	-	-	-
Lipophrys dalmatinus *	+	-	-	-	-	-	-

islands and rocks, just below the infralittoral fringe to a depth of 2-5 m. A precoralligenous aspect also appeared on large shaded reefs and ridges dispersed on steep slopes to 20 m and more.

A typical climax aspect of the coralligenous biocoenosis was characterized by calcified red algae, especially *Mesophyllum expansum*, a number of solitary and colonial corals, and large bryozoans. The community was recorded at many sites, on bedrock, cliffs, shelves, and ridges, in shadowed habitats and semidark caves, and at depths of 10-15 m along rocky slopes. Variations of the typical aspect were: (a) Association of *Mesophyllum expansum* and *Halimeda tuna* at less turbid sites under the influence of cold water upwelled from surrounding deep sea areas. (b) Facies of *Eunicella cavolinii* accompanied by *Mesophyllum expansum* and *Halimeda tuna*, sponges *Acanthella acuta, Axinella verucosa*, *Axinella cannabina*, and *Petrosia ficiformis*, the epibiontic *Alcyonium coralloides*, and bryozoans *Myriapora truncata* and *Smittina cervicornis*. This assemblage was typical of cliff and wall environments at 15-47 m. (c) Facies of *Eunicella stricta*. Single specimens of this horny coral were recorded at many sites but usually dispersed in settlements of *Cystoseira corniculata* var. *laxior*. Populations of *Eunicella singularis,* abundant enough to distinguish as a special facies of coralligenous biocoenosis, occurred rarely in environments with large stones on gravel and sandy deposits at 13-31 m. (d) Facies of *Paramuricea clavata*, recorded at stations GR-20, 24, and 27, on walls at 20-39 m. *Paramuricea* was commonly accompanied by *Peyssonnelia* sp., *Axinella cannabina, Tethya aurantium, Parazoanthus axinellae, Alcyonium acaule, Leptopsammia pruvoti*, and *Myriapora truncata*.

Biocoenosis of semi-dark caves. A well-developed community of this type was located in the submarine passage at Stražica Cape (station GR-20). This passage is 28 m long and 5.5-15 m deep. *Axinella cannabina, A. damicornis, Leptopsammia pruvoti, Acanthella acuta,* epizoic *Parazoanthus axinellae* and *Alcyonium coralloides*, and others settled on the round walls and ceiling of the passage, totally covering them. Assemblages of these characteristic species were small, distributed patch-like, and so intermixed on the surfaces that recognition of a peculiar facies *in situ* was impossible. There was nearly identical fauna in small caves at stations GR-19 and 41 at 20-22 m. Some characteristic species of this biocoenosis were regularly recorded on the insides of narrow and obscure cracks and crevices, on walls and steep bedrock, and under large rocky boulders. Evidently, these habitats represented enclaves of semi-dark caves in bottom areas occupied by the coralligenous biocoenosis, and, rarely, by the biocoenosis of infralittoral seaweeds.

Meadows of marine phanerogams. Several patches of *Cymodocea nodosa* and *Posidonia oceanica* were recorded. *Cymodocea nodosa* meadows were established on sandy bottoms, never dense, and poor in associated seaweeds. *Cymodocea* occupied no more than 75% of the sandy bottom in the most dense meadow (station GR-32). *Cymodocea* meadows proved a modest residence for macrofauna. In contrast, *Posidonia oceanica* beds, although spatially limited, were well developed at stations GR-20 and 36, where all signs of a climax stage of this well-known complex biocoenosis were evident. *Posidonia* occurred in small patch-like assemblages rarely extending beyond one square meter and rooted in gravel deposited in bedrock depressions and cracks at other sites. From above, these eelgrass patches seemed similar to the “colline” meadows described by BOUDOURESQUE *et al.* (1985).

Biocoenosis of coastal detrital bottoms. This biocoenosis occurred at the bases of very steep rocky slopes and vertical walls around the islands and rocks. The deposit of rough sand mixed with gravel and small stones was rich in organogenic debris of calcified algae, coral and bryozoan colonies, tubes of polychaete worms, and numerous molluscan shells. After the death of organisms, particles rolled down or fell off higher rocks and accumulated near walls. This deposit extended from 30-42 m, down moderately inclined slopes. Because of the great depth, scuba divers were unable to establish the lowest level of this biocoenosis and the sediment was not sampled for detailed research of the fauna. The biocoenosis in this area was confirmed by characteristic species such as *Geodia cydonium, Suberites domuncula, Pecten jacobaeus, Laevicardium oblongum*, *Vermiliopsis infundibulum*, and *Phallusia mammilata.* However, the presence at some sites of rheophilous fauna (anemone *Cerianthus membranaceaus*, echinoids *Sphaerechinus granularis, Echinocardium fenauxi*, and *Spatangus purpureus*) suggests strong water movement, supporting the transition appearance or population mixture of species from the SGBC (Biocoenosis of sand and gravel under influence of bottom currents) biocoenosis (PÉRÈS & PICARD, 1964). Detrital sand was partly covered by a film of fine silt at 27 m at GR-18 and at 34 m at GR-23 where *Holothuria forskali, Ascidia virginea*, and *Phallusia mammilata* were recorded. The facies of *Osmundaria volubilis* was located on genuine detrital sand mixed with pebbles and small stones at stations GR-29 and 32. The maximum covering rate of this alga was about 95%. Patch-like islets of a secondary hard bottom in detrital sand at station GR-21 offered a convenient habitat for species of the coralligenous biocoenosis settled in circalittoral plains.

Biocoenosis of coastal terrigenous ooze. Grab analyses revealed the occurrence of this biocoenosis on muddy sediments, poorly mixed with minced shell debris and fine sand particles at 65-100 m. A great amount of subfossil *Turritella communis* shells, up to 1100 per square meter, and an abundance of *Callianassa subterranea* indicated the affinity of the community to *Turritella* and *Callianassa* variances of this biocoenosis (ZAVODNIK, 1979b). The presence at several stations of species exclusive to the bathyal silts biocoenosis, such as *Onchnesoma steenstrupi* and *Calocaris macandreae,* and subfossil fragments of *Funiculina quadrangularis* stems (Table 4), suggest that the community has a mixed faunal composition, especially in Grgur Channel, between Prvić, and Sv. Grgur and Goli Islands (Fig. 4).

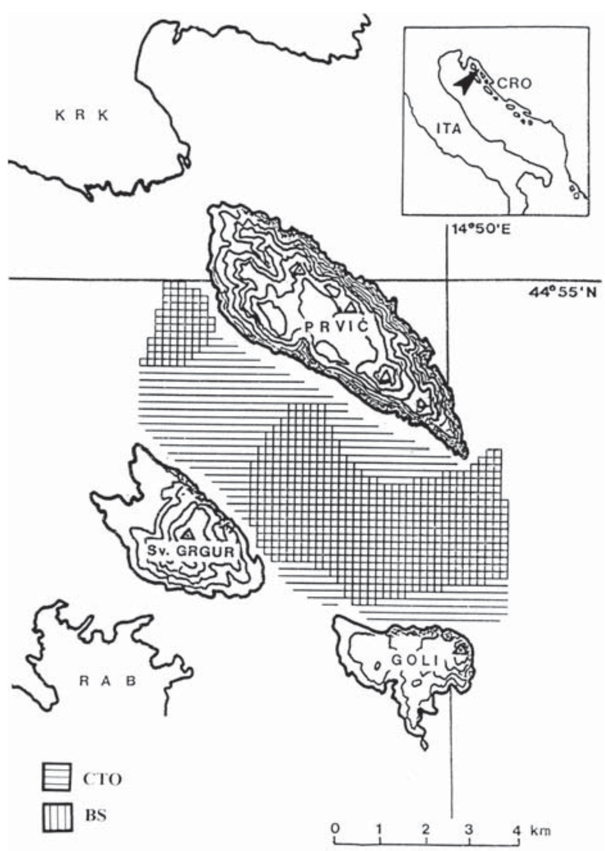

Fig. 4. Distribution of species characteristic of the biocoenosis of coastal terrigenous ooze (CTO) and bathyal silt (BS)

Fish assemblages

Complementary results were provided by the two sampling methods: seventy-one fish species were recorded by divers during the daytime and 47 species during night catches by trammel nets. Twenty-two species were common to both methods (Table 5).

The most numerous species in total bottom trammel net catches (Tables 10, 11) were *Scorpaena porcus* (Scorpaenidae; 43.2%), *Symphodus tinca* (Labridae; 8.3%), *Uranoscopus scaber* (Uranoscopidae; 7.4%), *Pagellus erythrinus* (Sparidae; 5.3%), and *Serranus scriba* (Serranidae; 4.1%). The bulk of divers' records referred to Blenniidae (12 species) and Gobiidae (16 species). Some species were recorded by divers at 2-4 sites but were not found in bottom trammel net catches.

The dominant species in biomass (wet weight) in bottom trammel net catches were *Scorpaena porcus* (43.2%), *Uranoscopus scaber* (8.2%), *Scorpaena scrofa* (6.3%), *Symphodus tinca* (6.2%), and *Pagellus erythrinus* (4.6%) (Table 12). According to estimates of catch per effort (CPU; MOROVIĆ, 1971), 20% of the catches belonged to "excellent" (>2 kg per net) and "very good" (1.5-2 kg per net) classes, 33% to "good class" (0.8-1.5 kg per net), and 27% to "poor class". The best average catch per net was in the Prvić Island area (1.712 kg) and the worst at Goli Island (0.795 kg).

Table 10. Number of specimens and wet weight (g) of species caught by bottom trammel sets at Sv. Grgur and Goli Islands

Island	Grgur			Goli			
Station	T-9	T-10	T-11	T-12	T-13	T-14	T-15
Taxon	N (W)	N (W)	N (W)	N (W)	N (W)	N (W)	N (W)
PISCES							
Scyliorhinus canicula	-	-	-	-	4 (1134)	-	-
Torpedo marmorata	-	-	-	1 (564)	-	-	-
Trisopterus minutus	-	-	-	-	5 (669)	-	-
Merluccius merluccius	-	1 (72)	-	-	1 (546)	-	-
Chelidonichthys lastoviza	1 (158)	-	1 (106)	1 (366)	1 (206)	1 (678)	1 (608)
Scorpaena notata	-	1 (80)	-	3 (240)	5 (418)	-	3 (132)
Scorpaena porcus	44 (4610)	8 (784)	17 (1692)	4 (604)	-	11 (1122)	37 (3123)
Scorpaena scrofa	1 (98)	2 (2378)	2 (725)	-	-	3 (3115)	1 (746)
Serranus cabrilla	-	-	5 (588)	-	-	-	3 (644)
Serranus hepatus	1 (12)	1 (8)	-	-	-	-	-
Serranus scriba	3 (322)	-	6 (744)	1 (82)	-	5 (610)	2 (281)
Boops boops	-	-	-	5 (648)	1 (124)	-	-
Dentex dentex	-	-	2 (1946)	-	-	-	-
Diplodus annularis	-	-	1 (38)	2 (92)	-	-	-
Diplodus vulgaris	-	-	3 (534)	-	-	-	-
Pagellus acarne	-	1 (114)	-	-	-	-	1 (104)
Pagellus erythrinus	5 (474)	5 (340)	-	2 (220)	14 (1965)	2 (970)	-
Mullus barbatus	-	9 (826)	-	-	8 (1048)	3 (376)	2 (243)
Spicara maena	1 (120)	-	-	-	-	-	-
Trachurus mediterraneus	-	-	1 (228)	-	-	-	1 (214)
Acantholabrus palloni	-	-	1 (122)	-	-	-	-
Coris julis	-	-	-	-	-	-	2 (48)
Labrus merula	-	-	-	1 (320)	-	2 (656)	-
Symphodus cinereus	-	-	1 (10)	-	-	-	-
Symphodus mediterraneus	-	1 (14)	-	-	-	-	-
Symphodus ocellatus	-	-	1 (12)	1 (10)	-	-	-
Symphodus tinca	1 (104)	1 (166)	30 (3878)	12 (1518)	-	6 (682)	5 (526)
Sarda sarda	-	-	1 (2015)	-	-	-	-
Scomber japonicus	3 (480)		-	11 (2548)	-	-	-

Table 10. Cont'd

Island	Grgur			Goli			
Station	T-9	T-10	T-11	T-12	T-13	T-14	T-15
Taxon	N (W)	N (W)	N (W)	N (W)	N (W)	N (W)	N (W)
Trachinus draco	-	1 (28)	-	-	-	-	-
Trachinus radiatus		-	-	1 (192)	-	-	-
Uranoscopus scaber	13 (1070)	14 (2231)	2 (376)	4 (1128)	-	1 (284)	6 (1038)
Monochirus hispidus	-	-	1 (26)	-	-	-	-
Synapturichthys kleinii	2 (350)	-	-	-	-	-	-
Total Pisces	75 (7798)	45 (7041)	75 (13040)	49 (8532)	39 (6110)	34 (8493)	64 (7707)
CEPHALOPODA							
Sepia officinalis	1 (130)	-	-	-	-	-	-
Octopus vulgaris	4 (6495)	-	1 (1970)	-	-	-	-
Total Cephalopoda	5 (6625)	-	1 (1970)	-	-	-	-
CRUSTACEA							
Homarus gammarus	-	-	1 (504)	-	-	-	-
Scyllarus arctus	-	-	6 (216)	2 (88)	1 (30)	6 (246)	4 (146)
Galathea strigosa	-	-	-	-	1 (46)	1 (48)	1 (64)
Munida rugosa	-	-	-	-	-	-	2 (49)
Liocarcinus corrugatus	-	-	-	-		-	1 (24)
Liocarcinus depurator	-	-	-	-	11 (215)	-	-
Total Crustacea	-	-	7 (720)	2 (88)	13 (291)	7 (294)	8 (283)
TOTAL	80 (14423)	45 (7041)	83 (15730)	51 (8620)	52 (6401)	41 (8787)	72 (7990)

Table 11. Number of specimens and wet weight (g) of species caught by bottom trammel sets at Prvić Island

Station	T-1	T-2	T-3	T-4	T-5	T-6	T-7	T-8
Taxon	N (W)	N (W)	N (W)	N (W)	N (W)	N (W)	N (W)	N (W)
PISCES								
Scyliorhinus canicula	-	-	-	1 (226)	-	-	-	-
Raja montagui	-	-	-	-	1 (222)	-	-	-
Torpedo marmorata	1 (438)	-	-	-	-	-	-	-
Myliobatis aquila	-	-	-	-	1 (658)	-	-	-
Trisopterus minutus	-	-	-	2 (201)	-	-	-	1 (162)
Merluccius merluccius	-	1 (634)	-	2 (634)	6 (2406)	-	-	1 (546)
Zeus faber	3 (568)	-	-	1 (42)	1 (770)	-	-	1 (502)
Chelidonichthys lastoviza	1 (142)	-	2 (548)	5 (1122)	4 (1348)	-	-	3 (606)
Scorpaena notata	-	1 (98)	-	5 (306)	-	-	-	16 (1127)
Scorpaena porcus	85 (12422)	25 (2764)	21 (3408)	47 (6328)	159 (18007)	67 (6402)	48 (5823)	34 (3186)
Scorpaena scrofa	-	-	2 (984)	3 (2830)	-	1 (88)	-	4 (3269)
Serranus cabrilla	-	1 (110)	4 (852)	1 (146)	-	1 (168)	1 (182)	8 (1224)
Serranus hepatus	-	-	-	-	-	-	-	1 (12)
Serranus scriba	17 (2474)	8 (1054)	-	2 (302)	2 (220)	2 (226)	7 (698)	2 (230)
Boops boops	-	1 (74)	-	-	-	-	-	-
Dentex dentex	-	1 (1095)	-	-	1 (602)	-	-	1 (1420)
Diplodus annularis	15 (786)	6 (285)	-	-	-	1 (48)	5 (212)	1 (50)

Table 11. Cont'd

Station Taxon	T-1 N (W)	T-2 N (W)	T-3 N (W)	T-4 N (W)	T-5 N (W)	T-6 N (W)	T-7 N (W)	T-8 N (W)
Diplodus vulgaris	1 (62)	-	1 (156)	-	-	-	-	2 (522)
Oblada melanura	3 (276)	-	-	-	-	-	-	-
Pagellus acarne	-	1 (114)	-	-	2 (190)	-	-	-
Pagellus erythrinus	2 (238)	5 (812)	11 (1458)	13 (2361)	8 (1306)	4 (594)	2 (200)	1 (302)
Pagrus pagrus	-	-	1 (118)	-	-	-	-	-
Chromis chromis	1 (26)	-	-	-	-	1 (8)	-	-
Mullus barbatus	-	-	1(90)	-	1 (104)	-	-	-
Mullus surmuletus	13 (2042)	1 (144)	-	1 (166)	6 (1276)	1 (214)	2 (376)	-
Spicara maena	2 (244)	1 (76)	-	9 (1119)	-	2 (290)	3 (344)	2 (229)
Spicara smaris	-	-	-	-	1 (18)	-	-	-
Trachurus trachurus	-	-	-	-	-	-	-	1 (154)
Coris julis	-	-	-	-	-	3 (226)	-	1 (25)
Labrus merula	2 (352)	4 (1270)	-	-	-	1 (314)	1 (624)	-
Symphodus ocellatus	-	-	-	-	-	-	1 (10)	-
Symphodus tinca	38 (4360)	3 (612)	-	-	1 (272)	2 (180)	14 (1416)	4 (358)
Trachinus draco	-	-	-	-	1 (38)	-	-	-
Trachinus radiatus	-	-	2 (440)	-	1 (266)	-	-	-
Uranoscopus scaber	6 (1080)	8 (1526)	7 (1098)	1 (454)	34 (6888)	4 (776)	2 (310)	2 (342)
Arnoglossus laterna	-	-	1 (12)	-	-	-	-	-
Arnoglossus thori	-	-	1 (12)	-	1 (28)	1 (30)	-	-
Zeugopterus regius	-	-	-	1 (32)	-	-	1 (18)	-
Buglossidium luteum	-	-	-	-	2 (46)	-	-	-
Monochirus hispidus	-	1 (50)	-	-	-	-	-	1 (20)
Synapturichthys kleinii	-	-	-	-	2 (614)	-	-	-
Total Pisces	190 (25510)	68 (10718)	54 (9176)	94 (16269)	235 (35279)	91 (9564)	87 (10213)	87 (14286)
CEPHALOPODA								
Sepia officinalis	1 (148)	1 (550)	-	-	2 (402)	2 (384)	-	-
Octopus vulgaris	2 (3930)	2 (5170)	-	-	2 (2150)	4 (6643)	-	3 (4335)
Total Cephalopoda	3 (4078)	3 (5720)	-	-	4 (2552)	6 (7027)	-	3 (4335)
CRUSTACEA								
Homarus gammarus	-	1 (2250)	-	-	-	-	-	-
Scyllarus arctus	1 (36)	3 (142)	-	-	-	5 (166)	-	24 (915)
Galathea strigosa	-	-	-	-	-	-	-	9 (471)
Munida rugosa	-	-	-	-	-	-	-	8 (192)
Liocarcinus corrugatus	-	-	-	-	1 (106)	-	-	-
Dromia personata	-	-	-	-	-	-	-	2 (288)
Total Crustacea	1 (36)	4 (2392)	-	-	1 (106)	5 (166)	-	43 (1870)
TOTAL	194 (29624)	75 (18830)	54 (9176)	94 (16269)	240 (37937)	102 (16757)	87 (10213)	133 (20491)
Total nets	10	10	15	13	15	10	10	10
Catch per net	19.4 (2962)	7.5 (1883)	3.6 (612)	7.2 (1252)	16.0 (2529)	10.2 (1676)	8.7 (1021)	13.3 (2049)

Table 12. Species composition of bottom trammel net catches at 15 sites surveyed during the end of spring (June) or summer (July/August) 1997

Taxon	N	%	Length (Lt) (cm) Range	Length (Lt) (cm) $\bar{x} \pm$ SD	Wet weight (g) Total	%	Range	$\bar{x} \pm$ SD
PISCES								
Scyliorhinus canicula (Linnaeus, 1758)	5	-	40.7 - 48.8	44.0 ± 3.17	1360	-	190 - 364	272.0 ± 71.18
Raja montagui Fowler, 1910	1	-	37.2	—	222	-	—	—
Torpedo marmorata Risso, 1810	2	-	28.6 - 30.8	29.7 ± 1.56	1002	-	438 - 564	501.0 ± 89.10
Myliobatis aquila (Linnaeus, 1758)	1	-	76.7	—	658	-	—	—
Trisopterus minutus (Linnaeus, 1758)	8	-	17.1 - 25.7	22.4 ± 2.86	1032	-	84 - 162	129.0 ± 31.21
Merluccius merluccius (Linnaeus, 1758)	12	-	20.3 - 46.4	35.8 ± 8.39	4838	2.1	72 - 88.6	403.2 ± 245.91
Zeus faber Linnaeus, 1758	6	-	12.9 - 36.9	24 ± 10.72	1882	-	36 - 770	313.7 ± 312.74
Chelidonichthys lastoviza (Bonnaterre, 1788)	21	1.5	20.9 - 39.2	28.8 ± 5.26	5888	2.6	106 - 678	280.4 ± 160.36
Scorpaena notata Rafinesque, 1810	34	2.4	9.2 - 19.3	15.5 ± 1.96	2401	1.1	16 - 138	70.6 ± 26.44
Scorpaena porcus Linnaeus, 1758	607	43.2	10.3 - 31.3	17.7 ± 3.35	70275	30.8	18 - 666	115.8 ± 82.01
Scorpaena scrofa Linnaeus, 1758	19	1.4	15.6 - 45.7	31.9 ± 8.85	14233	6.2	79 - 1780	749.1 ± 513.02
Serranus cabrilla (Linnaeus, 1758)	24	1.7	18.0 - 29.9	23.7 ± 2.82	3914	1.7	90 - 306	163.1 ± 56.41
Serranus hepatus (Linnaeus, 1758)	3	-	7.8 - 9.7	8.7 ± 0.95	32	-	8 - 12	10.7 ± 2.31
Serranus scriba (Linnaeus, 1758)	57	4.1	14.7 - 24.3	20. 6 ± 1.91	7243	3.2	36 - 230	127.1 ± 39.38
Boops boops (Linnaeus, 1758)	7	-	21.3 - 29.2	24.0 ± 2.70	846	-	74 - 202	120.9 ± 43.33
Dentex dentex (Linnaeus, 1758)	5	-	35.9 - 49.2	42.7 ± 5.15	5063	2.2	602 - 1420	1012.6 ± 324.85
Diplodus annularis (Linnaeus, 1758)	32	2.3	11.6 - 17.1	14.6 ± 1.02	1565	-	26 - 76	48.9 ± 9.94
Diplodus vulgaris (G. Saint-Hilaire, 1817)	7	-	15.0 - 28.7	21.9 ± 4.30	1274	-	62 - 404	182.0 ± 111.56
Oblada melanura (Linnaeus, 1758)	3	-	18.7 – 28.0	22.1 ± 5.11	376	-	84 - 208	125.3 ± 71.59
Pagellus acarne (Risso, 1827)	5	-	19.5 - 20.9	20.3 ± 0.58	522	-	94 - 114	104.4 ± 9.53
Pagellus erythrinus (Linnaeus, 1758)	74	5.3	8.9 - 33.8	22.3 ± 4.33	10441	4.6	8 - 508	141.1 ± 84.93
Pagrus pagrus (Linnaeus, 1758)	1	-	20.8	—	118	-	—	—
Chromis chromis (Linnaeus, 1758)	2	-	8.4 - 11.1	9.8 ± 1.91	34	-	8 - 26	17.0 ± 12.73
Mullus barbatus Linnaeus, 1758	24	1.7	16.3 - 25.4	21.5 ± 2.17	2687	1.2	38 - 180	112 ± 31.60
Mullus surmuletus Linnaeus, 1758	24	1.7	22.1 - 26.5	24.1 ± 1.29	4218	1.8	134 - 254	175.8 ± 34.89
Spicara maena (Linnaeus, 1758)	20	1.4	18.2 - 26.0	21.1 ± 1.64	2422	1.1	76 - 162	121.1 ±1 9.17
Spicara smaris (Linnaeus, 1758)	1	-	12.7	—	18	-	—	—
Trachurus mediterraneus (Steindachner, 1868)	2	-	29.7 - 32.1	30.9 ± 1.70	442	-	214 - 228	221.0 ± 9.90
Trachurus trachurus (Linnaeus, 1758)	1	-	26.3	—	154	-	—	—
Acantholabrus palloni (Risso, 1810)	1	-	21.0	—	122	-	—	—
Coris julis (Linnaeus, 1758)	6	-	13.7 - 20.7	17.1 ± 3.01	299	-	16 - 96	49.8 ± 33.33
Labrus merula Linnaeus, 1758	11	-	21.4 - 35.4	27.3 ± 4.31	3536	1.5	134 - 624	321.5 ± 149.27
Symphodus cinereus (Bonnaterre, 1788)	1	-	8.5	—	10	-	—	—
Symphodus mediterraneus (Linnaeus, 1758)	1	-	11.2	—	14	-	—	—
Symphodus ocellatus (Forsskål, 1775)	3	-	9.3 - 10.5	9.9 ± 0.60	32	-	10 - 12	10.7 ± 1.15
Symphodus tinca (Linnaeus, 1758)	117	8.3	17.3 - 33.1	21.4 ± 3.14	14072	6.2	52 - 390	120.3 ± 57.62
Sarda sarda (Bloch, 1793)	1	-	58.6	—	2015	-	—	—
Scomber japonicus Houtuyn, 1782	14	1.0	26.9 - 32.6	30.2 ± 1.85	3028	1.3	140 – 280	216.3 ± 45.52
Trachinus draco Linnaeus, 1758	2	-	15.7 - 17.9	16.8 ± 1.56	66	-	28 - 38	33.0 ± 7.07
Trachinus radiatus Cuvier, 1829	4	-	19.4 - 33.3	27.7 ± 6.31	898	-	74 – 366	224 ± 123.09
Uranoscopus scaber Linnaeus, 1758	104	7.4	13.4 – 36.0	21.9 ± 3.91	18701	8.2	34 - 562	179.8 ± 102.81
Arnoglossus laterna (Walbaum, 1792)	1	-	10.9	—	12	-	—	—

Table 12. Cont'd

Taxon	N	%	Length (Lt) (cm)		Wet weight (g)			
			Range	$\bar{x}$ ± SD	Total	%	Range	$\bar{x}$ ± SD
PISCES								
Arnoglossus thori Kyle, 1913	3	-	10.6 - 14.4	13.0 ± 2.06	70	-	12 - 30	23.3 ± 9.87
Zeugopterus regius (Bonnaterre, 1788)	2	-	10.9 - 11.9	11.4 ± 0.71	50	-	18 – 32	25.0 ± 9.90
Buglossidium luteum (Risso, 1810)	2	-	12.8 - 12.9	12.9 ± 0.07	46	-	22 - 24	23.0 ± 1.41
Monochirus hispidus Rafinesque, 1814	3	-	11.1 - 13.8	12.4 ± 1.36	96	-	20 – 50	32.0 ± 15.87
Synapturichthys kleinii (Risso, 1827)	4	-	20.4 - 35.9	29.6 ± 6.57	964	-	60 - 362	241± 29.01
Total	1287	91.7			189736	83.1		
CEPHALOPODA								
Sepia officinalis Linnaeus, 1758	7	-	10.3 - 17.5	12.6 ± 2.43	1614	-	130 - 550	230.6 ± 147.93
Octopus vulgaris Cuvier, 1797	18	1.3	—	—	30693	13.4	850 - 2670	1705.2 ± 563.26
Total	25	1.8			32307	14.2		
CRUSTACEA								
Homarus gammarus (Linnaeus, 1758)	2	-	29.1 - 44.5	36.8 ± 10.89	2754	1.2	504 - 2250	1377 ± 1234.61
Scyllarus arctus (Linnaeus, 1758)	52	3.7	9.9 - 13.8	11.6 ± 0.92	1985	-	22 - 62	38.2 ± 9.89
Galathea stringosa (Linnaeus, 1758)	12	-	9.2 - 11.2	10.3 ± 0.68	633	-	37 - 64	52.8 ± 7.71
Munida rugosa (Fabricius, 1775)	10	-	8.0 - 8.8	8.6 ± 0.29	241	-	18 - 30	24.1 ± 3.31
Liocarcinus corrugatus (Pennant, 1777)	2	-	3.1 - 5.4	4.3 ± 1.63	130	-	24 - 106	65.0 ± 57.98
Liocarcinus depurator (Linnaeus, 1758)	11	-	3.1 - 3.8	3.4 ± 0.18	215	-	17 - 23	19.6 ± 1.92
Dromia personata (Linnaeus, 1758)	2	-	5.4 - 8.6	7.0 ± 2.26	288	-	58 - 230	144 ± 121.62
Total	91	6.5			6242	2.7		
TOTAL	1403	100			228285	100		
Total nets	163				163			
Catch per net	8.6				1400.5			

Most fish species have an epibenthic (37%) or hyperbenthic (35%) mode of life. About 19% are cryptic, seeking shelter in limestone rock cracks (e.g., *Conger conger*), shellfish borings (Blenniidae, Tripterygiidae, and Gobiidae), niches under loose stones (Gobiesocidae), or sandy deposits (Scophthalmidae, Bothidae, and Soleidae). Occasionally, four benthopelagic and four pelagic species (4.2% each) were caught by a single trammel bottom set.

Carnivores dominated fish assemblages with 82 species (85%) of which 30 (37%) were microphagic, 28 (34%) were mesophagic, and 24 (29%) were macrophagic. Low numbers of herbivores (*Sarpa salpa* and three Blenniid species), omnivores (two Gobiids and seven Blenniids), and detritivores (*Oedachilus labeo*) were expected.

DISCUSSION

Biodiversity

The aim of this study was to survey the Senj Archipelago by making a diving census based on rapid visual identification of flora and fauna (BIANCHI *et al.*, 2004; GAMBI & DAPPIANO, 2004). However, many species are not active in daytime. Such individuals may be concealed in the sediment, under loose stones, in organic clumps or algae turf, etc. Field surveys and the desire to promptly present results are reflected by the "roughness" of the data since only easily identifiable macroflora and macrofauna can be censused (JAKLIN, 1998). Small and concealed organisms usually escape the attention of divers. The lack of a quantitative collection of biological material and the detailed and time-consuming processing of material in the laboratory became evident by comparing the our results, which were obtained from only one survey per transect, with detailed analyses of collections at Prvić Island undertaken by NOVOSEL *et al.* (2002). About half the species recorded by them were Porifera and Bryozoa, i.e., 'difficult and time-consuming' taxa that require a well-trained specialist for field recognition. Therefore, in view of the time-consuming process, we intentionally paid minor attention to these taxa.

Rapid scuba diving prospection was used many times in scientific and applied research in the eastern Adriatic, especially in pollution, fisheries, and coastal management projects. More or less detailed descriptions of diving research sites or transects are presented in project reports. But such data only rarely appear in professional scientific literature and theses (ŠIMUNOVIĆ & ANTOLIĆ, 1980; ZAVODNIK *et al.*, 1981, 2000; SENEŠ, 1988, 1989; BELAMARIĆ & ŠERMAN, 1989; TURK & VUKOVIČ, 1994; OREPIĆ *et al.*, 1997; KRUŽIĆ, 2001; NOVOSEL *et al.*, 2002).

In the Senj Archipelago, most characteristic sublittoral benthic communities in shallow water to 50 m are biocoenoses of infralittoral algae and coralligenous, represented by a precoralligenous facies and its typical climax stage (PÉRÈS & PICARD, 1964; HARMELIN, 1994). Spatial distribution of these communities is conditioned by climatic and edaphic environmental factors such as depth, type and quality of sea bed, water transparency, habitat isolation, and hydrodynamic and sedimentation conditions (PÉRÈS & PICARD, 1964; RIEDL, 1966; PÉRÈS, 1967; BELLAN-SANTINI, 1969).

For the most part, the Senj Archipelago is built of Cretaceous limestones. Tectonic movements and strong karstification in the geologic past resulted in current geomorphologic features (BENAC, 1996; JURAČIĆ *et al.*, 1999). The area was flooded by the sea after the last (Würm) glaciation, 6,000-10,000 years ago (ŠEGOTA, 1982; BENAC & JURAČIĆ, 1998), and extremely turbulent hydrodynamics generated by storm winds reduced recent sedimentation processes in shallow water environments. Deep narrow valleys between ancient hills and mountain peaks were partly filled by Holocene landborn deposits (ALFIREVIĆ, 1964; BENAC *et al.*, 2000). Karstic phenomena formed before the transgression are well preserved. The resulting underwater relief of the area features steep bedrock, sedimentary slopes, cliffs, and submerged walls that descend from 100 m above sea level to a depth of over 50 m.

The archipelago is characterized by submerged tidal notches, compact bedrock, and ledges around islands, islets, and rocks. The configuration of the shores and undersea landscape is reflected in the principal features of the rocky area: it is narrow horizontally but very high vertically. There are rocky overhangs or tidal notches along the shores of the islands at a depth of 0.5-1 m (BENAC *et al.*, 2004), formed by marine abrasion and bioerosion (TORUNSKI, 1979; SCHNEIDER & TORUNSKI, 1983). LORENZ (1863:300) estimated that about half of the calcareous rock in the Kvarner region was destroyed by date shell (*Lithophaga lithophaga*) borings. KLEEMANN (1973) suggested that the date shell boring rate, determined by the texture of the carbonate rock, ranged 4.3-12.9 mm/y. Bioerosion of the littoral rocks at low energy sites along the western coast of the Istrian peninsula, especially in the Rovinj environs, is about 0.1-1.1 mm/y (SCHNEIDER, 1976). Presumably, the destruction rate of rocks at high energy sites is even greater.

Geomorphologic and sedimentary features, together with stress hydrodynamics, determine in the distribution pattern of benthic communities. For example, the general lack of shallow water, sandy and sandy-muddy deposit plains, and slightly inclined slopes are reflected in the scarcity of marine phanerogams beds, especially *Cymodocea nodosa* meadows. This seagrass occurred at only two moderately sheltered sites at Sv. Grgur Island. No *Zostera* meadows at all were detected.

RAC & LOVRIĆ (2002) suggested that strong hydrodynamics is the most important factor determining the spatial distribution of marine phanerogams. The coastal rocks at station GR-38 are extremely exposed to sea surf and waves generated by the stormy bora wind. All three chthamalid barnacles were recorded there, *Euraphia depressa, Chthamalus montagui*, and *C. stellatus*, so intermixed with periwinkle (*Melaraphe neritoides*) and limpet (*Patella rustica*) that the limit between the mediolittoral and supralittoral communities could only be approximated by the occurrence of beadlet anemone (*Actinia equina*) and *Phymatolithon lenormandii* incrustations. *Lithophyllum tortuosum* appeared as cushion-shaped swellings similar to those described in the eastern Mediterranean (ZIMMERMANN, 1982). No large sideward growing "trottoir" constructions, as recorded in the western Mediterranean (PÉRÈS & PICARD, 1952, 1964), were seen.

Shaded overhangs, ledges, and vertical cliffs are not a favorable environment for well- developed settlements of infralittoral photophilous algae, especially *Cystoseira* and *Sargassum* associations. Thus, the general lack of gently sloping bedrock and strong hydrodynamics are the prime factors that neutralize spatial expansion of seaweeds. Algae settlements were depressed at high energy sites exposed to bora winds, i.e., they had a low cover rate and seaweed biomass. On the contrary, the morphology of the sea bottom, the low sedimentation rate, and the transparent unpolluted water allowed optimum development of the coralligenous biocoenosis. The area is very rich in most taxa characteristic of this community (PÉRÈS & PICARD, 1964). Its precoralligenous aspect occurred everywhere from shaded shallow water overhangs, bedrock, and boulder ridges to depths of over 20 m.

The destructive action of waves generated by storm winds is well expressed in the upper infralittoral zone of cliffs at the northeastern shores of islands and rocks. The phenomenon is especially evident by the strong depression or total absence of photophilous algae in the biocoenosis most characteristic to the upper infralittoral rocky bottom throughout the Mediterranean (PÉRÈS & PICARD, 1964; PÉRÈS, 1967; BELLAN-SANTINI *et al.*, 1994) and Adriatic (PÉRÈS & GAMULIN-BRIDA, 1973).

LORENZ (1863) discovered variations in the spatial distribution of shallow water benthic communities in the Kvarner region 140 years ago. He supposed that the main reasons for the phenomenon were the type of bottom (bedrock and deposits) and the exposure to destructive waves generated by storm winds. The greatest variations were in the supralittoral, mediolittoral, and upper infralittoral zones. Much later, ZALOKAR (1942) studied shallow rocky bottom communities along the mainland coast facing the Senj Archipelago. Skin diving and a simple diving device (KUŠČER, 1963b) enabled the author to introduce a quantitative abundance-dominance method to marine research that had been developed and standardized in land phytocoenology (BRAUN-BLANQUET, 1964).

A modern approach to land and marine phytocoenology was applied in the Senj Archipelago by LOVRIĆ (1976a, 1978) but the synecology of rocky shore fauna had never been studied in detail. Our results show that coastal populations in this area widely conform to those described in the western Mediterranean (PÉRÈS & PICARD, 1964; PÉRÈS, 1967; GARCÍA RASO *et al.*, 1992; BELLAN-SANTINI *et al.*, 1994) and other areas of the Adriatic (HUVÉ *et al.*, 1963; GAMULIN-BRIDA, 1967, 1979; PÉRÈS & GAMULIN-BRIDA, 1973; ZAVODNIK & ZAVODNIK, 1982, 1986; OREPIĆ *et al.*, 1997). As suggested long ago (ERCEGOVIĆ, 1934; ZEI, 1955), the width and/or height of a littoral s. str. zone, indicated by the distribution pattern of the marine organisms, depends on the incline of the rocky support and energy characteristics of the site and microhabitat. We found an identical distribution pattern in the coralligenous biocoenosis: a typical coralligène of the wall (PÉRÈS & PICARD, 1964) and very steep compact bedrock that was much higher than wide.

A gently sloping sedimentary bottom of sand and gravel rarely occurs in the Senj Archipelago. The inadequate deposit may be one reason for the apparent scarcity of seagrass meadows. Although *Posidonia oceanica* beds are far more characteristic to the central and southern parts of the eastern Adriatic (GAMULIN-BRIDA, 1967), they have been recorded in areas adjacent to the Senj Archipelago. *Posidonia* was recorded at the sea surface at Lošinj and Unije Islands (ZAVODNIK, 1992) and small meadows were recorded at a few meters depth at Rab and Pag Islands and in Rijeka Bay (LEGAC, 1974; ZAVODNIK *et al.*, 1981). In the present study, however, *Posidonia* nowhere occurred shallower than 3 m, perhaps due to uprooting of seagrass stems by storm waves (LOVRIĆ *et al.*, 1998). Well-developed *P. oceanica* beds were recorded at only two stations, GR-20 and 36, but for reasons explained above were not studied in detail. Visually, flora and fauna compositions of these beds largely conformed to those reported for other Adriatic areas (ZEI, 1962; ŠPAN *et al.*, 1989; ANTOLIĆ, 1994; Authors, unpubl.).

Cymodocea nodosa is a widely distributed seagrass in the north Adriatic, especially along the shallow west Istrian coast (ZAVODNIK, 1983; ZAVODNIK & JAKLIN, 1990) and at Krk and Rab Islands (LEGAC, 1974; GAMULIN-BRIDA *et al.*, 1980; ZAVODNIK *et al.*, 1981; JAKLIN & ARKO-PIJEVAC, 1994, 1997). We detected small meadows of this seagrass only at stations GR-3 and 32, both of which are located on the western side of Sv. Grgur Island in low energy areas sheltered from destructive influences of the bora wind. Both sites have adequate shallow water and a gently sloping sandy deposit. Contrary to LOVRIĆ *et al.* (1989), the spatial and depth distribution of seagrasses in the research area may be defined more by geomorphologic and sediment properties of the sea bottom than extreme hydrodynamic conditions generated by meteorological, i.e. wind, agents. On the other hand, our research agrees with GAMULIN-BRIDA (1968) that, in northern Adriatic channels, the upper limit of the circalittoral zone is as shallow as 20 m due to water movements generated by winds. Similar displacements in turbid environments of coralligenous assemblages were well noted in the western Mediterranean (HARMELIN, 1994).

The input of a large amount of food brought by steady water currents (RIEDL, 1964; SEKULIĆ & LOVRIĆ, 1987) and waves probably aided the formation of reeflike structures of the coral *Cladocora caespitosa* at Šilo Cape (station GR-24). Similar reefs at sites with rapid water drift were reported elsewhere in the Adriatic: at Sorinj Cape and Rab Island (LEGAC, pers. comm.), in the Rabac environs (ZAVODNIK & VIDAKOVIĆ, 1982), at Ljubački Cove (KRUŽIĆ, 2001), and in the Mljet National Park (KRUŽIĆ, 2001; KRUŽIĆ & POŽAR-DOMAC, 2002; KRUŽIĆ *et al.*, 2002). In accordance with CHOMSKY *et al.* (2004), the exceptionally large littoral limpet (*Patella rustica*) and beadlet anemone (*Actinia equina*) at stations GR-19 and GR-34 can be explained by plentiful food input. Further evidence of favorable effects of continuous water movement is the abundance of sessile suspension feeders, especially sponges, octocorallians (*Alcyonium acaule*, *Eunicella* spp.), and bryozoans.

Turbidity and the sedimentation rate are the main edaphic agents that determine the spatial distribution of benthic assemblages (PÉRÈS, 1961; RIEDL, 1964; GAMULIN-BRIDA, 1968). Our results do not unconditionally support the modelling approach to identification and distribution of benthic communities by means of neural networks and consideration of many variables concerning habitats (BAKRAN-PETRICIOLI *et al*., 2005). For example, on the northern coast of Goli Island (station GR-19), divers noted no trace of a large *P. oceanica* meadow as predicted by BAKRAN-PETRICIOLI *et al.* Further, instead of the predicted coralligenous bottom, our bottom grab samplings at stations 105/1, 106/1, 106/2, and 303/3 east of Goli Island revealed a common silted sandy deposit mixed with organogenic detritus and inhabited by pelophilous species at most.

The classic depth zonation of benthic communities was inverse at many sites due to the rocky shore, the shallow water sea bed, and the insolation of microhabitats. For example, many sciaphilous organisms affiliated with the precoralligenous facies of the coralligenous biocoenosis occurred at depths shallower than assemblages of photophilous algae in the upper infralittoral zone, i.e., in submerged tidal notches (BENAC *et al*., 2004). Thus, an overall mixture of photophilous and sciaphilous organisms was quite common, especially in algae taxa. A similar dependence of benthic communities on solar radiation occurs in the western Mediterranean (MARINOPOULOS, 1989).

The spatially mixed soft bottom communities were evidenced at some sites by the presence of species characteristic to the coastal terrigenous ooze biocoenosis (Fig. 4) as well as the bathyal silt biocoenosis. Such a mixing of species was well noted in the Mediterranean (CARPINE, 1970; VAMVAKAS, 1970). The most important factors for the distribution of larvae are the relatively great depth (80-100 m) and steady current. Species assemble in a dynamic equilibrium of communities. This mixed community (not transitional; ZAVODNIK, 1979b), described as "the biocoenosis *Nephrops norvegicus-Thenea muricata*" (GAMULIN-BRIDA, 1965) or "the biocoenosis of muddy bottoms of the open central Adriatic and of the insular zone of the northern Adriatic" (GAMULIN-BRIDA, 1967), is a typical habitat and fishing ground of the Norway lobster (*Nephrops norvegicus*; KARLOVAC, 1953; JUKIĆ, 1974; ŽUPANOVIĆ & JARDAS, 1989).

A mixture of algae associations and gorgonian colonies at 20-36 m was recorded 140 years ago in the Kvarner area (LORENZ, 1863:321). The author sampled biological material with a common fisheries dredge before scientific diving techniques were developed (RIEDL, 1966). The interspersed character of the algal coenoses was a secondary effect of strong hydrodynamics, sea temperatures lowered by submarine springs, and upwellings generated by storm winds (LOVRIĆ *et al*., 1998). These conditions were reflected in the spatial distribution of neritic and oceanic seaweed taxa and phytocoenoses (LOVRIĆ & LOVRIĆ, 1985; SEKULIĆ & LOVRIĆ, 1987; LOVRIĆ *et al*., 1989; LOVRIĆ & SEKULIĆ, 1991). The Senj Archipelago is a special ecological unit (RAC & LOVRIĆ, 1998) where destructive waves limit the upper border of seagrass meadows (LOVRIĆ *et al.*, 1998). A similar phenomenon has not yet been documented in the zoological realm although our results and reports by FIELD (1922) and HOSOMI (1977) indicate that heavy storms have harmful effects on shore mussel (*Mytilus edulis* and *M. galloprovincialis*) assemblages.

The coralligenous biocoenosis was poorly studied in the past because of technically limited diving equipment (NIKOLIĆ, 1958). While precoralligenous populations in tidal notches below subvertical overheads were surveyed by skin diving, the typical (i.e., climax) stage of the coralligenous biocoenosis that occurs along steep bedrock slopes and deep underwater walls could not be studied in detail until a modern scientific scuba diving method was developed half a century ago (RIEDL, 1954, 1963, 1966). Scuba research has been promoted by taxonomic interest in the Senj Archipelago and Prvić Island (ZIBROWIUS & GRIESHABER, 1977; LOGAN, 1979; SVOBODA, 1979). Photographs of marine organisms taken at Prvić and Sv. Grgur Islands have been published elsewhere (RIEDL, 1966; SVOBODA, 1979; ZAVODNIK & ŠIMUNOVIĆ, 1997).

Our scuba diving method, bottom trammel net catches, and preliminary bottom grab samplings indicate that the benthic marine fauna in the Senj Archipelago largely conforms with the fauna at other northern Adriatic sites (VATOVA, 1928; MATJAŠIČ & ŠTIRN, 1975; ZAVODNIK & KOVAČIĆ, 2000). Only one species endemic to the Adriatic fauna (*Polycitor adriaticus*) and a few species rarely noted in the north Adriatic (*Pilumnus vilosissimus, Echinocardium mortenseni, Raja montagui*, *Acantholabrus palloni*) were recorded during the present research. As far as we know, the sponges *Spongia agaricina* and *Spongia virgultosa* were not previously recorded in this part of the Adriatic. In addition to our taxonomic list, M. LEGAC (pers. comm.) collected the gastropode *Cyclope neritea* at station GR-03 and recorded *Loligo vulgaris* specimens in the area of GR-32. At the same site, I. LEGAC photographed clusters of *Loligo* eggs and *Scyliorhinus* egg capsules attached to a large *Axinella polypoides* sponge (ZAVODNIK & ŠIMUNOVIĆ, 1997:19).

Thanatocoenoses in deposit samples collected by bottom grab were not analyzed in detail. The great amount of subfossil *Turritella communis* shells (Table 4) could have indicated an overall mortality caused by predation, oxygen deficiency, or disease. However, predation can be eliminated since the shells were intact and had no injuries or perforations and, for reasons discussed above, the cause could not have been oxygen depletion in the near-bottom layer of the water column. Hence, the mortality was probably caused by an unknown disease epidemic. A similar mortality was recorded about half a century ago among Noah's ark (*Arca noae*) in the coastal sea of the western Istrian peninsula (HRS-BRENKO, 1974, 1980). Nearly all the subfossil *Turritella* shells were empty. A few shells were inhabited by cryptic sipuncula such as *Aspidosiphon muelleri* and *Onchnesoma steenstrupii* (Table 3). *Aspidosiphon* were recorded in about 4% of subfossil *Turritella* shells in the Velebit Channel, only 10 nautical miles away (MURINA & ZAVODNIK, 1979). The maximum inhabitation rates of sipuncula in *Turritella* shells in this area were recorded in the Gulf of Kvarner (57%; MURINA & ZAVODNIK, 1979) and Rijeka Bay (15%; ZAVODNIK, 1998).

The Senj Archipelago is not an important venue for commercial and game fishing but local fishermen from Baška and Krk Island have long caught sprat (*Sprattus sprattus*) around Prvić Island, especially at Sokol and Šilo Capes (BASIOLI, 1954). The ancient toponym 'tunêra' indicates that there was a tunny trap (in Croatian: 'tunara') in the Pećna cove area (station GR-35) at Prvić Island (LOVRIĆ, 1970), although neither FABER (1883), LORINI (1903), nor BASIOLI (1962, 1984) reported on any fishing gear of this type at Prvić Island. Newly spear fishers sporadically appear in the area during the tourist season.

Fish, cephalopod, and crustacean assemblages near Prvić, Sv. Grgur, and Goli Islands were not qualitatively or quantitatively analyzed until recently. Due to the unfavorable sea bottom relief and great depths, we were unable to perform bottom trammel net catch at sites influenced by the destructive effects of the bora wind. In catches from calmer sites, the most abundant families by biomass (wet weight) were Scorpaenidae, Octopodidae, Uranoscopidae, and Labridae (Table 12), very similar to the catch composition at other mainland coastal areas in the Adriatic (JARDAS, 1979, 1986; JARDAS & PALLAORO, 1989) but considerably different from the composition of bottom trammel net catches from offshore islands such as the Palagruža island group (JARDAS *et al.*, 1996; POŽAR-DOMAC *et al.*, 2000b). Our catch per effort values (CPU) are much higher than those established in other mainland coastal areas (POŽAR-DOMAC *et al.*, 1998; A. PALLAORO & I. JARDAS, unpubl.). Evaluation of the number of recorded species and CPU values suggest that the Senj Archipelago can be considered a relatively preserved fishing area. The main agent preventing intense fishing exploitation is the strong bora wind that blows an average 200 days per year (LOVRIĆ, 1971c).

Visual counts of fish by divers in the Adriatic are rare (KOVAČIĆ, 2002a). Despite the lack of exact quantitative data, results of the present research can be compared with reports on fish diversity in other areas. Species richness in the present research was slightly higher or similar to other visual counts in the north Adriatic (CASTELLARIN *et al.*, 2001; KOVAČIĆ, 2002a; LIPEJ *et al.*, 2003) due to the high number of Blenniid and Gobiid species. Species richness of coastal fish assemblages in the Senj Archipelago was superior to visual counts in other parts of the Adriatic (KOVAČIĆ, 2002a). The high energy factor most influences spatial distribution of benthic communities, especially assemblages of large seaweeds and seagrass meadows. Consequently, the occurrence and abundance of many fish species and their assemblages depend indirectly upon exposure of the habitat. Although the Senj Archipelago area, from qualitative and quantitative points of view, seems richer in fish than many other mainland and interior island areas of the eastern Adriatic, it has endured changes similar to those in neighboring areas (MOROVIĆ, 1965, 1971; JARDAS & PALLAORO, 1990; CETINIĆ & PALLAORO, 1993; JARDAS *et al.*, 1998; POŽAR-DOMAC *et al.*, 1998, 2000b; PALLAORO & JARDAS, unpubl.). The growing coastal exploitation, expressed by the decline of CPU, is the main cause of changes in assemblages of fish and edible invertebrates and the decrease in number, body length, and weight of many important and valued fish, cephalopods, and crustaceans.

Threats and conservation

The United Nations Mediterranean Action Plan (MAP) established a list of communities, associations and their facies, species, and areas to be included in national lists of areas to be protected (UNEP, 1999). Six benthic biocoenoses, comprising seven facies and associations and 15 species of marine flora and fauna, were listed in the coastal sea around Prvić, Sv. Grgur, and Goli Islands. Previous experience in the Mediterranean (BELLAN-SANTINI *et al.*, 1994; GALIL *et al.*, 1995; GALGANI *et al.*, 1996) shows that the most vulnerable assemblages are *Posidonia oceanica* beds because of environmental disturbance. Typical (i.e., climax) facies of the coralligenous biocoenosis and the biocoenosis of semi-dark caves are, in general, menaced by divers. Aesthetically, small beaches in the Samotvorac cape area (Prvić Island, station GR-22) are subject to the largest amount of anthropogenic litter, plastic and tar lumps being the largest components, indicating offshore origin.

The Krk City Assembly proclaimed Prvić Island, its coastal area, and the Grgur Channel a botanical and zoological reserve in 1972 (HRILJAC, 1972). Protected sea and undersea areas in Croatia are defined by statutory acts such as the Constitution Act of the Republic of Croatia, Declaration on Environmental Protection, Environmental Protection Act, Act on Preservation of Nature, etc. (RADOVIĆ, 1999). Special protection of the Senj Archipelago islands was suggested by the Spatial Plan of Primorsko-Goranska County. However, the form and degree of protection of marine environments depend on their condition before introduction of the protection program (LOVRIĆ, 1976c). The purpose of protection is to preserve highly valued flora and fauna and to restore species in risk. To achieve this, it is better to maintain a small area under a high degree of protection than a large area under a moderate protection regime. An effective example of this practice in Croatia is the Purara Islet, located within the borders of the Kornati National Park (BRALIĆ, 1990; GRUBELIĆ, 1997).

Because of menacing human activities such as overfishing, diving, damping, and pollution, a conservation program must preserve important benthic communities in the mediolittoral (i.e., tidal zone) to the circalittoral zones. One of the basics for establishment of "marine reserves", i.e. preserved areas of coastal seabeds, is the preservation of genetic resources and protection of endangered organisms including fish. The recovery of autochthonous fish assemblages is a main goal. Marine organisms at nonpolluted sites are most menaced by too intensive fishing and disturbance from maritime traffic, swimmers, spear fishers, and divers (BELLAN-SANTINI *et al*., 1994). Scuba diving has recently become a mass sport and a prosperous industry (VAN TREECK & SCHUHMACHER, 1998). Since the islands in this study are far from large tourist centers and have inaccessible rocky coasts, the impact of disturbance on fish assemblages is considerably less than the impact of fishing.

The effects of a marine reserve on the composition of fish assemblages can be checked only by complex scientific research prior to and during the years following the establishment of the reserve. Such research can prove whether the reserve area and protection measures were well chosen and consistently implemented. Mediterranean reserves (RAMADE & VICENTE, 1994), as in other parts of the world, were established and are maintained because of their favorable influence on marine flora and fauna.

Scientific research documenting changes in fish assemblages in protected areas is rare because the method of visual census was only recently developed and such research is very demanding. For data to be representative, a large amount of basic data is required, i.e., many days of research or many professional divers. Results of studies within a reserve are compared with results from outside areas or earlier studies within the reserve. Time is required to prepare data for presentation, adding to the complexity of multi-year research. Recent research produced a large data base at protected areas in the Mediterranean such as Park National de Port Cros (HARMELIN *et al.*, 1995) and Réserve Naturelle de Scandola (FRANCOUR, 1994) in France, Parque Natural de Cabo de Gata-Níjar in Spain (GARCÍA RASO *et al.*, 1992), and Parco Marina di Miramare (DE GIROLAMO *et al.*, 1999) and Riserva Marina di Ustica (VACCHI *et al.*, 1998; LA MESA & VACCHI, 1999) in Italy. Similar research has probably been conducted at other protected areas in the Mediterranean.

During the procedure of establishing protected areas, it is important to consider international categories to improve links between national and international systems. Bearing the above in mind, we renew our insistence that the Senj Archipelago be protected in the category of special marine reserves (RAMADE & VICENTE, 1994), i.e., marine parks (POŽAR-DOMAC *et al.*, 2000a). The park should encompass the maritime area including a minimum of 200 m from the shores of Prvić, Sv. Gurgur, and Goli Islands and the aquatorium between these islands (i.e., Grgur Channel). The park could be managed similar to the proposal for the Silba Marine Park (POŽAR-DOMAC *et al.*, 1998).

While tools and acts of protection refer exclusively to human activities, natural events, in principle, cannot be controlled by legal procedures. Thus, the Senj Archipelago benthos may suffer from vigorous hydro-meteorological conditions, phytoplankton blooms, and destructive alochthonous species. Periodic blooms of plankton and benthic microphyta have long been known in the northern part of Velebit Channel (PUCHER-PETKOVIĆ & MARASOVIĆ, 1984; DEGOBBIS *et al.*, 1995). Harmful effects of deposited mucous aggregates were noted in nearby Rijeka Bay (ZAVODNIK, 1977). Divers recorded an abundant coverage of mucuous aggregations in the thermocline layer at 12 m at station GR-24 in June 1995 and at 30 m at station GR-41 in September 1997. However, no mortality of benthic organisms was recorded and no lesions were detected in horny corals such as described by BAVESTRELLO & BOERO (1986) and MISTRI & CECCHERELLI (1997). Because it is a very dynamic marine environment, it cannot be anticipated that the Senj shallow water benthos might suffer oxygen depletion and overall mortality as frequently occurs in the shallow northern Adriatic Sea, especially in the Gulf of Triest and off the Istrian peninsula (PICCINETTI & MANFRIN, 1969; STACHOWITSCH, 1984, 1991; HRS-BRENKO *et al.*, 1992; ZAVODNIK *et al.*, 1994; ŠIMUNOVIĆ *et al.*, 1999; TRAVIZI, 2000; JAKLIN, 2002).

A recent unexpected threat to Adriatic infralittoral benthos was the green algae, *Caulerpa taxifolia* and *C. racemosa*, which were first recorded in this part of the Mediterranean only a few years ago. The nearest *C. taxifolia* settlements to the Senj Archipelago were located at Malinska in Rijeka Bay (28 km away) and in the Barbatski Channel at Rab Island (13 km; ZAVODNIK *et al*., 1998a,b, 2001; ŽULJEVIĆ *et al*., 1998). *Caulerpa racemosa* is much more invasive and recently became well distributed in the middle and southern Adriatic. It has not yet been recorded in the Kvarner area (ŽULJEVIĆ *et al*., 2003, 2004). The only north Adriatic settlement of this species was at Vrsar, a small town on the west Istrian coast (LJ. IVEŠA, pers. comm.). An invasion of these algae in the Senj Archipelago might be expected in the near future.

CONCLUSIONS

1.The diving method provides enough information to establish the state of the environment in coastal areas under control. Assessment of benthic fish assemblages is possible only through studies by divers and analyses of trammel bottom set catches.

2.The hard bottom communities of infralittoral seaweeds and coralligenous biocoenosis are the most characteristic in the studied coastal benthos ecosystem.

3.The extreme hydrodynamic regime in the Senj Archipelago contributes to a spatial mixture of coastal and shallow water populations characteristic of peculiar benthic communities.

4.Deep muddy deposits are occupied by the biocoenosis of coastal terrigenous ooze enriched by many species of the bathyal distribution. The community is most affiliated to the facies of *Turritella* which is distinctive in the northern part of the Kvarner insular region.

5.The Senj Archipelago is a domain of several marine species and benthic communities which, according to MAP, are protected in the Mediterranean. Special attention should be paid to eelgrass *Posidonia oceanica* assemblages and the biocoenosis of semi-dark caves.

6.The area is a well-preserved fishing area, i.e., not yet menaced by overfishing.

7.Due to its biodiversity, the Senj Archipelago is an appropriate area for protection within the category of marine (park) reserves.

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REFERENCES

ALFIREVIĆ, S. 1964. Sedimentološki pokrov kanalskog područja Jadrana i faktori koji uplivaju na njegovo formiranje (Sediment cover of the Adriatic channel part and factors which affect its forming). Acta Adriat., 11: 9-17.

ALFIREVIĆ, S. 1968. Results obtained by geological charting of trawling grounds in the channels of Northern Adriatic. Stud. Rev. gen. Fish. Coun. Medit., 37: 15-27.

ALFIREVIĆ, S. 1980. Sedimentološko kartiranje bentoskih biocenoza u kanalima sjeveroistočnog Jadrana (Sediment inventory of benthic biocoenoses in the channels of the North-eastern Adriatic). Geol. vjesnik, 32: 15-32.

ALFIREVIĆ, S., D. CRNKOVIĆ & H. GAMULIN-BRIDA. 1969. Problem racionalne eksploatacije škampa, *Nephrops norvegicus* (The problem of rational fishing of Norwegian lobster, *Nephrops norvegicus*). Thalassia Jugosl., 5: 5-12.

ANTOLIĆ, B. 1994. Floristički sastav i struktura zajednice posidonije, *Posidonia oceanica* (L.) Delile, u srednjem Jadranu (The floristic composition and structure of Posidonia commmunity, *Posidonia oceanica* (L.) Delile in the middle Adriatic). Ph.D. Thesis, University of Zagreb, 351 pp. + Tab. I-XXIII.

BAKRAN-PETRICIOLI, T., O. ANTONIČ, D. BUKOVEC, D. PETRICIOLI, I. JANEKOVIĆ, J. KRIŽAN, V. KUŠAN & S. DUJMOVIĆ. 2006. Modelling spatial distribution of the Croatian marine benthic habitats. Ecol. Model. 191 (1): 96-105.

BASIOLI, J. 1954. Baška. Ribarstvo (Baška, Krk Island, North Adriatic – Fisheries). Pomorska enciklopedija (1. izd.) (Maritime encyclopaedia, 1st edition). Leksikografski zavod FNRJ, Zagreb, 1: p.399.

BASIOLI, J. 1962. Tunolov na Jadranu (Tuna fishing in the Adriatic). Jadranski institut, Jugosl. Akad. zn. umjet., Zagreb, 187 pp.

BASIOLI, J. 1984. Ribarstvo na Jadranu (The fisheries of the Adriatic). Znanje, Zagreb, 323 pp.

BAVESTRELLO, G. & F. BOERO. 1986. Necrosi e rigenerazione in *Eunicella cavolinii* (Anthozoa, Cnidaria) in Mar Ligure (Necrosis and regeneration in *Eunicella cavolinii* (Anthozoa, Cnidaria) in the Ligurian Sea). Boll. Ist. biol. University of Genova, 52: 295-300.

BELAMARIĆ, J. & D. ŠERMAN. 1989. Ekološka studija podmorja Lokruma (Ecological study of the Lokrum Island submarine zone). In: Otok Lokrum (Lokrum Island), Hrv. Ekol. Društ., Zagreb. Ekološke monografije, 1: 361-411.

BELL, J. D. & M. L. HARMELIN-VIVIEN. 1983. Fish fauna of French Mediterranean *Posidonia oceanica* seagrass meadows. 2. Feeding habits. Téthys, 11: 1-14.

BELLAN, G. 1976. Contribution à l'étude des Annélides Polychètes de quelques fonds meubles circalittoraux des côtes Yougoslaves (Contribution to study of Polychaetous Annelids at various circalitoral soft bottoms along the Yugoslav coast). Thalassia Jugosl., 12: 391-397.

BELLAN-SANTINI, D. 1969. Contribution à l'étude des peuplements infralittoraux sur substrat rocheux (Contribution to study of infralittoral rocky substrate populations). Recl Trav. Stn mar. Endoume, 47 (63): 1-294.

BELLAN-SANTINI, D., J.-C. LACAZE & C. POIZAT. 1994. Les biocénoses marines et littorales de Méditerranée: Synthèse, menaces et perspectives (Marine and littoral communities in the Mediterranean: Synthesis, menaces and perspectives). Mus. natl. Hist. nat., Paris, Patrimoines naturels, 19: 246 pp.

BENAC, Č. 1996. Morfološka evolucija Riječkog zaljeva: utjecaj klimatskih i glacioeustatičkih promjena (Morfological evolution of the Rijeka Bay, North Adriatic: influence of climatic and glacioeustatic changes). Acta Geogr. Croat., 31: 69-84.

BENAC, Č. & M. JURAČIĆ. 1998. Geomorphological indicators of the sea-level changes during upper Pleistocene (Wuerm) and Holocene in the Kvarner region. Acta Geogr. Croat., 33: 27-45.

BENAC, Č., M. JURAČIĆ & T. BAKRAN-PETRICIOLI. 2004. Submerged tidal notches in the Rijeka Bay NE Adriatic Sea: indicators of relative sea-level change of recent tectonic movements. Mar. Geol., 212: 21-33.

BENAC, Č., M. JURAČIĆ & R. CRMARIĆ. 2000. Sedimenti u podmorju Kvarnera (The sediments in submarine zone of the Kvarner area, North Adriatic). Zbornik 2. Hrv. geol. kongr., 115-118.

BIANCHI, C. N., R. PRONZATO, R. CATTANEO-VIETTI, L. BENEDETTI CECCHI, C. MORRI, M. PANSINI, R. CHEMELLO, M. MILAZZO, S. FRASCHETTI, A. TERLIZZI, A. PEIRANO, E. SALVATI, F. BENZONI, B. CALCINA, C. CERRANO & G. BAVESTRELLO. 2004. Hard bottoms. In: M. C. Gambi & M. Dappiano (Editors), Mediterranean marine benthos: A manual of methods for its sampling and study. Biol. Mar. Medit., 11 (Suppl. 1): 185-215.

BOUDOURESQUE, C. F. 1971. Méthodes d'étude qualitative et quantitative du benthos (en particulier du phytobenthos) [Qualitative and quantitative methods in benthic studies (of phytobenthos in particular)]. Téthys, 3: 79-104.

BOUDOURESQUE, C. F., A. JEUDY DE GRISSAC & A. MEINESZ. 1985. Un nouveau type d'herbier à *Posidonia oceanica*: l'herbier de colline (A new type of *Posidonia oceanica* bed: a heap-like bed). Rapp. Comm. int. Mer Médit., 29 (5): 173-175.

BRALIĆ, I. 1990. Nacionalni parkovi Hrvatske (Croatian National parks). Školska knjiga, Zagreb, 160 pp.

BRAUN-BLANQUET, J. 1964. Pflanzensociologie (Plantsociology). Springer, Wien, Österreich. XIV + 865 pp.

BULJAN, M. & M. ZORE-ARMANDA. 1968. Aperçu historique sur les recherches hydrographiques en Mer Adriatique, en particulier des navires Ciclope, Najade et Vila Velebita (Historical review on hydrographic research in the Adriatic Sea, by vessels Ciclope, Najade and Vila Velebita in particular). Bull. Inst. océanogr. Monaco, No. spécial 2 (Congr. int. Hist. Océanogr., 1): 337-349.

CAR, L. & J. HADŽI. 1914. Izvještaji o 3. i 4. naučnom istraživanju Jadranskoga mora. Biologijska opažanja (Reports on 3rd and 4th scientific research of the Adriatic Sea. Biological surveys). Prir. istr. Hrv. Slav. JAZU, 5: 14-21.

CARPINE, C. 1970. Écologie de l'étage bathyal dans la Méditerranée occidentale (Ecology of the western Mediterranean bathyal zone). Mém. Inst. océan. Monaco, 2: 145 pp.

CASTELLARIN, C., G. VISINTIN & R. ODORICO. 2001. L'ittiofauna della Riserva Naturale Marina di Miramare (Golfo di Trieste, Alto Adriatico) (Ichthyofauna of Miramare marine Natural park – Trieste Bay, North Adriatic). Annls hist. nat., 11: 207-216.

CETINIĆ, P. & A. PALLAORO. 1993. Eksploatacijske karakteristike, značenje i ocjena djelovanja ribolova tramatom (Exploitation characteristics, significance and estimate of fishing with nets using ropes – tramata fishing). Pomorski zbornik, 31: 605-626.

CHOMSKY, O., Y. KAMENIR, M. HYAMS, Z. DUBINSKY & N. E. CHADWICK-FURMAN. 2004. Effects of feeding regime on growth rate in the Mediterranean sea anemone *Actinia equina* (Linnaeus). J. expl mar. Biol. Ecol., 299: 217-229.

CHRISTIAN, E. 1989. Biogeography, substrate preference, and feeding types of North Adriatic intertidal Collembola. P.S.Z.N. I: Mar. Ecol., 10: 79-94.

CORMACI, M., G. FURNARI & G. GIACCONE. 2004. Macrophytobenthos. In: M. C. Gambi & M. Dappiano (Editors): Mediterranean marine benthos: A manual of methods for its sampling and study. Biol. Mar. Medit., 11 (Suppl. 1): 217-246.

COSTELLO, M. J., C. EMBLOW & R. WHITE (Editors). 2001. European register of marine species. A check-list of the marine species in Europe and a bibliography of guides to their identification. Mus. natn. Hist. nat., Paris, France. Patrimoines naturels, 50: 463 pp.

CRNKOVIĆ, D. 1970. Prilog biološkoj i ekonomskoj problematici koćarenja u kanalskom području sjeveroistočnog Jadrana (A contribution to the study of biological and economic problems of trawling in the channels of the Nort-eastern Adriatic). Thalassia Jugosl., 6: 5-90.

DE GIROLAMO, M., S. STEFANI, C. MAZZOLDI & R. ODORICO. 1999. Effetti della totale proibizione della pesca sul popolamento ittico del Parco marino di Miramare (TS): analisi preliminare (Effects of the total fishing prohibition on fish populations in Miramare Marine park, Trieste. Preliminary analysis). Boll. Mus. civ. Stor. nat. Venezia, 49 (Suppl.): 311-315.

DEGOBBIS, D., S. FONDA-UMANI, P. FRANCO, A. MALEJ, R. PRECALI & N. SMODLAKA. 1995. Changes in the northern Adriatic ecosystem and the hypertrophic appearance of gelatinous aggregates. Sci. total Environ., 165: 43-58.

DELL'ANGELO, B. & D. ZAVODNIK. 2004. Marine fauna of the Mljet National Park (Adriatic Sea, Croatia). 4. Mollusca: Polyplacophora. Nat. Croat., 13: 319-341.

ERCEGOVIĆ, A. 1934. Wellengang und Lithophytenzone an der ostadriatischen Küste (Sea swelling and the lithophytic zone at the Eastern Adriatic coast. Acta Adriat., 1 (3): 1-20.

FABER, G. L. 1883. The Fisheries of the Adriatic and the Fish thereof. Bernard Quaritch, London, 292 pp.

FESSER, R. 1980. Zusätzliche Beschreibung von *Speleogobius trigloides* Zander & Jelinek (1976) (Gobiidae, Perciformes), sowie neue Fundorte und Freilandbeobachtungen [Complementary description of *Speleogobius trigloides* Zander & Jelinek (1976) (Gobiidae, Perciformes), as well as new finding lokalities and field observations]. Verh. Zool.-Bot. Ges. Wien, 118/119: 123-126.

FIELD, I. A. 1922. Biology and economic value of the sea mussel *Mytilus edulis*. Bull. U.S. Bur. Fish., 38: 127-259.

FILIPIĆ, P. & A. POŽAR-DOMAC. 1998. Croatian islands development and environmental protection strategy. In: J. L. M. De Prat (Editor): Proceedings of the Littoral 98 (4th Int. Conf.). Eur. Coast. Ass. Sci. Technol., Barcelona, pp. 221-231.

FOLK, R. L. 1954. The distinction between grain size and mineral composition in sedimentary nomenclature. J. Geol., 62: 344-356.

FRANCOUR, P. 1994. Pluriannual analysis of the reserve effect on ichthyofauna in the Scandola natural reserve (Corsica, northwestern Mediterranean). Oceanol. Acta, 17: 309-317.

FRANCOUR, P. 1997. Fish assemblages of *Posidonia oceanica* beds at Port-Cros (France, NW Mediterranean): Assessment of composition and long-term fluctuations by visual census. P.S.Z.N. I: Mar. Ecol., 18: 157-173.

GALGANI, F., A. SOUPLET & Y. CADIOU. 1996. Accumulation of debris on the deep sea floor off the French Mediterranean coast. Mar. Ecol. Prog. Ser., 142: 225-234.

GALIL, B. S., A. GOLIK & M. TUERKAY. 1995. Litters at the bottom of the sea. Mar. Pollut. Bull., 30: 22-24.

GAMBI, M. C. & M. DAPPIANO (Editors). 2004. Mediterranean marine benthos: A manual of methods for its sampling and study. Biol. Mar. Medit., 11 (Suppl. 1): I-XI + 1-604.

GAMULIN-BRIDA, H. 1965. Biocenoza muljevitog dna otvorenog srednjeg Jadrana (Muddy bottom biocoenose of the open middle Adriatic). Acta Adriat., 10 (10): 1-27.

GAMULIN-BRIDA, H. 1967. The benthic fauna of the Adriatic Sea. Oceanogr. Mar. Biol. Annu. Rev., 5: 535-568.

GAMULIN-BRIDA, H. 1968. Mouvements des masses d'eau et distribution des organismes marins et des biocoenoses benthiques en Adriatique (Water masses movements and distribution of marine organisms and benthic biocoenoses in the Adriatic Sea). Sarsia, 34: 149-161.

GAMULIN-BRIDA, H. 1979. Litoralne biocenoze na području srednjodalmatinskih otoka (Littoral biocoenoses at the middle Dalmatian island area). Prirod. istraž. Jugosl. Akad. zn. umjet., 43: 37-63.

GAMULIN-BRIDA, H., S. ALFIREVIĆ & D. CRNKOVIĆ. 1971. Contribution à la biologie de la faune endogée des fonds vaseux de l'Adriatique avec égard spécial à l'espèce *Nephrops norvegicus* (L.) (Contribution to biology of muddy bottom in fauna with special regards to species *Nephrops norvegicus*). Vie Milieu, Suppl. 22: 637-655.

GAMULIN-BRIDA, H., Z. PAVLETIĆ, D. CRNKOVIĆ, A. POŽAR-DOMAC, M. LEGAC & Ž. ŽUTIĆ-MALOSEJA. 1980. Prilog poznavanju bentosa infralitorala u području jugozapadne obale otoka Krka (A contribution to the knowledge of the infralittoral benthos along the south-western coast of the Krk Island). Acta Adriat., 21(2): 355-367.

GARCÍA RASO, J. E., A. A. LUQUE, J. TEMPLADO, C. SALAS, E. HERGUETA, D. MORENO & M. CALVO. 1992. Fauna y flora marinas del Parque Natural de Cabo de Gata-Níjar (Marine fauna and flora of the Cabo de Gata-Níjar Natural Park). Impr. M. Cromo, Madrid, 288 pp.

GOLDSCHMIDT, A., K. KOTRSCHAL & P. WIRTZ. 1984. Food and gut length of 14 Adriatic blenniid fish (Blenniidae, Percomorpha, Teleostei). Zool. Anz. Jena, 213: 145-150.

GRUBELIĆ, I. 1997. Osnovna obilježja bentoske faune otoka Purara, posebno zaštićenog dijela Nacionalnog parka ''Kornati'' (Benthic fauna of the Purara Island, specially protected part of the ''Kornati'' National Park). In: M. Meštrov, P. Durbešić & M. Kerovec (Editors). Kornati. Hrvatsko ekološko društvo etc., Zagreb, Ekološke Monografije, 7: 257-266.

HARMELIN, J.-G. 1990. Ichthyofaune des fonds rocheux de Méditerranée: Structure du peuplement du coralligène de l'île de Port-Cros (Parc national, France) [Mediterranean rocky bottom ichthyofauna: Structure of coralligenous bottom population at the Port-Cros Island (National Park, France)]. Mésogée, 50: 23-30.

HARMELIN, J. G. 1994. Les peuplements des substrats durs circalittoraux (Population of circalittoral hard substrates) In: D. Bellan-Santini, J.-C. Lacaze & C. Poizat (Editors). Les biocénoses marines et littorales de Méditerranée, synthèse, menaces et perspectives (Marine and littoral communities in the Mediterranean: Synthesis, menaces and perspectives). Secrétariat de la faune et de la flore, Mus. natn. Hist. nat., Paris, pp. 118-126.

HARMELIN, J. G., F. BACHET & F. GARCIA. 1995. Mediterranean marine reserves: Fish indices as tests of protection efficiency. P. S. Z. N. I. Mar. Ecol., 16: 233-250.

HERLER, J., R. A. PATZNER & C. STURMBAUER. 2005. A preliminary revision of the *Gobius auratus* species complex with redescription of *Gobius auratus* Risso, 1810. J. nat. Hist., 39: 1043-1075.

HEYMER, A. & C. D. ZANDER. 1992. Le statut de *Gobius auratus* Risso, 1810 et description de *Gobius xanthocephalus n. sp.* de la Méditerranée (Teleostei, Gobiidae) [Status of the Mediterranean *Gobius auratus* Risso, 1810, and description of *Gobius xanthocephalus n. sp.* (Teleostei, Gobiidae)]. Zool. Jb. Syst., 119: 291-314.

HOIĆ, J. 1896. Prvo naučno putovanje sa ''Margitom'', jahtom nautičke škole u Bakru (First scientific cruise with Bakar nautical school yacht ''Margita''). Glas. hrv. naravosl. Društva Zagreb, 9: 151-260.

HORVAT-MILEKOVIĆ, M. & A. Ž. LOVRIĆ. 1998. Prastari prirodoslovni nazivi u «vejskoj cakajšćini» brdskih sela na otoku Krku (Archaic natural terms in Veyska tongue of upland hamlets on Krk Island). In: Arko-Pijevac, M., M. Kovačić and D. Crnković (Editors), Prirodoslovna istraživanja riječkog područja (Natural history researches of the Rijeka region), Prirodoslovni muzej (Natural

History Museum) Rijeka, Hrvatska, pp. 235-247.

HOSOMI A. 1977. Ecological studies on the mussel *Mytilus galloprovincialis* (Lamarck), I. The fluctuation of its coverage. Jpn. J. Ecol., 27: 311-318.

HRILJAC, A. 1972. Odluka o proglašenju otoka Prvića s priobalnim vodama i Grgurovog kanala specijalnim botaničko-zoološkim rezervatom (The decree proclaiming Prvić Island, coastal sea and Grgur channel as special botanical and zoological reserve). Službene novine, Rijeka, 1972 (10): 253.

HRS-BRENKO, M. 1974. Stanje naselja školjkaša na obalama Jadrana (The condition of natural and commercial bivalve populations in the Adriatic Sea). Acta Adriat., 16 (7): 125-136.

HRS-BRENKO, M. 1980. Preliminary survey of populations of the bivalve Noah's ark (*Arca noae*, Linné) in the northern Adriatic Sea. Aquaculture, 21: 357-363.

HRS-BRENKO, M., A. JAKLIN, E. ZAHTILA & D. MEDAKOVIĆ. 1992. Školjkaši i nestašice kisika u sjevernom Jadranu (Bivalve species and lack of the oxygen in the Northern Adriatic Sea). Pomorski zbornik, 30: 581-597.

HRS-BRENKO, M. & M. LEGAC. 1996. A review of bivalve species in the eastern Adriatic Sea. II. Pteromorphia (Arcidae, Nuculanidae). Acta Adriat., 32: 655-670.

HUVÉ, H., P. HUVÉ & J. PICARD. 1963. Aperçu préliminaire sur le benthos littoral de la côte rocheuse adriatique italienne (Preliminary survey on the littoral benthos of the Italian Adriatic Sea rocky coast). Rapp. Comm. int. Mer Médit., 17 (2): 93-102.

JAKLIN, A. 1998. Prilozi morskoj fauni Riječkog zaljeva. 2. Puževi (Gastropoda) (Contribution to the Rijeka Bay (Adriatic Sea) marine fauna. 2. Gastropoda). In: Arko-Pijevac M., M. Kovačić & D. Crnković (Editors), Prirodoslovna istraživanja riječkog područja (Natural history researches of the Rijeka region), Prirodoslovni muzej (Natural History Museum) Rijeka, pp. 571-581.

JAKLIN, A. 2002. Oporavak makrofaune sedimentnog dna sjevernog Jadrana nakon nestašice kisika (Recovery of North Adriatic sedimentary bottom macrofauna after oxygen depletion). Ph. D. Thesis, University of Zagreb, 220 pp.

JAKLIN, A. & M. ARKO-PIJEVAC. 1994. Influences of silting to benthic communities of the western Krk Island coast. Period. biol., 96: 474-476.

JAKLIN, A. & M. ARKO-PIJEVAC. 1997. Benthic biocoenoses of the St. Marko islet (Rijeka Bay). Period. biol., 99: 219-228.

JARDAS, I. 1979. Stanje priobalnih naselja riba, glavonožaca i rakova uz našu obalu i perspektive ulova (State of the coastal settlements of fishes, cephalopods and crustaceans along the Yugoslav coast and the perspectives of catch). Ichthyologia, 11: 63-101.

JARDAS, I. 1986. Trammel bottom set catches along the eastern Adriatic coast (1971-1984). FAO Fish Rep., 345: 189-199.

JARDAS, I. 1996. Jadranska ihtiofauna (The Adriatic ichthyofauna). Školska knjiga, Zagreb, 536 pp.

JARDAS I. & A. PALLAORO. 1989. Neki pokazatelji opadanja biološkog bogatstva priobalnog područja Jadrana (1960-1988) [Some indications of the decline of the coastal Adriatic fishing resources (1960-1988)]. Pogledi, 19 (1): 159-176.

JARDAS, I. & A. PALLAORO. 1990. Primjeri devastacije priobalnih naselja u Jadranu (Some samples of devastation of the coastal fish settlements in the Adriatic Sea). Morsko ribarstvo, 42 (3): 90-94.

JARDAS, I., A. PALLAORO & P. CETINIĆ. 1996. Recentno stanje i dugogodišnje promjene u priobalnim naseljima riba, glavonožaca i jestivih vrsta rakova na području Palagruže (Recent status and long-term changes in coastal settlements of fish, cephalopods and edible crustaceans species of the Palagruža region). In: Hodžić M. (Editor), Zbornik Palagruža – Jadranski dragulj (Proceedings Palagruža – The pearl of the Adriatic).

Matica Hrvatska, Split – Kaštela, pp. 205-213.

JARDAS, I., A. PALLAORO, M. KRALJEVIĆ, J. DULČIĆ & P. CETINIĆ. 1998. Long-term changes in biodiversity of the coastal area of the Eastern Adriatic: fish, crustacean and cephalopoda communities. Period. biol., 100: 19-28.

JUKIĆ, S. 1974. The Yugoslav *Nephrops* fishery. Acta Adriat., 15 (8): 1-18.

JURAČIĆ, M., Č. BENAC & R. CRMARIĆ. 1999. Seabed and surface sediment map of the Kvarner region, Adriatic Sea, Croatia (Lithological map, 1:500,000). Geol. Croat., 52: 131-140.

KARLOVAC, O. 1953. An ecological study of *Nephrops norvegicus* L. of the high Adriatic. Izvješća Repts. Rib. Biol. Eksped. «Hvar», 5 (2 C): 1-51.

KIRINČIĆ, M. 2003. Podmorje otoka Prvića, Sv. Grgur i Goli otok (Submarine zone of Prvić, St. Grgur and Goli Islands. In: Randić M. (Editor), Prirodna baština Primorsko-goranske županije, Žagar, Rijeka, pp. 19-24.

KLEEMANN, K. 1973. *Lithophaga lithophaga* (L.) in different limestone. Malacologia, 14: 345-347.

KOVAČIĆ, M. 1995. *Gobius roulei* De Buen, 1928 (Pisces, Teleostei, Gobiidae), a fish new to the Adriatic fauna. Nat. Croat., 4: 173-184.

KOVAČIĆ, M. 1997. Cryptobenthic gobies and clingfishes in the Kvarner area, Adriatic Sea. Nat. Croat., 6: 423-435.

KOVAČIĆ, M. 1998. Ichthyological collection (Cyclostomata, Selachii, Osteichthyes) of the Natural History Museum Rijeka. In: Arko-Pijevac, M., M. Kovačić and D. Crnković (Editors), Prirodoslovna istraživanja Riječkog zaljeva (Natural history researches of Rijeka region), Prirodoslovni muzej (Natural history museum) Rijeka, pp. 685-698.

KOVAČIĆ, M. 2002a. A visual census of the coastal fish assemblage at Kostrena (the Kvarner area, Croatia). Annls Ser. hist. nat., 12 (1): 1-8.

KOVAČIĆ, M. 2002b. A northern Adriatic population of *Buenia affinis* (Gobiidae). Cybium, 26: 197-201.

KOTTHAUS, A. & M. ZEI. 1938. Izvještaj o pokusnom ribarenju ''koćom'' u Hrvatskom Primorju (Report on experimental fishing with bottom trawl in the Croatian littoral). God. Oceanogr. Inst. Split, 1: 125-140.

KRUŽIĆ, P. 2001. Grebenaste tvorbe vrste *Cladocora caespitosa* (L., 1767) (Anthozoa, Scleractinia) u Jadranskom moru (The coral bank structures of *Cladocora caespitosa* (L., 1767) species (Anthozoa, Scleractinia) in the Adriatic Sea). M. Sc. Thesis, University of Zagreb, 107 + XXII pp.

KRUŽIĆ, P. & A. POŽAR-DOMAC. 2002. Skeleton growth rates of coral bank of *Cladocora caespitosa* (Anthozoa, Scleractinia) in lake Veliko Jezero (Mljet National Park). Period. biol., 104: 123-129.

KRUŽIĆ, P., H. ZIBROWIUS & A. POŽAR-DOMAC. 2002. Actiniaria and Scleractinia (Cnidaria, Anthozoa) from the Adriatic Sea (Croatia): first records, confirmed occurrences and significant range extensions of certain species. Ital. J. Zool., 69: 345-353.

KUŠČER, I. 1963a. Od Svetega Marka do Vele luke (From St. Marko to Vela luka). In: I. Kuščer (Editor). Sprehodi pod morjem (Underwater promenades). Državna založba Slovenije. Ljubljana, 70-94.

KUŠČER, I. 1963b. Oprema za potapljanje (Equipment for diving). In: I. Kuščer (Editor). Sprehodi pod morjem (Underwater promenades). Državna založba Slovenije. Ljubljana, 126-134.

LAGO, L. & C. ROSSIT. 1981. Descriptio Histriae (Description of Istria). Lint, Trieste, 349 pp.

LA MESA, G. & M. VACCHI. 1999. An analysis of the coastal fish assemblage of the Ustica Island Marine Reserve (Mediterranean Sea). P.S.Z.N. I: Mar. Ecol., 20: 147-165.

LEGAC, M. 1974. Prilog poznavanju litoralne flore i faune otoka Raba (Contibution to the knowledge of Rab Island littoral flora and fauna). Vijesti muzeal. konzerv. Hrvatske, 23 (5-6): 75-87.

LEGAC, M. & M. HRS-BRENKO. 1982. A contribution to the knowledge of bivalve species distribution in the insular zones of the northern and part of middle Adriatic Sea. Acta Adriat., 23: 197-225.

LEGAC, M. & I. LEGAC. 1978. Prilog poznavanju podvodnih speleoloških objekata uz fotodokumentaciju (Contribution to the knowledge of underwater speleological localities with fotodocumentation). Simpozij o fotodokumentaciji krasa in jam, Postojna, 12.-14. 05. 1978. Zbornik referata, pp. 23-25.

LEGAC, M. & I. LEGAC. 1986. Prilog istraživanju podmorja otoka Grgur s obzirom na zaštitu (Contribution to the research of Grgur Island underwater world with special regard to its conservation). VII. Kongres biologa Jugoslavije, Budva, 29.9.-3.10.1986. Plenarni referati i izvodi saopštenja, E-12, p. 246.

LEGAC, M. & I. LEGAC. 1989. Amphoras – an interesting biotope of various flora and fauna species. Period. biol., 91: 122-123.

LEIDENFROST, G. 1914. Az I. Magyar *Najade* expedició (The 1st Hungarian Najade expedition). Tenger, 4: 81-140.

LIPEJ, L., M. ORLANDO BONACA & M. ŠIŠKO. 2003. Coastal fish diversity in three marine protected areas in the Gulf of Trieste (Northern Adriatic). P.S.Z.N. I: Mar. Ecol., 24: 1-15.

LOGAN, A. 1979. The recent Brachiopoda of the Mediterranean Sea. Bull. Inst. océanogr. Monaco, 72 (1434): 1-112.

LORENZ, J. R. 1863. Physicalische Verhältnisse und Vertheilung der Organismen im Quarnerischen Golfe (Physical conditions and distribution of organisms in the Kvarner Gulf). Verl. k. Akad. Wiss. Wien. 379 pp.

LORINI, P. 1903. Ribanje i ribarske sprave pri istočnim obalama Jadranskog mora (Fishing and fishing gears at eastern coasts of the Adriatic Sea). Naklada školskih knjiga, Beč, 266 pp.

LOVRIĆ, A. Ž. 1970. Prilog poznavanju onomastike Senjskog arhipelaga (Contribution to the knowledge of the Senj Archipelago onomastics, Adriatic Sea). Hidrogr. godišnjak, 1969: 125-143.

LOVRIĆ, A. Ž. 1971a. Ornitogene biocenoze u Kvarneru (Ornitogenic biocoenoses in Kvarner). Larus, 23: 39-72.

LOVRIĆ, A. Ž. 1971b. Coenodynamique et pédodynamique du mode battu par rapport à la bora et à l'abbrasion (Coenodynamics and pedodynamics at exposed sites with regards to bora wind and abrasion). Thalassia Jugosl., 7: 195-200.

LOVRIĆ, A. Ž. 1971c. *Lithophyllum tortuosum* rediscovered in the Kvarner Gulf (Northern Adriatic). Acta Bot. Croat., 39: 109-112.

LOVRIĆ, A. Ž. 1975. Analyse biogéographique des reserves naturelles sous-marines de l'Adriatique supérieur (Biogeographical analysis of natural underwater reserves of the northern Adriatic). Rapp. Comm. int. Mer Médit., 23 (2): 75-76.

LOVRIĆ, A. Ž. 1976a. Flora i fauna jugoistočnog Krka, otoka Prvića i okolnog mora (Flora and fauna of the south-eastern part of Krk Island, Prvić Island and surrounding sea area). Krčki zbornik, 8 (2): 34-40.

LOVRIĆ, A. Ž. 1976b. Zaštita prirode, unapredjenje pejsaža i ozelenjavanje Krka (Nature conservation, landscape improvement and introducing of greenery into area of Krk Island). Krčki zbornik, 8 (2): 279-286.

LOVRIĆ, A. Ž. 1976c. Proposition d'un reseau des surfaces protégées littorales et sous-marines dans l'Adriatique nord-est (Proposal to establish in the north-eastern Adriatic a network of protected littoral and underwater surfaces). Ekologija, 11 (2): 93-104.

LOVRIĆ, A. Ž. 1978. Fitocenološka analiza morske vegetacije istočnog Jadrana (Phytocoenological analysis of eastern Adriatic marine vegetation). Poročila Vzhodnoalp.-dinar. zdrušt. preuč. veget., 14: 215-229.

LOVRIĆ, A. Ž. 1979. Micro-Lithophytic zonation and stormy hydrodynamism in upper

Adriatic. Rapp. Comm. int. Mer Médit., 25-26 (6): 23-24.

LOVRIĆ, A. Ž. 1985. Indicating ecozonation of degraded vegetation in NE Adriatic. Rapp. Comm. int. Mer Médit., 29 (6): 229-230.

LOVRIĆ, A. Ž. 1997. Marine flora onomastics in islands Prvić, Grgur, Goli, and near shores Baška-Stinica in Northeastern Adriatic (30 year samplings in all seasons). Period. biol., 99: 271-283.

LOVRIĆ, A. Ž., O. ANTONIĆ & T. HRABRIĆ. 1998. Povijest istraživanja i biogeografske osobitosti otočja Prvić, Grgur i Goli (History of studies and biogeographic peculiarities of Prvić, Grgur and Goli Islands). In: Arko-Pijevac, M., M. Kovačić and D. Crnković (Editors): Prirodoslovna istraživanja Riječkog područja (Natural history researches of Rijeka region). Prirodoslovni muzej (Natural History Museum) Rijeka, pp. 109-119.

LOVRIĆ, A. Ž. & L. M. LOVRIĆ. 1983. Two decennia of prospecting and sampling vegetation landscapes in E. Adriatic benthos. Rapp. Comm. int. Mer Médit., 28 (8): 173-174.

LOVRIĆ, A. Ž. & L. M. LOVRIĆ. 1985. Gradient mapping of the surf exposition by indicating phytometers. Rapp. Comm. int. Mer Médit., 29 (6): 227-228.

LOVRIĆ, A. Ž., M. RAC & M. H. MILEKOVIĆ. 2002. Diversity of Old-Croatian names for seaweeds and maritime nature in the Adriatic islands. Nat. Croat., 11: 455-477.

LOVRIĆ, A. Ž., M. RAC & B. SEKULIĆ. 1989. Floristic and phytogeographical peculiarities of Grgur and Goli islands and of surrounding seafloors. Period. biol., 91: 68-69.

LOVRIĆ, A. Ž. & B. SEKULIĆ. 1991. Phytobenthos of the Kvarner (NE Adriatic) as an indicator of water masses dynamics. Thalassia Jugosl., 23: 75-93.

LOVRIĆ, A. Ž. & I. VOLARIĆ-MRŠIĆ. 1976. Flora i fauna jugoistočnog Krka, otoka Prvića i okolnog mora. (Flora and fauna of south-east Krk Island, Prvić Island and surrounding sea). Krčki zbornik, 8 (3): 34-40.

MAKJANIĆ, B. 1956. Jadransko more. Klima (Adriatic Sea. Climate). Pomorska enciklopedija, (1. izd), (Maritime encyclopaedia, 1st edition). Leksikografski zavod FNRJ, Zagreb, 3: 543-555.

MARINOPOULOS, J. 1989. Nouveaux concepts sur la structure des peuplements de l'infralittoral rocheux. (New concept of the structure of rocky infralittoral populations). C. R. Acad. Sci. Paris, 309 (3): 342-349.

MATJAŠIČ, J. & J. ŠTIRN. 1975. Flora in favna severnega Jadrana. Prispevek 1. (Flora and fauna of the North Adriatic, I). Slov. Akad. zn. umet., Razr. IV, 54 pp.

MILLER, P. J. 1972. The identity of *Gobius affinis* Kolombatović, with notes on the systematics and biology of *Pomatoschistus pictus* (Malm) (Pisces, Gobiidae). Ann. Mus. civ. Stor. nat. Genova, 77: 342-358.

MISTRI, M. & V. U. CECCHERELLI. 1997. Interazioni macrobenthos – mucillagine: danno e recupero di una popolazione di gorgonacei (Interaction between macrobenthos – mucilage: damage and recovery of one population of gorgonians). Biol. Mar. Medit., 4: 133-139.

MONNIOT, C. & F. MONNIOT. 1970. Quelques Ascidies de l'Adriatique (Some Ascidians of the Adriatic). Bull. Mus. natn. Hist. nat. Paris, 2 Sér., 42: 1189-1199.

MOROVIĆ, D. 1965. Les problèmes de la pêche cotière d'apres une analyse des captures au tramail (Problems of coastal fisheries after results of bottom trammel net catch analysis). Proc. gen. Fish. Coun. Medit., 8: 351-360.

MOROVIĆ, D. 1968. Aperçu historique sur les recherches biologiques effectuées avec le *Vila Velebita* en Adriatique (1913-1914) (Historical uotline on the biological research done with the Vila Velebita in the Adriatic, 1913-1914). Bull. Inst. océanogr. Monaco, Nº spécial 2 (Congr. int. Hist. Océanogr., 1): 351-357.

MOROVIĆ, D. 1971. Eksploatacija i zaštita ihtiofaune u obalnom pojasu srednjeg i južnog Jadrana (Exploitation and protection of ichthyofauna in the coastal region of the Middle and South Adriatic). Simpozij o zaštiti prirode u našem kršu (Symposium of Nature protection in our karst), JAZU, Zagreb, 2-3. 10. 1970. Jugosl. akad. zn. umjet., Zagreb, pp. 339-353.

MURINA, G.-V.V. & D. ZAVODNIK. 1979. Cruises of the research vessel «Vila Velebita» in the Kvarner region of the Adriatic Sea. XVI. Sipuncula. Thalassia Jugosl., 15: 245-255.

MURINA, G.-V. V. & D. ZAVODNIK. 1985/86. Sipuncula of the Adriatic Sea. Thalassia Jugosl., 21/22: 23-75.

NÉDÉLEC, C. 1975. Catalogue of small-scale fishing gear. Fisheries Industries Division, FAO, Surrey, 191 pp.

NIKOLIČ, M. 1958. Pod morsko gladino (Below the sea surface). Mladinska knjiga, Ljubljana, 133 pp.

NOVOSEL, M., T. BAKRAN-PETRICIOLI, A. POŽAR-DOMAC, P. KRUŽIĆ & I. RADIĆ. 2002. The benthos of the northern part of the Velebit Channel (Adriatic Sea, Croatia). Nat. Croat., 11: 387-409.

OREPIĆ, N., J. VIDMAR, E. ZAHTILA & D. ZAVODNIK. 1997. A marine benthos survey in the lakes of the National park ''Mljet'' (Adriatic Sea). Period. biol., 99: 229-245.

PATZNER, R. A. 1999. Habitat utilization and depth distribution of small cryptobenthic fishes (Blenidae, Gobiesocidae, Gobiidae, Tripterygiidae) in Ibiza (western Mediterranean Sea). Environ. Biol. Fish., 55: 207-214.

PÉRÈS, J.-M. 1961. Océanographie biologique et biologie marine. I. La vie benthique (Biological oceanography and marine biology. I. Benthic life). Press. Univ. Fr., Paris, 541 pp.

PÉRÈS, J.-M. 1967. Les biocoenoses benthiques dans le système phytal (Benthic biocoenoses of the phytal system). Recl Trav. Stn mar. Endoume, 42 (58): 3-113.

PÉRÈS, J.-M. & H. GAMULIN-BRIDA. 1973. Biološka oceanografija (Biological Oceanography). Školska knjiga, Zagreb, 493 pp.

PÉRÈS, J.-M. & J. PICARD. 1952. Les corniches calcaires d'origine biologique en Méditerranée occidentale (Calcareous ridge of biological origin in the western Mediterranean). Recl Trav. Stn mar. Endoume, 4: 2-33.

PÉRÈS, J.-M. & J. PICARD. 1964. Nouveau manuel de bionomie benthique de la Méditerranée (A new manual of Mediterranean benthic bionomics). Recl Trav. Stn mar. Endoume, 31 (47): 5-137.

PICCINETTI, C. & G. MANFRIN. 1969. Osservazioni sulla mortalità di pesci e di altri organismi verificatasi nel 1969 in Adriatico (Observations to the mortality of fishes and other organisms, verified in 1969 in the Adriatic). Note Lab. Biol. mar. Pesca Fano, 3 (4): 73-92.

POŽAR-DOMAC & T. BAKRAN-PETRICIOLI. 1996. Protection, management and sustainable development of the Croatian coastal zone. In: J. Taussik and J. Mitchell (Editors), Partnership in coastal zone management, Samara Publ. Lmtd, Cardigan, U.K., pp. 73-77.

POŽAR-DOMAC, A., T. BAKRAN-PETRICIOLI, P. FILIPIĆ, A. JAKLIN, N. LEDER, J. MUŽINIĆ, G. OLUJIĆ, A. PALLAORO, G. SINOVČIĆ, A. SMIRČIĆ, I. ŠIMUNOVIĆ, V. ŠOJAT, S. VIDIĆ, M. VUČETIĆ, V. VUČETIĆ, E. ZAHTILA, D. ZAVODNIK & N. ZAVODNIK. 1998. The Silba marine park – preliminary research of the main characteristics of the area, establishment of specially protected area, and marine park managing organization. Period. biol., 100: 7-18.

POŽAR-DOMAC, A., T. BAKRAN-PETRICIOLI, M. RADOŠEVIĆ & P. KRUŽIĆ. 2000a. Marine park network establishment in the Adriatic Sea – Croatian coastal zone development and protection. Period. biol., 102 (Suppl. 1): 704.

POŽAR-DOMAC, A., D. ZAVODNIK, A. JAKLIN, E. ZAHTILA, A. SMIRČIĆ, A. PALLAORO, N. LEDER, G. SINOVČIĆ, M. RADOŠEVIĆ, G. OLUJIĆ, P. KRUŽIĆ, N. ZAVODNIK, A. ŽULJEVIĆ, T. BAKRAN-PETRICIOLI, M. JURAČIĆ & B.

ANTOLIĆ. 2000b. Project ''Biodiversity preservation in the Adriatic Sea – Specially protected area Palagruža''. Period. biol., 102 (Suppl. 2): 49-57.

PUCHER-PETKOVIĆ, T. & I. MARASOVIĆ. 1984. Prilog poznavanju fenomena ''cvjetanja mora'' u Jadranu (A contribution to the knowledge of ''sea-water bloom'' phenomenon in the Adriatic). Pomorski zbornik, 22: 335-348.

RAC, M. & A. Ž. LOVRIĆ. 1998. Gradijent raznovrsnosti alga od Vinodolske obale do Krka i Raba (Gradient of biodiversity in marine algae from Vinodol seashore to the Krk and Rab Islands). In: M. Arko-Pijevac, M. Kovačić and D. Crnković (Editors), Prirodoslovna istraživanja riječkog područja (Natural history researches of the Rijeka region), Prirodoslovni muzej Rijeka, pp. 723-727.

RAC, M. & A. Ž. LOVRIĆ. 2002. Benthic and xeric vegetation of remote islands Sušac and Kopišće, and of adjacent seafloors in southern Adritic. Period. biol., 104: 139-147.

RADOVIĆ, J. 1999. (Editor). Pregled stanja biološke i krajobrazne raznolikosti Hrvatske sa strategijom i akcijskim planovima zaštite (Recent status of biological and landscape diversity in Croatia with strategy and conservation action plans). Državna uprava za zaštitu prirode i okoliša, Zagreb, 151 pp.

RAMADE, F. & N. VICENTE. 1994. La conservation des écosystemes côtiers et marins Méditerranéens (Conservation of Mediterranean coastal and marine ecosystems). In: BELLAN-SANTINI C., J.-C. LACAZE & C. POIZAT (Editors), Les biocénoses marines et littorales de Méditerranée: Synthèse, menaces et perspectives (Marine and littoral communities in the Mediterranean: Synthesis, menaces and perspectives). Mus. natn. Hist. nat., Paris, Patrimoines naturels, 19: 246 pp.

RANDIĆ, M. (Editor). 2003. Prirodna baština Primorsko-goranske županije. Vrijednost koja nestaje (Natural heritage of Primorsko – goranska županija. Value that disappears). Žagar, Rijeka, 310 pp.

RIEDL, R. 1954. Unterwasserforschung im Mittelmeer. Österreichische Tyrrhenia-Expedition 1952 (Underwater research in the Mediterranean. Austrian Tyrrhenia-expedition). Naturw. Rdsch., 2: 65-71.

RIEDL, R. 1963. Probleme und Methoden der Erforschung des litoralen Benthos (Problems and methods of littoral benthos research). Verh. Dtsch. Zool. Ges., 1962, Wien. Zool. Anz., Suppl. 26: 505-567.

RIEDL, R. 1964. Die Erscheinungen der Wasserbewegung und ihre Wirkung auf Sedentarier im mediterranen Felslitoral (Phenomena of water movements and their influence on sedentary organisms of Mediterranean rocky littoral). Helgol. Wissenschaftiche Meeresunters., 10: 155-186.

RIEDL, R. 1966. Biologie der Meereshöhlen (Biology of sea caves). Parey, Hamburg Berlin, 636 pp.

SCHNEIDER, J. 1976. Biological and inorganic factors in the destruction of limestone coasts. Contr. Sedimentol., 6: 1-112.

SCHNEIDER, J. & H. TORUNSKI. 1983. Biokarst on limestone coasts, morphogenesis and sediment production. P.S.Z.N. I: Mar. Ecol., 4: 45-63.

SEKULIĆ, B. & A. Ž. LOVRIĆ. 1987. Influence of sea currents on the distribution of phytobenthos off the northeastern shore of the Adriatic Sea. Environ. Conserv., 14: 259-260.

SENEŠ, J. 1988. The island Banjole – a type region of recent marine ecosystems on north Adriatic shelf. Geol. Zbor. Geol. carpath. (Bratislava), 39: 713-738.

SENEŠ, J. 1989. North Adriatic inter-island shelf ecosystems of the Rovinj area. Geol. Zbor. Geol. carpath. (Bratislava), 40: 333-354.

SILÉN, L. & J.-G. HARMELIN. 1976. *Haplopoma sciaphilum* sp. n., a cave-living bryozoan from the Skagerrak and the Mediterranean. Zoologica Scr., 5: 61-66.

STACHOWITSCH, M. 1984. Mass mortality in the Gulf of Trieste: The course of community destruction. P.S.Z.N. I: Mar. Ecol., 5: 243-264.

STACHOWITSCH, M. 1991. Anoxia in the Northern Adriatic Sea: rapid death, slow recovery. In: R. V. Tyson & T. H. Pearson (Editors), Modern and ancient continental shelf anoxia. Geol. Soc. spec. Publ., 58: 119-129.

STILLER-RÜDIGER, J. & D. ZAVODNIK. 1990. Hungarian research in the Adriatic Sea. In: Lenz, W. & M. Deacon (Editors), Ocean Sciences: Their History in Relation to Man. Proc. IV Int. Congr. Hist. Oceanogr., Sept. 1987, Hamburg. Dtsch. Hydrogr. Z., Erg.-H. B, (22): 209-213.

SVOBODA, A. 1979. Beitrag zur Ökologie, Biometrie und Systematik der mediterranen *Aglaophenia* Arten (Hydroidea) (Contribution to ecology, biometry, and systematics of Mediterranean *Aglaophenia* species, Hydroidea). Zool. Verh. Leiden, 167: 3-114.

ŠEGOTA, T. 1982. Razina mora i vertikalno gibanje dna Jadranskog mora od ris-virmskog interglacijala do danas (Sea level position and the vertical movement of the Adriatic Sea bottom from Riss-Würm Interglacial to Recent). Geol. vjesnik, 35: 93-109.

ŠIMUNOVIĆ, A. 1970. Recherches écologiques sur les peuplements faunistiques de l'étage supralittoral des côtes rocheuses de l'Adriatique moyenne (Ecological research on faunal populations in the supralittoral zone of the Middle Adriatic rocky shores). Acta Adriat., 14: 3-39.

ŠIMUNOVIĆ, A. & B. ANTOLIĆ. 1980. Promjene izazvane zemljotresom u bentoskim biocenozama Bokokotorskog zaljeva (Changes in benthic biocoenoses of the Bokakotorska Bay due to earthquake). Simpozijum o zemljotresu na Crnogorskom primorju od 15.IV.1979. godine, Hercegnovi, 15.-17. Apr. 1980. Zbornik radova, pp. 473-480.

ŠIMUNOVIĆ, A., C. PICCINETTI & M. ZORE-ARMANDA. 1999. Kill of benthic organisms as a response to anoxic state in the northern Adriatic Sea (a critical review). Acta Adriat., 40: 37-64.

ŠPAN, A., A. POŽAR-DOMAC, B. ANTOLIĆ & J. BELAMARIĆ. 1989. Bentos litoralnog područja otoka Lokruma (Benthic flora and fauna of Lokrum Island littoral zone). In: Otok Lokrum (Lokrum Island), Hrv. Ekol. Društ., Zagreb. Ekološke monografije, 1: 329-360.

ŠTEVČIĆ, Z. 1998. Morski deseteronožni raci kvarnerske regije (Marine Decapod Crustacea of the Kvarner region- North Adriatic). In: Arko-Pijevac M., M. Kovačić and D. Crnković (Editors), Prirodoslovna istraživanja riječkog područja (Natural history researches of the Rijeka region), Prirodoslovni muzej (Natural History Museum) Rijeka, pp. 647-660.

ŠTOVIČEK-ŠTIRN, M. 1991. Moj drugi svet. I. del. Jadranski svet (My second World. Part I. Adriatic world). In: Dolenc M. (Editor): Podmorski svet in mi (Underwater world and us). Prešernova družba, Ljubljana, pp. 143-170.

TORUNSKI, H. 1979. Biological erosion and significance for the morphogenesis of limestone coasts and for nearshore sedimentation (Northern Adriatic). Senckenberg. marit., 11: 193-265.

TRAVIZI, A. 2000. Effect of anoxic stress on density and distribution of sediment meiofauna. Period. biol., 102: 207-215.

TURK, R. & A. VUKOVIČ. 1994. Preliminarna inventarizacija in topografija flore in favne morskega dela naravnega rezervata Strunjan (Inventory and preliminary topography of flora and fauna in Strunjan marine National Park). Annls Istr. Medit. Stud., '94 (4): 101-112.

TVRTKOVIĆ, N. 1996. Josef Roman Lorenz von Liburnau – jedan od pionira sinekologije (Josef Roman Lorenz von Liburnau – one of the pioneers of sinecology). Priroda, 86 (828-829): 31-32.

UNEP, 1999. Report of the Meeting of MAP National Focal Points. 6-9 Sept. 1999, Athens, UNEP (OCA)/MED WG. 167/4, Annex III, Appendix B, C, pp. 45-52.

VACCHI, M., S. BUSSOTTI, P. GUIDETTI & G. LA MESA. 1998. Study of the coastal fish assemblage in the marine reserve of the Ustica Island (southern Tyrrhenian Sea). Ital. J. Zool., 65 (Suppl.): 281-286.

VAMVAKAS, C. N. 1970. Peuplements benthiques des substrats meubles de l'étage bathyal du sud de la mer Egée (The benthic populations of the bathyal mud in the Aegean Sea, Eastern Mediterranean). Téthys, 2: 89-129.

van TREECK, P. & H. SCHUHMACHER. 1998. Mass diving tourism – A new dimension calls for a new management approaches. Mar. Pollut. Bull., 37: 499-504.

VATOVA, A. 1928. Compendio della flora e fauna del mare Adriatico presso Rovigno (Compendium of flora and fauna of the Adriatic Sea near Rovinj). Mem. R. Comm. Talass. Ital., 143: 614 pp.

VELKOVRH, F. 1975. New contributions to Adriatic malacofauna. Biosistematika, 1: 101-114.

www.algaebase.org

www.fishbase.org

ZALOKAR, M. 1942. Les associations sous-marines de la côte adriatique au-dessous de Velebit (Underwater associations of the Adriatic coast below Velebit). Bull. Soc. bot. Genève, 33: 1-24.

ZAVODNIK, D. 1967. Dinamika litoralnega fitala na zahodnoistrski obali (Dynamics of the littoral phytal at the West Istrian coast). Razprave – Dissert. Slov. akad. zn. umet., Cl. IV, 10: 5-67.

ZAVODNIK, D. 1977. Benthic communities in the Adriatic Sea: Reflects of pollution. Thalassia Jugosl., 13: 413-422.

ZAVODNIK, D. 1979a. Cruises of the research vessel «Vila Velebita» in the Kvarner region of the Adriatic Sea. I. Introduction and itinerary. Thalassia Jugosl., 15: 1-19.

ZAVODNIK, D. 1979b. Cruises of the research vessel «Vila Velebita» in the Kvarner region of the Adriatic Sea. XXI. Benthic investigations. Thalassia Jugosl., 15: 313-350.

ZAVODNIK, D. 1980. Distribution of Echinodermata in the North Adriatic insular region. Acta Adriat., 21: 437-468.

ZAVODNIK, D. 1990. The ships and marine research of Rovinj Zoological station before 1918. In: W. Lenz and M. Deacon (Editors), Ocean Sciences: Their History and Relation to Man. Proc. 4th int. Congr. Hist. Oceanogr., Sept. 1987, Hamburg, Germany. Dtsch. Hydrogr. Z., Erg.-H. B (22): 214-219.

ZAVODNIK, D. 1994. Distribution and ecology of Echiura and Priapulida in the Adriatic Sea. Period. biol., 96: 459-462.

ZAVODNIK, D. 1998. Prilozi morskoj fauni Riječkog zaljeva. 5. Štrcaljci (Sipuncula) i zvjezdani (Echiura) (Contribution to the marine fauna of the Rijeka Bay, Adriatic Sea. 5. Sipuncula and Echiura). In: Arko-Pijevac M., M. Kovačić and D. Crnković (Editors), Prirodoslovna istraživanja riječkog područja (Nature history researches of the Rijeka region), Prirodoslovni muzej (Natural history museum) Rijeka, pp. 617-622.

ZAVODNIK, D. 2003. Marine fauna of Mljet National Park (Adriatic Sea, Croatia). 2. Echinodermata. Acta Adriat., 44: 105-160.

ZAVODNIK, D., A. JAKLIN, M. RADOŠEVIĆ & N. ZAVODNIK. 2000. Distribution of benthos at Jabuka, an islet of volcanic rock (Adriatic Sea). Period. biol., 102: 157-167.

ZAVODNIK, D. & M. KOVAČIĆ. 2000. Index of marine fauna in Rijeka Bay (Adriatic Sea, Croatia). Nat. Croat., 9: 297-379.

ZAVODNIK, D. & V. G. MURINA. 1975. Contribution to Sipuncula of North Adriatic insular region. Rapp. Comm. int. Mer Médit., 23 (2): 127-128.

ZAVODNIK, D. & A. ŠIMUNOVIĆ. 1997. Beskralješnjaci morskog dna Jadrana (Benthic avertebrata of the Adriatic Sea). Svjetlost, Sarajevo, 217 pp.

ZAVODNIK, D., A. ŠPAN, N. ZAVODNIK, A. ŠIMUNOVIĆ & B. ANTOLIĆ. 1981. Benthos of the western coast of the island Krk (Rijeka Bay, the North Adriatic Sea). Thalassia Jugosl., 23: 235-337.

ZAVODNIK, D., A. TRAVIZI & A. JAKLIN. 1994. Phytoplankton bloom consequences on benthic organisms. In: UNEP/FAO, Final reports on research projects dealing with eutrophication problems. MAP Tech. Repts Ser. No. 78, UNEP, Athens, pp. 91-120.

ZAVODNIK, D. & J. VIDAKOVIĆ. 1982. Bentoske zajednice na području Rapca (Benthic commmunities in the area of Rabac (Northern Adriatic Sea). Acta Adriat., 23: 243-258.

ZAVODNIK, D. & N. ZAVODNIK. 1982. Survey of benthic communities in the area of Osor (North Adriatic Sea). Acta Adriat., 23: 259-270.

ZAVODNIK, D. & N. ZAVODNIK. 1986. Biološka valorizacija zaljeva Raša. III. Bentos (Biological valorization of the Raša Bay. III. Benthos). Pomorski zbornik, 24: 535-554.

ZAVODNIK, N. 1983. Prilog poznavanju morskih alga i cvjetnica zapadne obale Istre (Observations on the flora of seaweds and seagrasses on the western coast of Istria, North Adriatic). Biosistematika, 9: 1-13.

ZAVODNIK, N. 1992. Prilozi morskoj flori i fauni lošinjske otočne skupine. II. Morske cvjetnice (*Spermatophyta*) (Observation on the marine flora and fauna on the Lošinj Archipelago area, North Adriatic. II. Marine seagrasses (Spermatophyta). In: Sokolić J. (Editor), Biologija Cresa i Lošinja (Biology of Cres and Lošinj Islands). Otočki ljetopis Cres-Lošinj, 8: 215-220.

ZAVODNIK, N., LJ. IVEŠA, A. TRAVIZI & A. JAKLIN. 2001. Recent study of *Caulerpa taxifolia* (Chlorophyta) settlement at Malinska, Croatia (North Adriatic Sea, Krk Island). In: Gravez V., S. Ruitton, C. F. Boudouresque, L. Le Direac'h, A. Meinesz, G. Scabbia and M. Verlaque (Editors), Proc. Fourth int. Workshop on *Caulerpa taxifolia*, GIS Posidonie publ., Marseille, pp. 118-127.

ZAVODNIK, N. & A. JAKLIN. 1990. Long-term changes in the Northern Adriatic marine phanerogam beds. Rapp. Comm. int. Mer Médit., 32 (1): 15.

ZAVODNIK, N., A. JAKLIN & Ž. LABURA. 1998 a. Pojava tropske alge *Caulerpa taxifolia* u Riječkom zaljevu (Occurrence of the tropic marine alga *Caulerpa taxifolia* in the Rijeka Bay, North Adriatic Sea). In: Arko-Pijevac M., M. Kovačić and D. Crnković (Editors), Prirodoslovna istraživanja riječkog područja (Nature history researches of the Rijeka region), Prirodoslovni muzej (Natural History Museum) Rijeka, pp. 717-123.

ZAVODNIK, N., A. TRAVIZI, A. JAKLIN & Ž. LABURA. 1998 b. *Caulerpa taxifolia* (Chlorophyta) in the North Adriatic Sea at Malinska (Krk Island, Croatia). In: Boudouresque C. F., V. Gravez, A. Meinesz and F. Palluy (Editors), Proc. Third int. Workshop on *Caulerpa taxifolia*, GIS Posidonie publ., Marseille, pp. 175-184.

ZEI, M. 1949. Raziskovanje s travlom na ribolovnem področju vzhodnega Jadrana (Bottom trawl survey on East Adriatic fishery grounds). Razprave Slov. akad. zn. umet., 4: 89-119.

ZEI, M. 1955. Doprinos k ekologiji morskega litorala (s. lat.). Supralitoral, litoral in zgornji infralitoral na kamniti zahodnoistrski obali (Contribution to the knowledge of marine littoral (s. lat). Supralittoral, littoral, and upper infralittoral at the West Istrian coast). Razprave – Dissert. IV razr. Slov. Akad. zn. umet., 3: 255-300.

ZEI, M. 1962. Preliminary observations on the life in *Posidonia* beds. Publ. Staz. Zool. Napoli, 32 (Suppl.): 86-90.

ZIBROWIUS, H. 1980. Les Scléractiniaires de la Méditerranée et de l'Atlantique nord-oriental (Scleractinians of the Mediterranean and north-eastern Atlantic). Mem. Inst. océanogr. Monaco, 11: 1-284.

ZIBROWIUS, H. & A. GRIESHABER. 1977 (1975): Scléractiniaires de l'Adriatique (Adriatic Scleractinians). Téthys, 7: 375-384.

ZIMMERMANN, L. 1982. Anmerkungen zur Verbreitung, Bionomie und taxonomischen Stellung von *Lithophyllum tortuosum* (Esper) Foslie und anderen biogenen Gesteinsbildnern im Mittelmeer (Observation on distribution, bionomy, and taxonomic position of *Lithophyllum tortuosum* (Esper) Foslie and other biogenic aggregationers in the Mediterranean). Senckenbergiana marit., 14: 9-21.

ŽULJEVIĆ, A., B. ANTOLIĆ, M. DESPALATOVIĆ & V. ONOFRI. 2004. The spread of the invasive variety of *Caulerpa racemosa* in the Adriatic Sea. Rapp. Comm. int. Mer Médit., 37: 466.

ŽULJEVIĆ A., B. ANTOLIĆ & V. ONOFRI. 2003. First record of *Caulerpa racemosa* (Caulerpales. Chlorophyta) in the Adriatic Sea. J. mar. biol. Ass. U.K., 83: 711-712.

ŽULJEVIĆ, A., N. ZAVODNIK, B. ANTOLIĆ, A. JAKLIN & A. ŠPAN. 1998. Suivi de l'invasion de l'algue tropicale *Caulerpa taxifolia* devant les côtes croates de la Méditerranée: situation au 31. décembre 1997 (Monitoring of the tropical alga *Caulerpa taxifolia* invasion along Croatian coast of the Mediterranean: situation by 31 Dec 1997). In: Meinesz A., J. M. Cottalorda, D. Chiaverini, N. Cassar and J. de Vaugelas (Editors), Suivi de l'invasion de *Caulerpa taxifolia* en Méditerranée: situation au 31. 12. 1997 (Monitoring of the tropic alga *Caulerpa taxifolia* invasion in the Mediterranean). LEML-UNSA, Nice, pp. 211-224.

ŽUPANOVIĆ, Š. & I. JARDAS. 1989. Fauna i flora Jadrana. 4. Jabučka kotlina, 1. (Fauna and Flora of the Adriatic. 4. The Jabuka Pit, 1). Logos, Split, 415 pp.

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Prikaz bentosa Senjske otočne skupine (sjeverni Jadran, Hrvatska)

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SAŽETAK

Stjecajem okolnosti podmorje otoka Prvić, Sv. Grgur i Goli do danas je ostalo slabo poznato. Stoga su ovdje prikazani značajniji rezultati naših povremenih istraživanja makroflore i faune i životnih zajednica morskog dna. Metodom jednokratnog autonomnog ronjenja bentos je snimljen na 26 obalnih postaja te je na 14 od njih izvršena i vizualna procjena ihtiofaune. Radi utvrđivanja sastava i stanja ribljih naselja na 15 postaja koristile su se mreže poponice. Na sedimentnom dnu u većim dubinama na 27 postaja uzorkovalo se grabilom.

Ukupno je zabilježeno 56 vrsta makroalga, dvije morske cvjetnice, 218 vrsta beskralješnjaka i 96 vrsta riba. U podmorju istraživanog područja na tvrdom dnu su najznačajnije zajednice infralitoralnih alga i koraligena, dok su za duboko muljevito dno značajni elementi biocenoze obalnog terigenog mulja i zajednica batijalnih muljeva. Zbog specifičnih hidrodinamskih uvjeta u svim razinama dolazi do lokalnog miješanja naselja vrsta karakterističnih za pojedine zajednice. Pokazalo se da je metoda autonomnog ronjenja vrlo pogodna za brzu identifikaciju i procjenu stanja priobalnog makrobentosa, dok se riblja naselja mogu zadovoljavajuće procijeniti samo usporednim rezultatima ronjenja i analiza lovina iz ribarskih alata.

Iako su rezultati naših istraživanja vjeran odraz primijenjenih metoda rada, nema sumnje da su životne zajednice morskog dna kao i riblja naselja u ovom području vrlo raznolika i primjerno očuvana. Stoga podržavamo prijedlog trajne zakonske zaštite podmorja istraživane otočne skupine u kategoriji morskog parka.

Ključne riječi: bentos, ekologija, fauna, flora, Jadransko more

ANNEX

Taxa recorded at benthos stations: c = common, abundant; d = dominant, fish shoal; o = ova; r = rare; s = only empty shells; + = present but abundance not assessed.

Station GR-	**03**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**
CYANOPHYTA																											
Rivularia atra Roth	+	-	c	c	c	-	-	-	c	+	-	-	-	+	+	+	r	c	+	-	-	-	-	c	-	-	+
Rivularia mesenterica Thur.	-	c	+	c	c	-	-	c	-	-	r	-	-	+	-	-	+	-	r	-	-	-	-	-	-	-	-
RHODOPHYCOTA																											
Acrosymphyton purpureum (J.Ag.) Sjoe.	+	-	-	-	-	-	-	-	-	-	-	-	r	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Amphiroa cryptarthrodia Zanard.	-	-	-	+	-	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Amphiroa rigida Lamx	+	+	c	c	c	c	-	+	r	r	r	r	-	+	r	r	r	-	-	r	-	-	+	-	-	c	-
Amphiroa sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-
Botryocladia botryoides (Wulf.) Feldm.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Catenella caespitosa (With.) Irv.	-	-	c	-	c	d	-	c	-	-	-	c	-	-	c	c	-	-	r	+	-	-	c	c	-	d	c
Corallina elongata Ell & Sol.	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Corallina officinalis L.	-	-	+	c	c	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-
Corallina sp.	-	+	c	d	r	d	-	d	d	-	+	d	-	-	-	-	-	-	-	+	-	-	-	-	-	d	-
Halymenia sp.	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hildenbrandia prototypus Nardo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	c	-	-	-	-	-	-	-
Jania rubens (L.) Lamx	-	c	-	+	-	-	-	-	-	-	-	-	-	c	-	+	r	-	-	+	-	-	-	-	-	-	-
Jania sp.	-	-	-	-	-	-	-	-	-	+	+	+	c	+	+	+	-	-	-	+	-	-	+	-	-	-	-
Laurencua glandulifera (Kütz.) Kütz.	+	-	-	-	-	-	-	-	c	-	-	r	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Laurencia obtusa (Huds.) Lamx	+	-	-	-	-	+	-	d	+	-	d	-	-	c	c	-	-	-	-	c	-	-	r	c	-	-	-
Laurencia pinnatifida (Gmel.) Lamx	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Laurencia sp.	-	-	-	-	-	-	-	c	c	-	+	c	-	-	-	c	-	+	-	-	-	-	-	-	-	c	+
Lithophyllum tortuosum (Esp.) Foslie	-	+	-	-	-	c	-	-	-	-	d	d	-	-	-	-	-	-	-	-	-	-	-	-	-	+	r
Mesolithophyllum expansum Cab.&Mend.	-	c	-	c	c	c	-	-	c	+	+	r	-	+	r	-	+	-	-	-	-	-	+	-	-	-	r
Nemalion helminthoides (Vell.) Batt.	+	-	-	-	-	-	-	-	-	r	-	-	-	+	r	-	-	-	-	-	-	-	-	+	-	-	-
Nitophyllum punctatum (Stack.) Grev.	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Osmundaria volubilis (L.) Norris	-	-	-	-	-	+	c	-	-	c	-	+	-	c	+	+	d	c	c	c	+	-	-	+	-	-	c
Peyssonnelia polymorpha (Zanard.) Schmitz	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	c	+
Peyssonnelia squamaria (Gmel.) Decai.	-	-	+	-	c	-	-	-	-	-	c	+	-	c	r	+	c	-	-	-	-	-	-	-	-	-	-
Peyssonnelia sp.	-	d	+	d	c	d	-	d	c	c	c	d	-	+	d	c	c	c	c	d	-	-	d	d	-	d	c
Phyllophora crispa (Huds.) P.S.Dix.	-	c	-	+	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+

Station GR-	03	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Phymatolithon calcareum (Pall.) Adey&McKibb.	-	-	-	-	-	c	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phymatolithon lenormandii (Aresch.) Adey	-	d	c	d	-	d	-	d	d	d	d	+	-	d	-	-	-	d	-	-	-	-	d	+	-	c	-
Ralfsia pacifica Hollen.	-	-	-	-	-	-	-	-	-	-	r	-	-	c	-	-	-	-	-	-	-	-	-	-	-	-	-
Sphaerococcus coronopifolius (Good.&Wood.) Stack.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	+	-	-	-	-	-	-	-
Spongites fruticulosus Kütz.	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wrangelia penicillata (C.Ag.) C.Ag.	c	c	r	-	-	-	-	r	r	r	-	+	r	+	-	r	-	+	-	+	-	-	r	+	-	r	r
PHAEOPHYCOTA																											
Cutleria multifida (Smith) Grev.	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cutleria sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	c	-	+	-	-	-	-	-	-	-	-	-	-	-
Cystoseira amentacea (C.Ag.) Bory	c	-	-	-	-	-	-	+	-	c	c	c	-	c	-	c	-	-	-	-	+	-	-	-	-	-	-
Cystoseira barbata (Stack.) C.Ag.	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Cystoseira compressa (Esp.) Gerl. & Nizam.	+	+	r	c	-	-	-	-	c	d	-	-	c	r	-	+	+	-	-	-	-	-	-	+	-	c	-
Cystoseira corniculata var. *laxior* Erc.	-	-	-	-	-	-	-	-	d	-	-	-	-	c	-	c	-	d	-	c	+	-	-	+	c	c	+
Cystoseira crinita Duby	-	-	-	-	-	-	-	-	c	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cystoseira foeniculacea (L.) Grev.	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Cystoseira spinosa Sauv.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Cystoseira sp. indet.	-	+	+	c	d	-	-	c	+	-	r	r	+	c	+	+	+	-	-	-	-	-	-	c	-	c	d
Dictyopteris polypodioides (De Cand.) Lamx	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dictyota dichotoma (Huds.) Lamx	r	c	c	+	c	c	-	+	c	r	-	r	-	+	r	+	r	-	-	+	-	-	c	-	-	-	-
Dictyota linearis (C.Ag.) Grev.	+	c	c	+	-	c	-	-	+	+	-	-	-	c	-	+	+	-	-	-	-	-	-	-	-	-	-
Dictyota spp.	-	-	+	-	-	+	-	r	+	-	c	+	+	-	-	+	-	-	-	-	-	-	-	-	-	c	-
Ectocarpus sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	c	-
Fucus virsoides J.Ag.	+	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	r	+	-	-	-	-	c	-	-	-
Padina pavonica (L.) Thivy	c	+	d	c	c	+	-	c	c	+	+	+	c	c	+	+	r	+	-	-	+	-	+	r	-	+	r
Sargassum acinarium (L.) Setch.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	c	-	-	-	-	-	-	-	-	-	-
Sargassum vulgare C.Ag.	-	-	-	-	-	-	-	-	-	c	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-
Sargassum sp.	-	r	-	r	-	r	-	+	r	-	-	-	-	-	-	r	-	+	-	-	-	-	-	-	-	-	-
Stypocaulon scoparium (L.) Kütz.	-	-	+	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-
Zanardinia typus (Nardo) G.Furn.	-	r	r	-	-	c	-	+	+	-	+	+	-	r	r	-	-	-	-	c	-	-	r	-	-	+	-
CHLOROPHYCOTA																											
Acetabularia acetabulum (L.) Silva	d	+	+	c	+	+	-	c	c	c	+	r	c	r	c	+	r	+	-	r	-	-	r	+	-	r	r
Cladophora prolifera (Roth) Kütz.	-	c	+	+	-	+	-	+	-	-	+	+	-	+	+	+	+	+	-	-	-	-	-	-	-	-	-

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Cladophora sp.	-	c	-	-	-	c	-	c	r	-	c	c	-	r	+	-	r	+	c	c	-	-	c	c	-	c	c
Codium bursa (L.) C.Ag.	-	c	c	+	c	c	-	c	r	+	c	c	-	c	+	r	-	+	-	+	+	-	+	+	-	+	+
Codium setchellii Gard.	-	+	+	+	r	c	-	+	+	-	r	+	-	-	c	+	r	+	-	+	-	-	+	r	-	c	-
Codium tomentosum Stack.	-	r	+	c	-	r	-	r	+	-	-	+	-	-	r	-	+	+	-	+	-	-	-	-	-	r	-
Dasycladus vermicularis (Scop.) Krass.	c	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	c	+	-	-	-	-	-	-	-	-	-
Flabellia petiolata (Turra) Nizam.	-	c	+	c	c	c	-	c	+	+	+	c	-	c	c	+	c	+	+	+	-	-	-	+	-	c	c
Halimeda tuna (Ell. & Sol.) Lamx	-	d	+	d	-	c	-	c	+	-	r	r	-	c	c	c	-	+	-	c	-	-	-	-	-	c	-
Ulva rigida C.Ag.	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Valonia macrophysa Kütz.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Valonia utricularis (Roth) C.Ag.	-	-	+	-	r	-	-	-	+	-	-	+	-	+	+	-	-	r	-	-	-	-	-	-	-	-	-
LICHENES																											
Verrucaria adriatica A. Zahlbr.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	c	-	-	c	c
MAGNOLIOPHYTA																											
Cymodocea nodosa (Ucria) Asch.	c	-	-	-	-	-	-	-	-	-	-	-		-	-	-	d	-	-	-	-	-	-	-	-	-	-
Posidonia oceanica (L.) Del.	r	-	+	-	d	-	-	-	-	-	-	-		+	-	-	r	-	-	-	d	+	-	+	+	-	-
PORIFERA																											
Acanthella acuta Schmidt, 1862	-	r	-	r	r	r	-	r	+	-	+	r	-	-	-	r	-	-	+	r	-	-	-	-	-	+	-
Agelas oroides (Schmidt, 1864)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-
Anchinoe tenacior Topsent, 1936	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Aplysina aerophoba Nardo, 1843	+	r	r	c	c	+	+	+	+	+	c	+	-	+	+	r	r	+	+	r	-	-	+	+	+	r	+
Aplysina cavernicola (Vacelet, 1959)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Axinella cannabina (Esper, 1794)	-	r	-	+	r	r	-	-	+	-	r	r	-	-	-	-	r	-	r	-	-	-	-	+	-	r	+
Axinella damicornis (Esper, 1794)	-	+	-	+	r	-	-	-	-	-	-	-	-	-	+	+	r	-	-	+	-	-	-	r	-	-	-
Axinella polypoides Schmidt, 1862	-	-	-	-	-	r	-	+	+	-	-	r	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-
Axinella verrucosa (Esper, 1794)	-	-	-	+	-	c	+	-	+	+	+	+	-	-	-	-	-	-	+	-	-	-	+	+	-	+	+
Caccospongia sp.	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
Chondrilla nucula Schmidt, 1862	-	r	+	+	-	+	-	c	c	-	+	r	-	-	+	+	-	+	-	+	-	-	+	-	-	-	-
Chondrosia reniformis (Nardo, 1847)	-	+	-	+	c	-	-	c	+	+	+	+	-	+	r	+	-	-	-	-	-	-	+	r	-	r	-
Clathria coralloides (Olivi, 1792)	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cliona celata (Grant, 1826)	+	-	+	-	-	-	-	-	-	-	-	-	-	r	-	+	r	-	-	+	-	-	-	-	-	-	-
Cliona viridis (Schmidt, 1862)	-	-	c	-	c	-	-	c	+	-	-	+	-	-	-	+	-	c	+	-	-	-	-	+	-	c	-
Crambe crambe (Schmidt, 1862)	-	-	-	-	c	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Dysidea sp.	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Geodia cydonium (Jameson, 1811)	-	-	-	-	-	-	-	-	-	r	-	-	-	r	-	-	-	-	-	-	-	-	r	-	-	-	r
Hemimycale columella (Bowerbank, 1866)	-	-	-	-	-	-	-	-	+	-	-	-	-	r	-	-	-	-	-	r	-	-	-	-	-	-	-
Ircinia sp.	-	-	-	-	r	-	-	+	-	-	r	+	-	-	-	+	r	-	-	-	-	-	-	-	-	-	-
Oscarella lobularis (Schmidt, 1862)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-
Petrosia ficiformis (Poiret, 1798)	-	r	r	+	r	+	r	+	+	-	r	+	-	r	+	r	r	+	-	-	-	-	r	-	-	r	+
Spirastrella cunctatrix Schmidt, 1868	-	+	-	+	-	+	-	+	r	-	-	-	-	-	r	+	-	-	-	+	-	-	-	-	-	r	-
Spongia agaricina Pallas, 1766	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-
Spongia officinalis Linnaeus, 1759	-	-	-	r	r	r	-	-	-	-	r	r	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-
Spongia virgultosa Schmidt, 1868	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Suberites domuncula (Olivi, 1792)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Tethya aurantium (Pallas, 1766)	-	r	-	r	+	r	-	+	+	-	r	r	-	-	-	+	r	-	r	-	-	-	r	r	-	-	r
Tethya citrina Sará & Melone, 1965	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CNIDARIA																											
Actinia cari Delle Chiaje, 1825	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Actinia equina (Linnaeus, 1758)	-	+	c	r	c	c	-	r	c	c	+	c	-	+	c	c	+	c	r	r	-	-	c	c	-	c	c
Aglaophenia sp.	-	-	-	+	-	+	-	-	-	+	-	-	-	+	r	+	+	-	-	-	-	-	-	c	-	-	c
Aiptasia diaphana (Rapp, 1829)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aiptasia mutabilis (Gravenhorst, 1831)	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	r	-	-	c	-	-	-	-
Alcyonium acaule Marion, 1878	-	r	-	r	c	-	+	r	c	+	r	c	-	+	+	r	-	-	-	-	-	-	+	-	-	-	r
Alcyonium coralloides (Pallas, 1766)	-	+	-	+	r	+	-	-	+	-	-	-	-	-	+	-	-	-	r	-	-	-	r	-	-	+	+
Anemonia viridis (Forsskål, 1775)	+	r	+	r	-	r	-	r	-	r	r	+	r	r	+	r	r	+	+	-	-	-	-	r	-	-	-
Balanophyllia europaea (Risso, 1826)	-	+	+	+	-	+	-	+	+	r	r	+	-	+	+	r	r	+	-	r	-	-	-	-	-	r	-
Bunodactis verrucosa (Pennant, 1777)	-	-	-	-	-	-	-	+	-	+	+	r	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-
Calliactis parasitica (Couch, 1838)	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-
Caryophyllia inornata (Duncan, 1878)	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r
Caryophyllia smithii Stokes & Broderip, 1828	-	-	-	-	-	+	-	-	-	-	-	+	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-
Cerianthus membranaceus (Spallanzani, 1784)	-	-	r	-	-	r	-	-	-	-	r	r	-	r	-	r	r	r	-	-	-	-	-	r	-	-	-
Cereus pedunculatus (Pennant, 1777)	-	-	-	-	-	-	-	-	r	r	-	-	-	r	-	-	-	-	-	-	-	-	-	c	-	-	-
Cladocora caespitosa (Linnaeus, 1767)	-	r	r	-	-	r	-	r	c	c	-	r	-	r	+	-	-	+	+	-	+	-	-	-	-	-	-
Condylactis aurantiaca (Delle Chiaje, 1825)	-	-	r	c	+	+	-	-	-	-	-	-	-	c	-	-	r	r	-	-	-	-	-	r	-	-	-
Cribrinopsis crassa (Andres, 1884)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	r	-	-	-	-	-	r	-

Station GR-	**03**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**
Eudendrium sp.	-	+	-	r	-	+	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Eunicella cavolinii (Koch, 1887)	-	+	-	c	c	c	+	r	c	+	c	+	-	r	r	r	-	-	+	r	-	-	+	r	-	+	+
Eunicella singularis (Esper, 1791)	-	r	-	r	+	r	+	-	+	-	r	r	-	r	r	-	-	+	r	r	-	-	+	-	-	r	r
Hoplangia durotrix Gosse, 1860	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Leptopsammia pruvoti Lacaze-Duthiers, 1897	-	c	-	c	c	+	-	-	r	-	+	+	-	+	+	r	-	-	+	+	-	-	c	-	-	+	+
Paramuricea clavata (Risso, 1826)	-	-	-	-	+	r	-	-	c	-	-	+	-	-	-	-	-	-	r	-	-	-	r	-	-	-	-
Parazoanthus axinellae (Schmidt, 1862)	-	c	c	+	c	c	+	c	+	+	+	+	-	r	r	+	c	-	+	-	-	-	+	+	-	+	+
MOLLUSCA																											
POLYPLACOPHORA																											
Chiton olivaceus Spengler, 1797	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-
Lepidochitona caprearum (Scacchi, 1836)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	+	-
GASTROPODA																											
Aplysia parvula Guilding in Moerch, 1863	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-
Aplysia punctata (Cuvier, 1803)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Aplysia sp.juv.	-	-	r	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bittium reticulatum Da Costa, 1778	-	+	c	c	-	-	-	-	-	c	+	r	-	c	c	+	-	c	+	-	-	-	-	+	-	+	c
Bolinus brandaris (Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	+	-	-	-	-	-
Bosellia mimetica Trinchese, 1891	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-
Cerithium vulgatum Bruguiére, 1792	-	-	-	-	-	-	-	-	-	r	+	-	-	+	r	r	c	-	-	-	-	-	-	-	-	-	-
Cerithium sp.	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conus mediterraneus Hwass in Bruguière, 1792	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	+	-	-	-	-	-	r	-	r	-
Cratena peregrina (Gmelin, 1791)	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dendrodoris limbata (Cuvier, 1804)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-
Discodoris atromaculata (Bergh, 1880)	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-
Elysia timida (Risso, 1818)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-
Elysia viridis (Montagu, 1804)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-
Emarginula sp.	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Facelina bostoniensis (Counthouy, 1838)	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Flabellina affinis (Gmelin, 1791)	-	+	-	r	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Flabellina lineata (Loven, 1846)	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-
Flabellina pedata (Montagu, 1815)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	r	-
Galeodea echinophora (Linnaeuss, 1758)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	s	-	-	-	-	-	-	-	-	-	-

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Gastropteron rubrum (Rafinesque, 1814)	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-
Gibbula varia (Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	s	-	r	-	-	-	-	-	-	-	-	-
Gibbula sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	c	+	-	-	-	-	-	-	-
Glossodoris sp.	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Haliotis tuberculata lamellosa Lamarck, 1822	-	-	+	-	r	r	-	-	-	r	r	-	r	s	-	-	-	-	-	-	-	-	-	r	-	r	-
Hexaplex trunculus (Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	r	-	-	-	+	+	-	-	-	-	-
Janolus cristatus (Delle Chiaje, 1841)	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Melaraphe neritoides (Linnaeus, 1758)	+	c	+	+	c	c	-	c	+	r	-	-	-	+	+	-	+	c	c	c	-	-	c	-	-	+	-
Muricopsis cristata (Brocchi, 1814)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-
Neosimnia spelta Linnaeus, 1758	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-
Osilinus articulatus (Lamarck, 1822)	-	-	-	-	-	-	-	-	-	-	-	-	c	-	-	-	-	r	r	-	-	-	-	-	-	-	-
Osilinus turbinatus (v. Born, 1778)	c	r	+	c	-	-	-	-	r	+	+	-	-	+	c	+	-	+	c	r	-	-	-	r	-	c	c
Patella caerulea Linnaeus, 1758	c	c	c	+	c	r	-	c	r	r	+	r	+	c	c	c	r	+	c	c	-	-	r	r	-	r	c
Patella rustica Linnaeus, 1758	c	c	c	c	c	c	-	r	-	r	+	+	-	c	c	r	-	r	c	r	-	-	c	c	-	c	c
Patella ulyssiponensis Gmelin, 1791	r	-	c	-	-	r	-	-	-	-	+	-	-	r	r	-	-	-	r	-	-	-	-	r	-	-	r
Phorcus mutabilis (Philippi, 1846)	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pisania striata (Gmelin, 1791)	r	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-
Pollia dorbignyi (Payraudeau, 1826)	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scaphander lignarius (Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	s	-	-	-	-	-	-	-	-	-	-
Serpulorbis arenarius Linnaeus, 1758	-	-	-	r	r	r	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thuridilla hopei (Verany, 1853)	-	-	-	-	-	-	-	-	-	-	o	-	-	r	-	-	-	r	+	r	-	-	-	r	-	r	+
Tylodina perversa (Gmelin, 1791)	-	-	-	-	-	-	-	-	-	-	+	r	-	-	+	r	-	-	-	-	-	-	-	-	-	-	-
Vermetus triquetrus Bivona Ant., 1832	-	-	-	-	-	-	-	-	-	c	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
BIVALVIA																											
Acanthocardia paucicostata (Sow. G.B. II, 1841)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	s	-	-	-	-	-	-	-	-	-	-
Acanthocardia spinosa (Solander, 1786)	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acanthocardia tuberculata (Linnaeus, 1758)	-	-	s	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arca noae Linnaeus, 1758	-	-	-	r	-	r	-	-	r	-	-	-	-	-	-	r	r	-	r	r	-	-	-	-	-	-	-
Barbatia barbata (Linnaeus, 1758)	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chama gryphoides Linnaeus, 1758	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlamys glabra (Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlamys varia (Linnaeus, 1758)	-	-	-	r	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-

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Clausinella brongniartii (Payraudeau, 1826)	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gari depressa Pennant, 1777	-	-	-	-	-	-	-	-	-	-	-	-	s	+	-	-	s	-	-	-	-	-	-	-	-	-	-
Gastrochaena dubia (Pennant, 1777)	+	c	c	c	c	c	-	c	c	c	c	c	-	c	c	c	r	c	-	c	-	-	c	+	-	c	c
Laevicardium oblongum (Gmelin, 1791)	-	-	+	r	-	-	-	-	-	-	-	-	-	-	-	s	s	-	-	-	-	-	-	-	-	-	-
Lima hians (Gmelin, 1791)	-	-	-	-	r	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lima lima (Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	+	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lima sp.juv.	-	-	-	-	-	-	-	-	-	-		-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-
Lithophaga lithophaga (Linnaeus, 1758)	-	c	-	c	c	c	-	c	+	c	+	c	-	c	-	-	-	-	-	+	-	-	-	-	-	c	-
Modiolus barbatus (Linnaeus, 1758)	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mytilaster minimus (Poli, 1795)	-	-	c	-	+	c	-	-	-	-	-	+	-	-	c	c	+	c	+	+	-	-	r	+	-	c	+
Mytilus galloprovinicialis Lamarck, 1819	-	c	-	-	r	c	-	c	r	r	+	-	-	r	+	r	-	-	-	-	-	-	-	r	-	c	c
Ostrea edulis Linnaeus, 1758	-	-	r	-	r	r	-	-	r	r	-	r	-	r	-	-	-	-	-	-	-	-	-	-	-	r	+
Pecten jacobaeus (Linnaeuss, 1758)	-	-	r	r	+	-	-	-	-	-	-	-	-	-	-	s	s	s	-	-	-	-	-	-	-	-	-
Pinna nobilis Linnaeus, 1758	+	-	+	-	-	-	-	-	-	-	-	-	-	r	-	-	-	r	-	-	-	-	-	-	-	-	-
Solecurtus scopula Turton, 1822	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	s	-	-	-	-	-	-	-
Spondylus gaederopus Linnaeus, 1758	-	-	-	-	r	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Striarca lactea (Linnaeus, 1758)	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Timoclea ovata (Pennant, 1777)	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Venus casina Linnaeus, 1758	-	-	-	s	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Venus verrucosa Linnaeus, 1758	+	-	-	r	r	-	-	-	-	-	-	-	-	s	-	-	+	-	-	-	-	-	-	-	-	-	-
CEPHALOPODA																											
Octopus vulgaris Cuvier, 1797	-	-	+	-	r	-	+	-	r	c	+	-	-	r	+	r	+	+	-	-	+	+	r	r	+	-	-
Sepia officinalis Linnaeus, 1758	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-
ANNELIDA POLYCHAETA																											
Amphiglena mediterranea (Leydig, 1851)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	c	c	-	-	-	+	-	-	c
Bispira mariae Lo Bianco, 1893	-	-	r	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eunice aphroditois (Pallas, 1788)	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-
Eupolymnia nebulosa (Montagu, 1818)	-	-	-	-	+	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Filograna sp. sensu Bianchi, 1981	-	c	-	c	r	+	-	-	-	-	+	r	-	-	r	-	-	+	+	-	-	-	-	-	-	-	r
Myxicola infundibulum (Renier, 1804)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-
Pomatoceros triqueter (Linnaeus, 1767)	r	-	+	-	-	-	-	-	-	-	+	-	-	+	-	-	c	-	-	-	-	-	-	-	-	-	-
Protula intestinum (Savignyi, 1818)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	r	-	r	-	-	-	r	-	r	-

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Protula tubularia (Montagu, 1803)	-	-	-	-	c	r	-	+	+	-	+	r	-	+	r	+	-	r	-	+	-	-	-	-	-	-	r
Sabella pavonina Savignyi, 1822	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	+	r	-	-	-	-	-	-	-	-	-	-
Sabella spallanzanii (Gmelin, 1791)	-	r	+	r	r	-	-	+	-	-	-	r	-	+	-	+	r	-	r	-	-	-	r	-	-	-	-
Serpula vermicularis Linnaeus, 1767	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	c	r	-	-	-	-	-	-	-	-	-	-
Vermiliopsis infundibulum Philippi, 1844	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
CRUSTACEA																											
Acanthonyx lunulatus (Risso, 1816)	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Balanus perforatus Bruguiére, 1789	-	-	-	-	-	-	-	c	-	-	+	+	-	-	-	-	-	-	-	r	-	-	-	-	-	-	c
Cestopagurus timidus (Roux, 1830)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-
Chthamalus montagui Southward, 1976	-	c	+	+	c	-	-	-	-	-	+	-	-	-	c	+	-	c	+	c	-	-	r	c	-	+	c
Chthamalus stellatus (Poli, 1795)	c	d	c	d	d	d	-	d	d	r	-	c	-	c	c	r	+	c	r	r	-	-	c	c	-	+	d
Clibanarius erythropus (Latreille, 1818)	-	-	-	-	-	-	-	-	-	-	-	-	-	c	-	-	-	-	-	-	-	-	-	-	-	-	-
Eriphia verrucosa (Forsskål, 1775)	r	-	-	-	-	r	-	-	-	r	-	-	r	-	-	-	-	-	-	-	-	-	-	r	-	-	-
Euraphia depressa (Poli, 1795)	-	c	+	r	c	c	-	c	+	r	+	-	c	r	c	+	-	r	+	c	-	-	c	r	-	+	+
Eurynome aspera (Pennant, 1777)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Galathea bolivari Zariquiey-Alvarez, 1950	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
Galathea cenarroi Zariquiey-Alvarez, 1968	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Galathea strigosa (Linnaeus, 1767)	-	-	-	-	+	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Homarus gammarus (Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	r	-	-
Ligia italica Fabricius, 1798	+	-	c	c	c	-	-	-	r	+	-	+	+	+	r	-	-	-	-	-	-	-	+	+	-	-	r
Liocarcinus depurator (Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lissa chiragra (Fabricius, 1775)	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	+	-	-
Macropodia longirostris (Fabricius, 1775)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-
Maja crispata Risso, 1827	-	-	-	-	-	-	-	-	-	-	-	-	r	r	-	-	-	-	-	-	-	-	-	-	-	-	-
Maja squinado (Herbst, 1788)	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Munida rugosa (Fabricius, 1775)	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	r	-	-	+
Pachygrapsus marmoratus (Fabricius, 1787)	r	-	-	-	-	-	-	-	r	+	-	-	r	-	+	-	+	-	-	+	-	-	-	-	-	-	-
Palaemon elegans Rathke, 1837	+	-	+	+	-	-	-	-	-	+	-	-	+	-	+	-	-	-	-	+	-	-	-	-	-	-	-
Pilumnus vilosissimus (Rafinesque, 1814)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Pisa tetraodon (Pennant, 1777)	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-
Pisa sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-
Pisidia longicornis (Linnaeus, 1767)	-	-	-	-	-	-	-	-	c	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Pisidia longimana (Risso, 1816)	+	-	-	-	-	-	-	-	-	c	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Porcellana platycheles (Pennant, 1777)	c	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scyllarus arctus (Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	r	-	-	+	+	-	+	c	-	-
Typton sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Xantho hydrophilus (Herbst, 1790)	+	-	-	-	-	-	-	-	-	c	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ECHINODERMATA																											
Amphipholis squamata (Delle Chiaje, 1828)	-	-	-	-	-	+	-	-	r	+	-	-	-	-	-	-	-	r	+	-	-	-	-	-	-	-	-
Antedon mediterranea (Lamarck, 1816)	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-
Arbacia lixula (Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-	r	-	-	-	-	-	r	-
Astropecten aranciacus (Linnaeus, 1758)	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	r	r	-	-	-	-	-	-	r	-	-	-
Astropecten bispinosus (Otto, 1823)	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	+	-	-	-	-	-	-	-	-	-	-	-
Coscinasterias tenuispina (Lamarck, 1816)	-	-	-	-	-	-	-	r	-	r	-	-	-	-	-	-	+	-	-	r	-	-	-	-	-	-	-
Echinaster sepositus (Retzius, 1783)	r	r	r	r	+	r	+	r	r	+	+	r	-	r	+	r	r	r	r	+	-	-	r	-	-	r	-
Echinocardium fenauxi Péquignat, 1963	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	s	-	-	-	-	-	-	-	-	-	-	-
Echinocardium mortenseni Thiéry, 1909	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	s	-	-	-	-	-	-	-	-	-
Echinocardium sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	s	-	-	-	-	-	-	-	-	-	-	-	-	-
Echinocyamus pusillus (O.F. Müller, 1776)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	s	-	-	-	-	-	s	-	-	-
Eostichopus regalis (Cuvier, 1817)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	r	-	-	r	-	-	-	r	-	-	-
Holothuria forskali Delle Chiaje, 1823	-	+	+	+	r	-	-	+	+	+	r	+	-	+	c	c	c	r	+	r	+	+	+	+	-	r	+
Holothuria tubulosa Gmelin, 1788	+	+	c	r	+	+	-	+	r	+	+	r	r	c	r	r	r	+	-	r	+	-	-	r	+	r	-
Marthasterias glacialis (Linnaeus, 1758)	-	-	-	r	-	r	+	+	r	-	-	-	-	r	r	-	+	+	-	r	-	-	-	r	+	r	-
Ophioderma longicaudum (Retzius, 1805)	r	-	-	-	-	-	-	-	-	-	-	-	-	+	r	-	+	+	-	-	-	-	-	-	-	-	-
Ophiothrix fragilis (Abildgaard, 1789)	+	-	-	-	-	-	-	-	c	c	-	-	-	+	-	-	-	+	-	-	-	-	-	-	-	+	+
Ophiura albida Forbes, 1839	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Ophiura ophiura (Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-
Paracentrotus lividus (Lamarck, 1816)	-	-	+	c	c	c	-	+	c	+	+	r	-	+	+	+	c	-	-	c	-	-	-	r	-	r	-
Schizaster canaliferus (Lamarck, 1816)	s	-	s	-	-	-	-	-	-	-	-	-	-	-	-	-	s	s	-	-	-	-	-	-	-	-	-
Spatangus purpureus (O.F. Müller, 1776)	s	-	-	-	-	-	-	-	r	-	r	-	-	s	-	-	-	r	-	-	-	-	-	r	-	-	-
Sphaerechinus granularis (Lamarck, 1816)	-	c	+	+	c	r	-	+	r	+	r	+	+	c	c	r	+	+	-	r	-	-	r	-	r	+	-
TUNICATA																											
Ascidia virginea (O.F. Müller, 1776)	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ascidia sp.	-	-	-	c	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-

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Clavelina sp.	-	-	-	+	r	+	-	-	r	-	-	-	-	+	r	-	-	r	+	+	-	-	-	-	-	-	-
Didemnidae indet.	-	-	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Halocynthia papillosa (Linnaeus, 1767)	-	+	r	r	+	+	r	+	+	-	r	+	-	r	+	r	r	+	+	+	-	-	r	+	-	r	+
Microcosmus sabatieri Roule, 1885	-	+	+	-	-	-	-	r	-	+	-	-	-	r	-	-	+	-	-	-	-	-	-	-	-	-	-
Microcosmus savignyi Monniot, 1962	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Microcosmus sp.	-	-	r	-	+	-	-	r	-	-	r	r	-	r	r	r	-	r	-	r	-	-	r	r	-	+	-
Phallusia fumigata (Grube, 1864)	-	-	r	-	-	-	-	r	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Phallusia mammillata (Cuvier, 1815)	-	-	+	-	-	-	-	r	-	-	-	-	-	-	-	c	r	r	-	-	-	-	-	-	-	-	-
Polycitor adriaticus (Drasche, 1883)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-
VARIA																											
Bonellia viridis Rolando, 1821	-	-	r	-	+	r	-	-	-	+	r	r	-	r	+	r	+	-	-	r	-	-	-	r	-	r	-
Chartella papyracea (Ellis & Solander, 1786)	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Myriapora truncata (Pallas, 1766)	-	+	-	r	r	+	-	r	-	-	r	+	-	r	-	+	r	-	+	+	-	-	+	-	-	+	+
Phascolosoma granulatum Leuckart, 1828	-	-	-	-	-	-	-	-	+	-	-	r	-	r	-	-	-	-	-	+	-	-	r	+	-	-	+
Schizobrachiella sanguinea (Norman, 1868)	-	-	-	+	-	-	-	+	c	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Schizotheca serratimargo (Hincks, 1886)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
Sertella septentrionalis (Harmer, 1933)	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Smittina cervicornis (Pallas, 1766)	-	-	-	r	-	+	-	-	-	-	r	+	-	-	-	r	+	-	c	+	-	-	+	r	-	-	+
Tubulipora liliacea (Pallas, 1766)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
VERTEBRATA PISCES																											
Acantholabrus palloni (Risso, 1810)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-
Aidablennius sphynx (Valenciennes, 1836)	+	-	r	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Atherina boyeri Risso, 1810	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	c	-	-	-	-	-	-	-	-
Atherina hepsetus Linnaeus, 1758	+	-	-	-	-	-	-	+	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Atherina sp.	+	-	-	-	-	-	-	+	-	-	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Boops boops (Linnaeus, 1758)	+	+	-	-	c	-	-	-	-	-	-	-	r	+	-	+	-	-	-	-	r	-	-	-	-	-	-
Buenia affinis Iljin, 1930	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	+	-	-	-
Chelidonichthys lastovizza (Bonnaterre, 1788)	-	-	-	-	-	-	-	-	-	-	-	-	r	r	-	-	-	-	-	-	-	r	-	r	r	-	-
Chromis chromis (Linnaeus, 1758)	+	c	+	c	c	c	-	c	c	r	c	c	+	c	c	c	-	c	+	c	-	+	c	+	-	c	+
Chromogobius zebratus (Kolombatović, 1891)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Chromogobius sp.	+	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conger conger (Linnaeus, 1758)	-	-	-	+	+	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Coris julis (Linnaeus, 1758)	+	r	r	c	c	+	-	r	+	c	+	r	r	c	r	+	c	c	+	-	-	-	r	+	-	-	+
Coryphoblennius galerita (Linnaeus, 1758)	-	+	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dentex dentex (Linnaeus, 1758)	-	-	-	-	-	-	r	-	-	-	+	-	-	-	-	-	-	-	-	-	r	-	-	-	r	-	-
Diplodus annularis (Linnaeus, 1758)	+	-	+	r	-	-	+	r	r	+	+	+	+	r	-	+	-	-	r	-	+	c	-	-	r	-	-
Diplodus puntazzo (Cetti, 1777)	+	-	-	-	r	-	-	+	+	r	+	+	-	+	-	r	-	-	-	-	-	-	c	-	-	-	-
Diplodus sargus (Linnaeus, 1758)	-	-	-	-	c	-	-	+	+	r	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Diplodus vulgaris (G. St.-Hilaire, 1817)	r	c	r	r	c	+	+	+	+	+	+	+	-	r	+	+	r	c	r	-	-	+	-	-	r	-	-
Gobius auratus Risso, 1810	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gobius bucchichi Steindachner, 1870	+	-	+	+	+	-	-	-	+	+	-	-	-	+	+	-	+	-	+	-	-	-	-	-	-	-	-
Gobius cobitis Pallas, 1811	+	-	+	-	-	-	-	-	-	-	-	-	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-
Gobius cruentatus Gmelin, 1789	+	+	+	r	+	+	-	+	+	+	+	+	-	+	-	+	+	-	+	-	-	-	+	-	-	-	+
Gobius fallax Sarato, 1889	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Gobius geniporus Val. in Cuv. & Val., 1837	+	-	+	+	-	-	-	+	+	+	+	+	-	+	-	+	+	-	-	-	-	-	-	+	-	-	-
Gobius niger Linnaeus, 1758	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Gobius paganellus Linnaeus, 1758	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gobius roulei de Buen, 1928	+	-	+	+	-	-	-	+	-	+	-	+	-	+	+	+	c	-	-	-	-	-	-	+	-	-	-
Gobius vittatus Vinciguerra, 1883	-	+	+	+	+	+	-	+	+	+	+	+	-	+	+	+	+	-	+	-	-	-	+	+	-	-	+
Gobiidae indet.	-	-	-	+	+	+	-	+	+	-	+	+	-	+	+	+	-	-	+	-	-	-	+	+	-	-	+
Labrus merula Linnaeus, 1758	-	-	-	+	+	-	r	+	+	+	-	+	-	r	-	r	-	r	-	-	+	+	-	+	-	-	-
Lepadogaster candollei Risso, 1810	+	-	+	-	+	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-
Lepadogaster lepadogaster (Bonnaterre, 1788)	-	-	+	-	-	+	-	-	-	-	-	-	-	+	-	+	+	-	-	r	-	-	-	-	-	-	-
Lepadogaster sp.	-	-	+	-	-	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Lipophrys canevai (Vinciguerra, 1880)	-	+	+	r	+	+	-	r	r	c	+	+	-	+	-	-	-	-	+	-	-	-	+	+	-	-	+
Lipophrys dalmatinus (Steindachner & Kolombatović, 1883)	-	+	-	r	r	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lipophrys nigriceps (Vinciguerra, 1883)	+	r	-	-	+	r	-	r	+	+	+	+	-	-	+	+	+	-	+	-	-	-	-	-	-	-	+
Paralipophrys trigloides (Val. in Cuv. & Val., 1836)	-	-	-	-	-	-	-	+	+	-	+	c	r	r	-	-	-	-	-	-	-	-	-	-	-	-	-
Lophius piscatorius Linnaeus, 1758	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Merluccius merluccius (Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	r	-	-	-	-	-	-
Monochirus hispidus Rafinesque, 1814	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	r	-	-
Oedalechilus labeo (Cuvier, 1829)	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mugil sp.	+	-	-	+	+	-	-	-	-	-	-	-	-	c	-	-	-	-	-	-	-	-	-	-	-	-	-
*Mullus barbatus*Linnauus, 1758	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-

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*Mullus surmuletus*Linnaeus, 1758	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	c	-	-	-	-	-
Oblada melanura (Linnaeus, 1758)	c	r	+	c	c	c	-	c	r	+	+	+	c	c	+	+	-	+	+	-	-	+	-	-	-	-	+
Pagellus acarne (Risso, 1826)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-
Pagellus erythrinus (Linnaeus, 1758)	+	-	-	-	-	-	-	-	-	+	-	-	c	r	-	-	-	-	-	-	+	+	-	+	-	-	-
Parablennius gattorugine (Linnaeus, 1758)	-	-	r	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parablennius incognitus (Bath, 1968)	-	-	-	+	+	+	-	+	+	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-
Parablennius rouxi (Cocco, 1833)	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	+	+	-	+	-	-	-	+	+	-	r	+
Parablennius sanguinolentus (Pallas, 1814)	r	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-
Parablennius tentacularis (Brünnich, 1768)	+	-	+	-	-	-	-	+	-	+	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-
Parablennius zvonimiri (Kolombatović, 1892)	-	+	-	-	-	r	-	+	+	-	+	+	-	+	r	-	-	-	r	-	-	-	-	-	-	-	+
Sarda sarda (Bloch, 1793)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-
Sarpa salpa (Linnaeus, 1758)	+	-	-	-	-	-	-	-	-	r	+	+	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-
Sciaena umbra (Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scomber japonicus Houttuyn, 1782	-	-	-	-	-	-	-	-	-	-	-	-	-	c	-	-	-	-	-	-	-	-	-	-	-	-	-
Scorpaena notata Rafinesque, 1810	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	r	-	-	-	-	-	-
Scorpaena porcus Linnaeus, 1758	+	-	-	r	+	-	-	+	+	-	r	r	-	+	-	+	-	-	r	-	c	c	-	+	c	+	-
Scorpaena scrofa Linnaeus, 1758	-	-	-	-	-	-	-	-	r	r	+	-	-	-	-	-	-	-	-	-	-	-	-	+	r	-	-
Scyliorhinus canicula (Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scylliorhinus sp.	-	-	-	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Serranus cabrilla (Linnaeus, 1758)	-	-	-	+	-	r	-	+	+	r	-	+	-	+	-	-	-	r	-	-	r	-	-	-	+	-	-
Serranus hepatus (Linnaeus, 1758)	-	+	+	+	+	+	-	+	+	-	+	+	-	+	+	+	c	+	r	r	-	-	+	r	-	+	+
Serranus scriba (Linnaeus, 1758)	+	-	r	r	+	+	-	+	+	+	r	+	-	r	+	+	r	-	+	-	+	c	+	+	+	-	+
Sparus aurata Linnaeus, 1758	-	-	-	-	c	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Speleogobius trigloides Zander & Jelinek, 1976	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+
Spicara maena (Linnaeus, 1758)	-	-	-	-	-	-	-	+	+	+	+	+	-	-	-	c	-	c	-	-	+	+	+	-	-	-	-
Spicara smaris (Linnaeus, 1758)	-	-	-	-	-	-	-	+	+	-	-	+	-	c	-	-	-	-	-	-	-	-	-	-	-	-	-
Symphodus cinereus (Bonnaterre, 1788)	+	+	-	-	-	-	-	+	+	+	-	-	-	+	-	-	c	-	-	-	-	-	-	+	+	-	-
Symphodus doderleini Jordan, 1891	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Symphodus mediterraneus (Linnaeus, 1758)	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	+	+	-	+	-	-	-	+	+	-	-	+
Symphodus melanocercus (Risso, 1810)	-	-	-	-	+	-	-	+	-	-	-	+	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-
Symphodus ocellatus Forsskål, 1775	+	-	+	+	+	+	-	+	+	+	+	+	-	r	+	+	c	-	+	-	-	-	+	+	r	-	+
Symphodus roissali (Risso, 1810)	-	-	+	r	+	+	-	+	+	+	-	+	-	+	-	+	-	-	+	-	-	-	-	-	-	-	-

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Symphodus rostratus (Bloch, 1797)	-	-	+	+	-	-	-	+	+	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Symphodus tinca (Linnaeus, 1758)	+	+	+	+	+	+	-	+	+	+	+	+	-	c	+	+	+	-	r	-	+	c	-	+	c	-	+
Syngnathus sp.juv.	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thorogobius epipphiatus (Lowe, 1839)	-	-	-	-	+	-	-	-	-	-	+	+	-	-	-	-	-	-	+	-	-	-	-	r	-	-	+
Thorogobius macrolepis (Kolombatović, 1891)	-	-	+	+	+	-	-	+	+	-	+	+	-	-	+	+	-	-	+	-	-	-	+	+	-	-	+
Torpedo marmorata Risso, 1810	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	r	-	-	-	-	-
Trachinus araneus Cuvier, 1829	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-
Trachinus draco Linnaeus, 1759	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-
Trachinus radiatus Cuvier, 1829	-	-	-	+	-	-	-	-	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-
Trachinus sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Trigla sp.	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trigloporus lastovizza (Brünnich, 1768)	-	-	-	-	-	-	-	-	-	-	-	-	r	r	-	-	-	-	-	-	-	r	-	r	r	-	-
Tripterygion delaisi Cadenat & Blache, 1971	-	+	+	-	+	-	-	+	+	+	+	+	-	+	r	+	-	-	+	-	-	-	+	+	-	r	+
Tripterygion melanurus Guichenot, 1845	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tripterygion tripteronotus (Risso, 1810)	r	+	+	+	r	-	-	+	+	c	+	+	-	+	-	-	+	-	+	-	-	-	-	+	-	-	+
Trisopterus minutus (Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranoscopus scaber Linnaeus, 1758	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	+	+	-	+	r	-	-
Zebrus zebrus (Risso, 1827)	+	-	-	-	+	-	-	-	-	+	-	-	-	+	+	+	+	-	-	-	-	-	-	-	-	-	+
Zeus faber Linnaeus, 1758	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	r	-	-	-	-	-

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Croatian scientists should provide a summary in Croatian containing the complete title, name(s) of author(s) and affiliation(s). The titles of chapters (Introduction, ect.) should be typed in block capitals. Titles and subtitles should be typed on a separate line and not interfere. For the text please use Times New Roman with font size 11, for names in capitals, size 9. Names of autors in species quotations please write in lowercase.

Measurements should be given in International System of Units (SI).

Key words should be identified by using ASFA theasaurus aviable online at:
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Vouchers of the material used in biological papers should be clearly quoted.

References

Text citations are given as SMITH (1974) or (SMITH, 1974). If reference is made in the text written by more than two authors, the first author should be followed by *et al*. (SMITH *et al*., 1974). In the list of references all authors must be mentioned. Surnames of authors are written with a comma and initial: SMITH, D. The initials of any additional co-authors, excluding the first, precede the surname: SMITH, D. & A. ROBERTS; SMITH, D., A. ROBERTS & R. BLACK.

The list of references should be arranged alphabetically by authors names and chronologically per author. If an author on the list is also mentioned with co-authors, the following order shouled be used: publications of a single author arranged chronologically, followed by publications of the same author with more than one co-author. Publications by the same author(s) in the same year should be listed as 1974a, b, c etc., both in the text citations and in the list of references.

Journal abbreviations should be in accordance with the World List of Scientific Periodicals.

References should be arranged in the following manner:

Periodicals:

WALNE, P.R. 1964. Observation on the fertility of the oyster (*Ostrea edulis*). J. Mar. Biol. Assoc. U.K., 44: 293-310.

FALCONER, D.S. & M. LATYSZEWSKI. 1965. The environment in relation to selection for size in mice. J. Genet., 51: 67-80.

AULSTAND, D., T. GJEDREN & B. SKJERVOLD. 1972. Genetic and environmental sources of variations in
length of rainbow (*Salmo gairdneri*). J. Fish. Board Can., 29: 237-241.

Books:

BOOLOOTIAN, R.A. 1966. Physiology of Echinodermata. Interscience Publisher. New York, N.Y., 882 pp.

ALEXANDER, G., J.P. SIGNORE & E.S.E. HAFEZ. 1974. Behavioural aspects of reproduction. In: E.S.E. Hafez (Editor). Reproduction in Farm Animals. Lea and Febiger, Philadelphia. Pa., pp. 222-254.

Edited symposia:

O'CONNOR, C. 1975. Reproductive periodicities and population dynamics of some New South Wales sea urchins with a view to open sea culture. In: G. Persoone and E. Jaspers (Editors). 10th European Symposium on Marine Biology, Ostend, Belgium, 17-23 September, Vol. 1. Universal press, Wetteren, Belgium, pp. 285-301.

Quoting only one page:

SINOVČIĆ, G. 1995. First data on some aspects of biology and population dynamics of Atlantic mackerel, *Scomber scombrus* L. in the Adriatic. Rapp. Comm. int. Mer Médit., 34: p. 258.

Theses:

DABROWSKI, K. 1976. Studies on the utilisation of non-protein compounds in common carp nutrition. Thesis, University of Olsztyn, 96 pp.

If referred text is mimeographed, the note (mimeo) should be added at the end of the reference.

The papers which are not written in English, should be referred in original language with translated title in English (in brackets):

GAMULIN-BRIDA, H. & A. POŽAR-DOMAC. 1974a. Bentoske biocenoze Jadranskog mora kao novi izvori hrane i raznih sirovina s posebnim obzirom na spužve i koralje (Benthic biocoenoses of the Adriatic as new sources of food and various raw materials, with special consideration for sponges and corals). Acta Adriat., 16(4): 71-95.

The titles translated in English should indicate the original language in brackets:

TOĞULGA, M. 1977. The studies on population dynamics of red mullet (*Mullus barbatus,* Lin. 1758) in Izmir Bay (in Turkish). Ege University, Journal of Faculty of Science, Series B, C.I., S. 2:175-194.

Tables

Tables should be written on separate sheets and numbered consecutively with all remaining pages. Tables are numbered using Arabic numerals. Avoid vertical lines. Avoid unnecessary bolded text. For the legends use Times New Roman font size 9 (italics).

Illustrations

Graphs, maps and other illustrations should be of such a size as to allow a reduction by a factor of 4.

Figures captions should be typed in italics on a separate sheet of the manuscript. They should be referred to in the text:

- They showed no differences in survival (Fig. 1).
- The corresponding values of the test solutions are shown in Fig. 1.

Photographs with high quality resolution (300 dpi) are also acceptable. Preferable size of photos is 15x10cm. Originals of illustrations and photographs are required.

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