CONTRIBUTION TO SEDIMENT MACROFAUNA IN THE AREA OF ROVINJ (NORTH ADRIATIC SEA)

by

Dusan Zavodnik*, Jasna Vidakovic* and Louis Amoureux (1)**

* - Rudler Boskovic » Institute, Center for Marine Research, 52210 Rovinj. Yugoslavia.
* * Université Catholique de l'Ouest, Laboratoire de Zoologie, 2 bis, rue Volney, 49005 Angers, France.

Résumé

On a étudié ici les fonds meubles du port de Rovinj et de la région marine immédiatement environnante pour en mieux connaître la macrofaune. 167 espèces ont été reconnues, parmi lesquelles les Polychètes sont largement dominantes. Un Capitellidae, *Xeopseudocapitella brasiliensis,* est découvert pour la première fois en Europe.

On constate une plus grande richesse et une plus grande diversité qu'on ne le prévoyait eu égard aux déversements polluants récents. Ceux-ci semblent avoir une influence moins grande sur la distribution des animaux que le type du substrat.

Introduction

In the area of Rovinj, the benthos has been studied for more than one century. While several coastal research projects were done in the nearest vicinity of the town of Rovinj, the sedimentary bottoms around the town have been scarcely explored until recently. In fact, the only data on total sediments macrofauna in this area are those noted by Vatova (1928, 1935). Gamulin-Brida *et al.* (1968) and Zavodnik (1971) have explored benthos at some station in Lone and Valdibora Bays. Data on Polychaeta from Lone Bay have been also provided by Amoureux (1976). Information on sediments are given by Vatova (1935) and Vidakovic (1984).

The existing data were insufficient to authoritatively qualify the bottom communities and their fauna in the area near the city of Rovinj and in its harbor. Yet such data are indispensable for estimations of recent pollution effects. Our research objective was, therefore, to obtain data on the present composition of fauna on the sedimentary bottoms, which in the future could be used as baseline data for comparisons and the checking of possible alterations caused by pollution and/or other reasons.

(1) Present address: 22, Rue Saint-Louis, 35000 Rennes, France.

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Methods

All field work was accomplished in 1978-1980. The stations were grouped in the three arbitrary zones (Fig. 1), with regard to distribution of marine macroflora (Golubic, 1968), and to sanitary quality of sea water (Fuks, 1974):

Zone A: City harbor of Rovinj (11 stations)
Zone B: Inshore coastal waters of Rovinj (2 stations)
Zone C: Outer zone of coastal waters (3 stations).

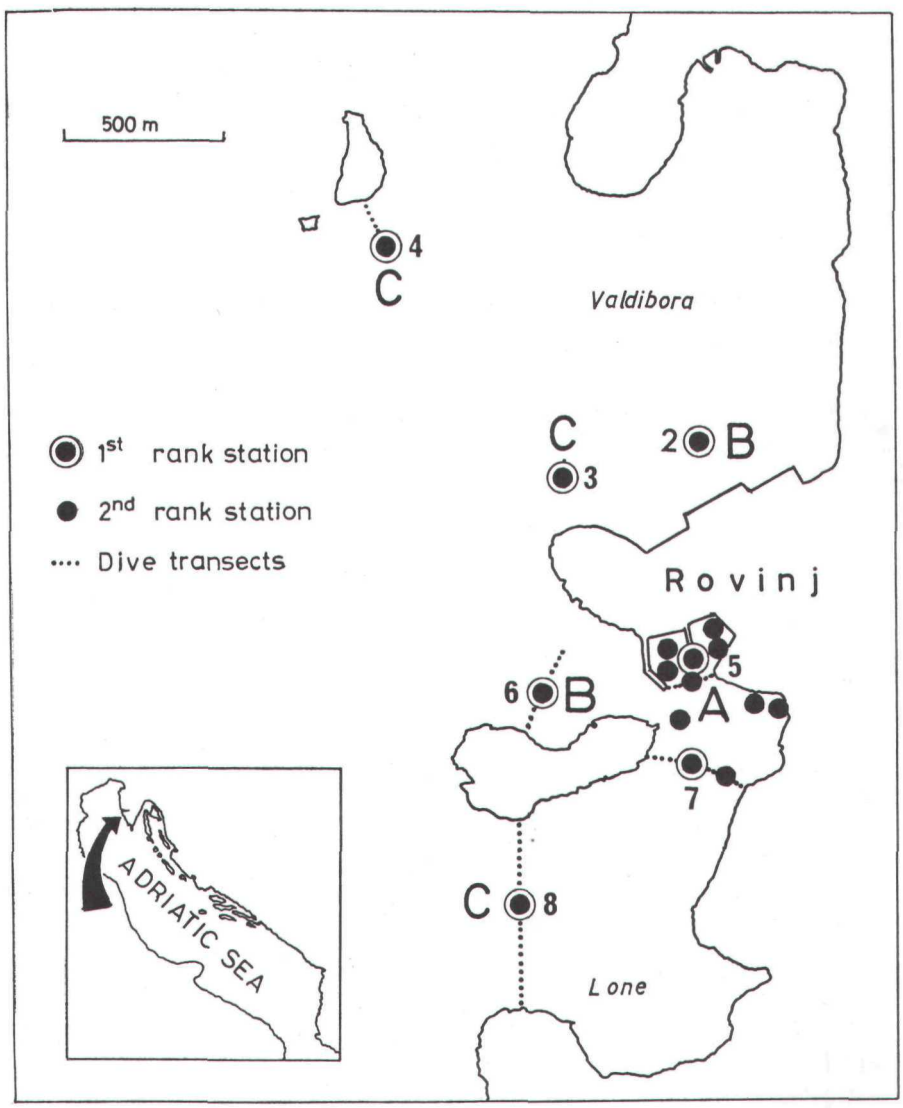

FIG. 1
Research area. Explanation to arbitrary zines (A, B, C) is given in **text.**

The quantitative samples were taken by the Van Veen grab 0.1 m^2, each sample consisted of two samplings. At seven stations of the 1st rank the material was sampled seasonally. Simultaneously, sampling for water analyses and for sediment meiofauna was also conducted (Vidakovic, 1984), but only the extracted macrofauna is considered in the present paper.

For qualitative sampling in the city harbor (zone A), at the 2nd rank stations, a Petersen grab 0.05 m^2 was also used. Additional *in situ* observations and samplings were effected by Scuba divers along 5 transects which run continuously from the littoral belt to the maximum depth in the area.

The sampled material was processed through sieves of 2 mm mesh. Taxonomic analyses were fulfilled in the Center for Marine Research in Rovinj, and in the Zoological Institute of the Catholic University in Angers. Benthic communities were classified according to Pérès and Picard (1964). For statistical processing only quantitative grab samples taken seasonally were used, but in the list of species data is also included from qualitative grab samples, and samples collected by SCUBA divers. For each investigated station and for each group of animals collected during the investigation, the Shannon-Weaver (H') index, evenness (E) and interspecific encounter probability (PIE) were calculated (Read *et al.,* 1978):

$$\text{(a)}\quad H' = -\sum_{i=1}^{S} \frac{N_i}{N} \ln \frac{N_i}{N}$$

$$\text{(b)}\quad E = \frac{e^H - 1}{S - 1}$$

$$\text{(c)}\quad PIE = \left(\frac{N}{N-1}\right)\left(1 - \sum_{i=1}^{S} \left(\frac{N_i}{N}\right)^2\right)$$

where:

N = total number of individuals in the community

S = total number of the species

N_i = number of individuals of the i^{th} species

Low PIE values are characteristic for stressed communities. Also, log-normal distribution of individuals among the species were calculated according to Gray and Mirza (1979).

RESULTS

The taxonomic analyses of macrofauna revealed 167 species (Table 1) of which 2 had not been previously reported from the area of Rovinj: the decapod crustacean *Philocheras monacanthus,* and the polychaete worm *Neopseudocapitella brasiliensis which* is also new for the European marine fauna (Amoureux, 1983).

TABLE I
List of species

Species	Arbitrary zones A	B	C	Total number of specimens	Ecological significance
CNIDARIA					
Podocoryne carnea M. Sars	+			+	Wed.
Epizoanthus sp.			+	4	—
Adamsia palliata (Bohadsch)	+			1	Mix.
Anthozoa indet.	+			1	—
NEMERTINI indet.	+			3	—
SIPUNCULA					
Aspidosiphon muelleri Diesing			+	1	Wed.
Aspidosiphon kovalevskii Murina	+	+	+	9	Wed.
Sipunculus nudus Linnaeus		+	+	2	Sand tol.
Golfingia adriatica Murina			+	1	—
Golfingia catharinae (Grube)	+	+	+	6	Silt tol.
Golfngia elongata Keferstein			+	1	excl. CD
Sipuncula indet.		+	+	7	—
MOLLUSCA					
Acanthochiton communis (Risso)	+			1	—
Callochiton laevis (Montagu)			+	1	—
Chiton olivaceus Spengler		+		1	—
Heliacus sowerbyi (Hanley)			+	1	—
Gourmya vulgata (Bruguière)	+			3	Wed.
Hinia (Tritonella) incrassata (Ström)	+			2	Wed.
Fusinus rostratus (Olivi)			+	2	Mix.
Lunatia alderi (Forbes)	+		+	4	—
Lunatia guillemini (Payraudeau)	+		+	3	Min., Ind. inst.
Murex brandaris Linnaeus	+			1	—
Truncolariopsis trunculus (Linnaeus)	+			4	Wed.
Acera bullata Müller	+			1	—
Actaeon tornatilis (Linnaeus)	+			1	excl. FGS
Dentalium vulgare da Costa	+			1	Sand tol.
Dentalim dentale Linnaeus			+	1	Wed.
Dentalium rubescens Deshayes	+	+	+	5	Silt tol.
Nucula sulcata Bronn	+			1	Silt str.
Nucula nucleus Linnaeus			+	1	Mix.
Nucula turgida nitidosa Winckworth		+	+	11	Ind. inst.
Nucula fragilis (Chemnitz)			+	3	Mix.
Modiolus barbatus (Linnaeus)	+			1	Wed.
Monia patelliformis (Linnaeus)			+	4	—
Myrtea spinifera (Montagu)		+		1	Wed.
Lucinella divaricata (Linnaeus)	+			13	—
Loripes lacteus (Linnaeus)	+			17	excl. SSCM
Loripinus fragilis (Philippi)	+	+	+	18	Mixt.
Ctena decussata (O.G. Costa)		+		1	—
Parvicardium nodosum (Turton)	+			1	—
Papillicardium papillosum (Poli)			+	1	Pref. CD
Acanthocardia aculeata (Linnaeus)		+		1	—
Sphaerocardium paucicostatum (Sowerby)			+	1	Silt tol.
Cardium sp.		+	+	2	—

Species	Arbitrary zones A	B	C	Total number of specimens	Ecological significance
Gouldia minima (Montagu)	+		+	3	Sand tol.
Pitar rude (Poli)	+	+	+	8	Pref. CD
Chamela galina (Linnaeus)	+			2	Pref. FGS
Dosinia exoleta (Linnaeus)	+			1	excl. SGBC
Venus verrucosa Linnaeus	+			2	excl. BMP
Venerupis corrugata (Gmelin)	+		+	4	—
Venerupis aureus (Gmelin)	+			17	excl. SSCM
Venerupis sp.	+			4	—
Gastrana fragilis (Linnaeus)	+			1	—
Quadrans serratus (Brocchi)		+	+	4	—
Moerella donacina (Linnaeus)	+			2	excl. CD
Fabulina fabula (Gronovius)	+			2	—
Gari fervensis (Gmelin)	+			1	—
Tellinella pulchella (Lamarck)	+	+	+	110	Sand tol.
Abra pellucida (Brocchi)	+			1	—
Spisula eliptica (Brown)	+	+	+	15	Sand tol.
Spisula subtruncata (da Costa)		+	+	5	excl. FGS
Cultrensis adriaticus Coen	+	+	+	9	Mix.
Hiatella arctica (Linnaeus)			+	1	Wed.
Corbula gibba (Olivi)	+	+	+	88	Wed.
Lyonsia norvegica (Gmelin)			+	1	Mix.
ANNELIDA POLYCHAETA					
Pontogenia chrysocoma (Baird)	+			1	—
Malmgrenia castanea McIntosh			+	1	—
Harmothoe lunulata (Delle Chiaje)			+	2	Wed.
Harmothoe sp.	+	+		2	—
Leanira yhleni Malmgren		+	+	2	Min.
Sthenelais boa (Johnston)	+			1	Sand tol.
Sthenelais ctenolepis Claparède	+	+	+	17	—
Euphrosine foliosa (Audouin et M. Edwards)	+			1	—
Anaitides (*Phyllodoce*) *lineata* (Claparède)	+	+		16	excl. CTO
Paranaitis kosteriensis (Malmgren)			+	2	—
Mysta picta (Quatrefages)	+	+		5	—
Mysta cf. siphonodonta (Delle Chiaje)	+			1	—
Neanthes caudata (Delle Chiaje)	+			33	Ind. pol.
Nereis lamellosa Ehlers	+			4	—
Platynereis dumerilii Audouin et M. Edwards	+			6	pref. PSW
Nephthys incisa Malmgren	+	+	+	7	Min.
Nephthys hystricis McIntosh		+	+		excl. CTO
Glycera convoluta Keferstein	+			4	pref. FSS
Glycera unicornis Savigny	+			5	Silt tol.
Glycera rouxii Audouin et M. Edwards	+	+	+	10	Silt tol.
Glycera cf. gigantea Quatrefages	+			1	pref. SGBC
Goniada maculata Oersted	+	+	+	7	excl. CTO
Eunice vittata (Delle Chiaje)	+	+	+	40	Wed.
Nematonereis unicornis (Grube)		+	+	5	Mix.
Hyalinoecia grubei Marenzeller	+	+	+	30	—
Arabella geniculata (Claparède)	+	+	+	4	Grav.
Drilonereis filum Claparède		+	+	3	Wed.

Species	Arbitrary zones A	B	C	Total number of specimens	Ecological significance
Lumbrineris impatiens Claparède			+	1	Wed.
Lumbrineris latreilli Audouin et M. Edwards	+	+	+	79	Wed.
Lumbrineris gracilis (Ehlers)	+			4	pref. SGBC
Lumbrineris sp.	+		+	6	—
Aonides oxycephala (Sars)	+		+	10	—
Nerinides cantabra Rioja	+			1	excl. FSS
Polydora flava Claparède			+	1	—
Scolelepis fuliginosa (Claparède)	+			66	Ind. pol.
Spio multioculata Rioja		+		7	Silt tol.
Magelona alleni Wilson		+		2	excl. CTO
Chaetozone setosa Malmgren	+		+	3	Mud. tol.
Brada villosa (Rathke)			+	2	excl. BS
Pherusa eruca (Claparède)	+	+	+	12	Mix.
Dasybranchus sp.			+	1	—
Capitella capitata (Fabricius)	+			9	Ind. pol.
Neopseudocapitella brasiliensis Rullier et Amoureux	+			14	—
Pseudoleiocapitella fauveli Harmelin	+	+		3	—
Notomastus latericeus Sars	+	+	+	103	Wed.
Asychis gotoi Izuka			+	1	Silt str.
Euclymene oerstedi (Claparède)		+	+	5	excl. FGS
Euclymene lumbricoides (Quatrefages)		+		3	—
Euclymene sp. (frgm.)	+	+	+	35	—
Maldane glebifex Grube		+	+	4	Silt str.
Maldanidae gen. sp.	+			1	—
Petaloproctus terricola Quatrefages		+	+	4	excl. SSCM
Leiochone tricirrata Bellan			+	1	—
Owenia fusiformis Delle Chiaje	+	+		13	Sand tol.
Sternaspis scutata (Renier)			+	12	excl. CTO
Amphictene auricoma (Müller)	+	+	+	43	Silt tol.
Lagis koreni Malmgren	+	+		17	Sand tol.
Melinna palmata Grube	+		+	3	Min.
Lanice conchylega (Pallas)	+			1	—
Amaeana trilobata (Sars)		+	+	5	—
Amphitrite cirrata Müller		+		1	—
Pista cristata (Müller)	+	+	+	72	Min.
Polymnia sp.	+			1	—
Polycirrus sp.		+	+	7	—
Thelepus cincinnatus (Fabricius)			+	1	pref. CD
Amphitritinae gen. sp.		+	+	6	—
Terebellides stroemi Sars	+	+	+	19	Mud. tol.
Chone cf. filicaudata Southern	+			4	excl. FGS
Chone collaris Langerhans	+			1	—
Chone sp.	+			4	—
Dialychone acustica Claparède	+			12	excl. FGS
Jasmineira candela (Grube)		+		2	—
Jasmineira cf. caudata Langerhans	+			2	—
Pomatoceros triqueter Linnaeus			+	3	Con.
ARTHROPODA CRUSTACEA					
Sycionia carinata (Brünnich)	+			2	Wed.
Athanas nitescens Leach	+			1	Wed.
Thoralus cranchii (Leach)	+		+	2	pref. PSW

Species	Arbitrary zones A	B	C	Total number of specimens	Ecological significance
Thoralus sp.	+			1	—
Processa sp.	+	+	+	14	—
Philocheras monacanthus Holthuis	+	+		3	—
Philocheras sp.	+			1	—
Paguristes oculatus (Fabricius)	+	+	+	14	pref. CD
Diogenes pugilator Roux	+			5	Sand tol.
Pagurus cuanensis Bell			+	5	—
Anapagurus sp.	+	+		6	—
Galathea sp.		+		1	—
Pisidia longimana (Risso)	+	+		2	—
Ilia nucleus (Linnaeus)	+			1	—
Achaeus cranchii Leach		+		1	pref. PSW
Macropodia rostrata Linnaeus		+		1	pref. PSW
Parthenope angulifrons Latreille	+			3	—
Macropipus pusillus (Leach)		+	+	2	excl. SGBC
Cirolana sp.			+	1	—
Amphipoda indet.	+		+	32	—
TENTACULATA					
Micropora complanata (Norman)			+	1	Wed.
Scrupocellaria reptans Linnaeus			+	1	Wed.
Cellaria fistulosa (Ellis et Solander)			+	2	pref. C
Schizoporella sp.			+	2	—
Cryptosula sp.			+	1	—
Sertella beaniana (King)			+	1	excl. C
HEMICORDATA					
Glossobalanus minutus (Kowalevsky)			+	1	—
ECHINODERMATA					
Trachythyone tergestina (M. Sars)			+	1	pref. CTO
Trachythyone elongata Düben et Koren		+	+	11	Silt tol.
Thyone fusus (O.F. Müller) - juv.			+	1	Mix.
Thyone cherbonnieri Reys		+		1	—
Phyllophorus urna Grube	+		+	2	Wed.
Leptosynapta inhaerens (O.F. Müller)			+	1	excl. CTO
Labidoplax digitata (Montagu)			+	2	excl. CTO
Amphiura chiajei Forbes	+	+	+	30	Silt tol.
Amphiura cherbonnieri Guille	+			1	—
Amphiura filiformis O.F. Müller	+	+	+	20	Min.
Amphipholis squamata Delle Chiaje	+			1	Wed.
Ophiothrix fragilis (Abildgaard)		+	+	4	Wed.
Ophioderma longicaudum (Retzius)		+		3	—
Ophiura grubei Heller	+			6	excl. CD
Psammechinus microtuberculatus (Blainville)		+		1	pref. CD
Paracentrotus lividus (Lamarck)	+	+	+	22	pref. PSW
Echinocyamus pusillus (O.F. Müller) (test)		+		1	Grav.
Schizaster canaliferus (Lamarck)		+		2	Silt tol.
TUNICATA					
Distoma adriaticum Drasche			+	1	pref. CD
Ascidiella aspersa (Müller)	+			1	Wed.

Species	Abritrary zones A	B	C	Total number of specimens	Ecological significance
Ascidia virginea (Müller)			+	1	—
Polycarpa pomaria (Savigny)		+	+	3	excl. CD
Distomus variolosus Gaertner			+	2	—
Microcosmus sabatieri Roule			+	1	—
Microcosmus sp.		+		1	
Tunicata indet.		+	+	2	—
ACRANIA					
Branchiostoma lanceolatum (Pallas)	+			5	excl. SGBC

Abbreviations

C = Community of coralligenous bottom
BS = Community of bathyal silts
CD = Community of coastal detritical bottom
DO = Community of coastal detritical bottom partly mixed with ooze
BMP = Beds of marine phanerogams
CTO = Community of coastal terrigenous ooze
FGS = Community of fine grained sands
FSS = Community of fine superficial sands
PSW = Community of photophilic sea weeds
SGBC = Community of rough sands and fine gravels under the influence of bottom currents
SSCM = Community of silty sediments of calm mode
excl. = exclusive species
pref. = preferential species
Sand str. = species living only in sandy bottoms
Sand tol. = species living on sands and tolerant to other fractions
Silt str. = species living only on silty bottoms
Silt tol. = species living in silts and tolerant to other fractions
Grav. = species living on gravely bottoms
Min. = species living in fine sands and silts
Mix. = species living on mixed bottoms
Wed. = species with wide ecological distribution
— = species of which the ecological significance is insignificant or not yet defined
+ = species present in the samples

At most stations sampled by grabs, the macrofauna is mixed according to the ecological preferences of peculiar species. Thus, at most sites, the communities of sedimentary bottoms can be noted as «mixed» or «transitive». Only three well defined biocoenoses could. be identified in the investigated area:

— biocoenosis of fine, well sorted sands, populated by the marine phanerogam *Cymodocea nodosa,*

— *biocoenosis* of coastal detritic bottom, and

— biocoenosis of detritic bottoms mixed with ooze.

It should be noted, that in the rough sand patches superimposed on the hard bottom, species characteristic for the biocoenosis of rough sands and fine gravels under the influence of bottom currents were found (i.e. *Branchiostoma lanceolatum).*

The arbitrary zone A is under the direct influence of domestic sewage sludge. At the two 1st rank stations studied 84 species of Mollusca, Polychaeta, Crustacea and Echinodermata (total 423 individuals) were collected. Dominant species in this zone were: *Loripinus fragilis, Corbula gibba, Tellinella pulchella, Lumbrineris latreilli, Notomastus latericeus, Pista cristata, Diogenes pugilator, Paguristes oculatus* and *Amphiura chiajei.* At the 1st rank station

TABLE II

Species diversity (H˙), dominance diversity (E) and PIE for Mollusca, Polychaeta, Crustacea and Echinodermata from three arbitrary zones in the area of Rovinj.

Arbitrary zone	Group	No. species	No. specimens	H'	E	PIE
A	Mollusca	24	84	2.565	0.522	0.890
	Polychaeta	31	310	2.780	0.487	0.908
	Crustacea	12	27	2.278	0.796	0.915
	Echinodermata	7	17	1.558	0.625	0.772
B	Mollusca	14	41	2.057	0.525	0.826
	Polychaeta	33	116	3.014	0.625	0.939
	Crustacea	9	16	1.977	0.778	0.883
	Echinodermata	8	19	1.731	0.664	0.813
C	Mollusca	22	119	2.035	0.277	0.748
	Polychaeta	37	208	2.828	0.430	0.888
	Crustacea	6	19	1.531	0.725	0.795
	Echinodermata	9	44	1.577	0.480	0745

located within the city harbor, a lower species diversity of grab samples was noted in comparison to station which is located at the entrance of the harbor. The lowest species diversity in this zone was calculated, however, for echinoderms (Table II). Though, the diving survey revealed that within the harbor, the sands and gravels are rich in mobile surface macrofauna, especially in *Hinia incrassata, Gourmya vulgata, Truncullariopsis trunculus, Paguristes oculatus, Diogenes pugilator, Pisidia longimana, Paracentrotus lividus* and several Gobiid fishes.

In the zone B, inshore coastal waters of Rovinj are included which are under slight influence of sewage sludge. At the 1st rank stations, characterized by silty-sand sediment (Vidakovic, 1984), 97 species and 192 individuals were counted. Dominant species at these stations were *Corbula gibba, Tellinella pulchella, Notomastus latericeus, Pista eristata, Eunice vittata, Paguristes oculatus* and *Amphiura chiajei.* The highest species diversity was calculated for Polychaetes and the lowest one for Echinodermata, again (Table II).

The arbitrary zone C is the outer zone of coastal waters which is characterized by sandy-silt and silty-sand sediments (Vatova, 1935). 112 species represented by 358 individuals were studied during our research. Dominant species at zone C stations were: *Corbula gibba, Tellinella pulchella, Amphictene auricoma, Notomastus latericeus, Paguristes oculatus, Amphiura chiajei* and *Amphiura filiformis.* It is interesting that in this zone, the species diversity, dominance diversity and PIE of some animal groups were somewhat lower than

calculated for groups of stations located in the arbitrary zones A and B (Table II). The log-normal distribution of individuals among species (Fig. 2) are the same for all three arbitrary zones.

DISCUSSION

Previous research of algal communities on rocky shores carried out during the past two decades, indicated a continous decline in species distribution and diversity of seaweeds in the area. It is supposed that these phenomena are caused by organic pollution through municipal wastes and industrial effluents Olunda, 1974, 1980; Katzmann, 1972). The unfavorable spatial effects of pollution were mapped by Golubic (1968) almost two decenniums ago; the author noted the lowest diversity of marine macroflora, accompanied with the dominance of nitrophile species just in the area which in the present paper is designated as zone A and B. Similar spatial distribution of polluted waters was confirmed also by bacteriological surveys (Fuks, 1974). In the innermost part of the city harbor, Golubic (1960) identified a characteristic flora of cyanophytes, and noted a complete absence of non-nitrophile species. Igic (1982) had recorded at this locality a well formed fouling community which, by its composition, is characteristic for harbor ecosystems in the northern Adriatic. In the outer part of the city harbor, N. Zavodnik (1979) had recorded a dense population of *Scytosiphon lomentaria*.

Considering the above reports, we had expected that, because of the impact of untreated sewage sludge, a low species diversity (H') of benthic macrofauna, a high dominance diversity (E) and low PIE would be noted. But, according to our results, the fauna is still rather diverse in the Rovinj harbor ecosystem (zone A). It is, however, characterized by species of wide ecological distribution which are tolerant of various environmental conditions, and by species indicative for polluted environments (i.e. N*eanthes caudata, Scolelepis fuliginosa* and *Capitclla capitata)*. The populations indicate a general instability of this habitat, which was expected from the results of similar surveys in other parts of the Mediterranean (Pérès and Picard, 1964; Bellan, 1967, 1976; Bellan *et al.,* 1978). But, in the area of St. Katarina Island, at about 2 meter depth, the divers have found a small area of rough sand the presence of which is an indication of strong bottom current. The sand was populated by species of wide ecological distribution, those characteristic for the biocoenosis of high photophilic algae, and those which are important in the biocoenosis of rough sand and fine gravels under the influence of bottom currents. The presence of the populations characteristic for the last cited community in the near vicinity of the city (in the arbitrary zones A and B, Table I) was rather unexpected, because hitherto this biocoenosis was considered as typical for clear and non-polluted water ecosystems (Pérès and Picard, 1964). Obviously, the influences of wastes are most expressed in surface layers of water, and much

reduced near the bottom especially at sites which are under the continous influence of bottom currents arriving from relatively non-polluted offshore areas.

In the arbitrary zone B, according to the grab survey, only one typical benthic community was found: the biocoenosis of detritic bottom partly mixed with ooze. The diving survey, however, showed various transitions between the pure sand and detritic bottom; these mixed communities usually were distributed patchly.

Macrobenthic communities of sedimentary bottoms in the hypothetic zone C apparently were not affected by the direct impact of city wastes. The results of our survey are quite comparable to those of Vatova (1928, 1935) of almost 50 years ago. The minor alterations noted can be attributed to the increased and constant fine fractioned sediment impact (Zavodnik, 1971) rather than to effects of organic pollution. Additional SCUBA and skin diving surveys in the area revealed a number of sublittoral benthic communities which in this area, generally, are patchly distributed. In light of the primary objective of the present study, they were not specially investigated. However, extensive alterations in benthic seaweeds and marine phanerogams populations were noted in comparison to previous data, a topic that will be treated in another paper.

Apparently, according to species diversity (H'), dominance diversity (E) and PIE, hypothetical arbitrary zones A, B and C are very similar (Table II). Also, the log-normal distribution of individuals among the species indicates no differences between the three investigated zones (Fig. 2).

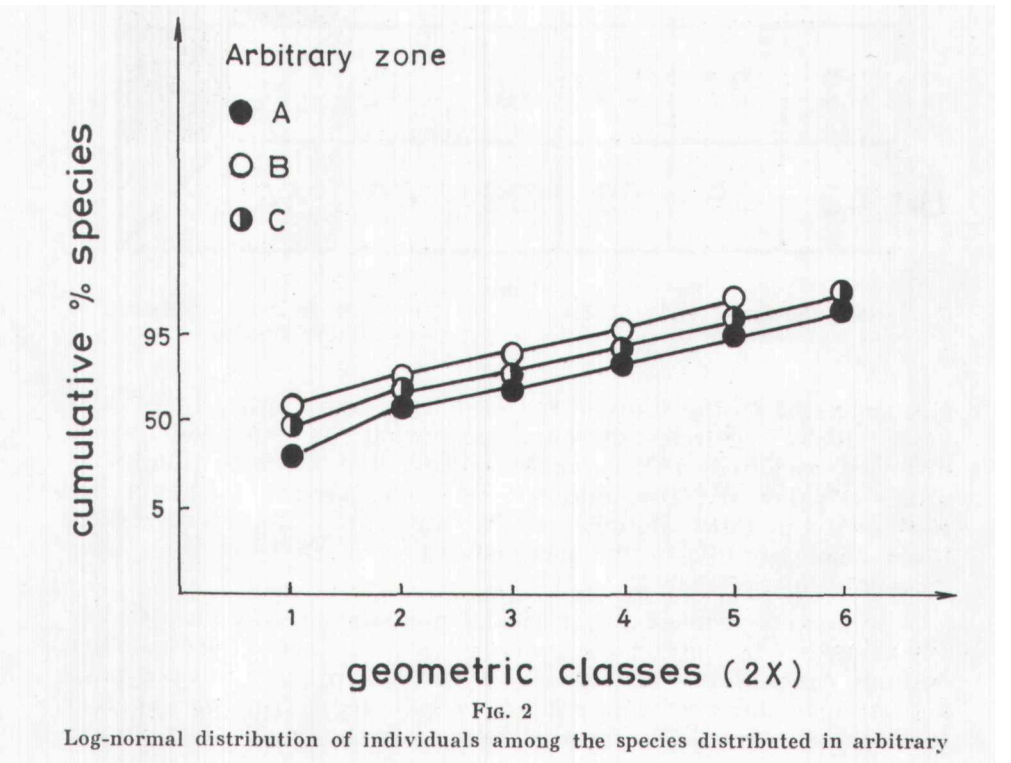

FIG. 2

Log-normal distribution of individuals among the species distributed in arbitrary

The Trellis diagram (Fig. 3) shows that macrofauna at most stations studied was fairly similar with regard to common species. This diagram also indicates that, at present, in the vicinity of Rovinj the sediment type influences the abundances and distribution of species more than town sewage input. A similar conclusion was

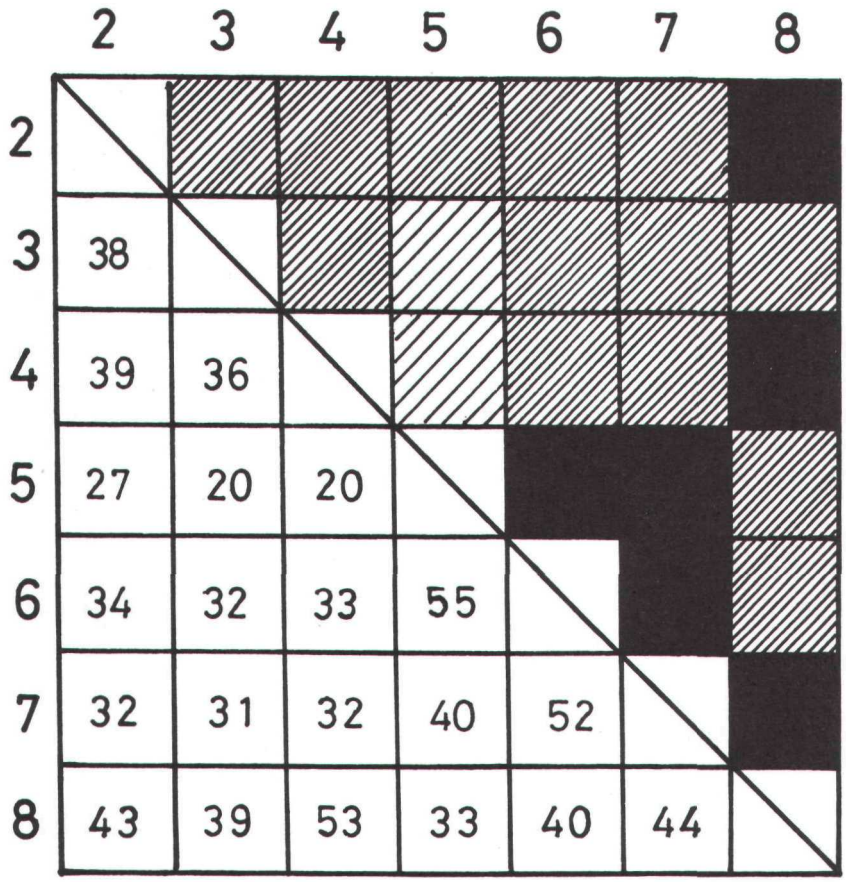

FIG. 3
Similarities (Sorensen's QS) of 1st rank stations with regard to numbers of macrofauna species (Mollusca, Polychaeta, Crustacea, Echinodermata).

also suggested by the study of sediment meiofauna in the area (Vidakovic, 1983). Species diversity, somewhat increased dominance diversity, and high PIE (near 1) suggest that the area studied is under very low stress conditions. Similarly, Avcin *et al.* (1974), in moderately polluted stations of the Koyer Bay, found diversities lower than 1, while in the non-polluted areas the diversities were frequently higher than 2.

As previously noted 167 species of macrofauna were identified in our samples. In spite of the thorough investigations of sedimentary bottoms communities carried out in the Rovinj area, in the past, 2 previously unreported species were collected. This means that further additions to the marine fauna can be expected in future

surveys, and not just in poorly known habitats (i.e. interstitial meiofauna) but also in the sediments which are supposed to be well explored. It should be noted also, that we did not succeed in collecting the bivalve *Uncidens arupinensis* which is known only from a type specimen collected by Vatova in the Rovinj harbor (Coen, 1934).

CONCLUSIONS

1. The survey of sedimentary bottoms revealed 167 species of macrofauna, of which 1 *(Neopseudocapitella brasiliensis)* is new to European seas.
2. In the near vicinity of Rovinj city, and in its harbor, the bottom macrofauna is richer than was expected, considering the organic pollution effects on algal communities, and the sanitary quality of coastal waters.
3. Direct effects of municipal wastes are limited with regard to sediment macrofauna. Its composition indicates that the area studied is under low stress conditions.

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Summary

In the harbor and the near vicinity of Rovinj, north Adriatic, the sediment macrofauna was surveyed with the objective to establish the present conditions of the fauna and possible effects of untreated sewages to sublittoral benthic communities.

A total of 167 animals species are listed, among which Polychaeta are dominant. A capitellid worm *Neopseudocapitella brasiliensis* new to European marine fauna is noted.

It was found that benthic fauna in the area is still rather diverse which is an indication that the area is under low stress conditions. It seems that the spatial distribution of macrofauna is at present conditioned by substrate composition rather than it is influenced by effluents.

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