Note on the marine flora of the Banjole islet (North Adriatic)

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The small islet Banjole, located at 1 Nm off Rovinj, is wide known as a traditional training area of students in biology from many European universities. The islet is famous for its two underwater caves, excellent communities zonation related to the exposure to wind and waves and richness of habitats. It is strange enough that the islet's marine flora has never been studied in detail. According to previous notes, mostly occasional, of which some were recorded more than a century ago, the Banjole islet is extraordinarily rich in dense brown algae assemblages which distribution reflect influences from coastal and offshore waters.

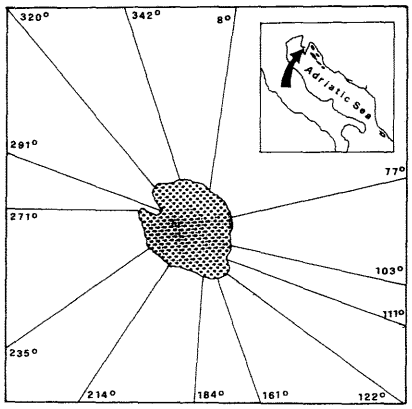

Fig. 1.- Islet Banjole: sampling sites

Some 20 years ago, dense *Cystoseira* and *Sargassum* settlements covered completely the islet's rocky slopes, and on the detritic sandy bottom a *Cymodocea nodosa* meadow was mapped (ZAVODNIK, 1967, SENES, 1988). Around that time already a decrease in algal abundance was noted in the Rovinj city area which was obviously caused by a complex industrial and urban pollution (GOLUBIC, 1968, KATZMANN, 1972, MUNDA, 1974). In the past decennium, basic alterations occurred in the islet's benthic communities, too. In the upper infralittoral zone, algal forests decreased to a stage of a ground carpet, and the *Cymodocea* bed disappeared. Our research performed along 13 SCUBA transects (Fig. 1) revealed only 145 algal taxa: Rhodophyta 98, Phaeophyta 27 and Chlorophyta 20 (Fig. 2).

To day, in the islet's mediolittoral zone in the winter-spring period the mostly common annual species are *Ulva rigida*, some *Enteromorpha, Cladophora* and *Ceramium* species.

In the summer period they are substituted by diverse *Gelidium, Gelidiella, Polysiphonia* species and others. At some sheltered sites low quantities of the perennial brown alga *Fucus virsoides* occurred, while on the exposed rocks a worm-like *Nemalion helminthoides* was noted. The infralittoral habitats are covered by dense settlements of *Padina pavonica* mixed with *Acetabularia cetabulum*. *Cystoseira* species were mostly substituted by *Stypocaulon scoparia* and *Dictyota* species. At the depth of 10-20 m, at a distance of about 30 m from the shore line, dense assemblages of *Pseudolithophyllum expansum* occurred, while *Peyssonnelia polymorpha* and *Peyssonnelia rubra* indicate a typical infracoralligene in the sense of SENES (1988). On calcareous algae were rarely attached solitary thalli of *Cystoseira corniculata* ssp. *laxior, Dictyota linearis, Codium bursa, Halimeda tuna* and *Udotea petiolata*. Changes in the Banjole marine flora, conspicuous to all divers, in all probability were instigated by complex pollution agents.

But recently also several eutrophication phenomena are perhaps involved in the decrease of some algal and seaweed assemblages in the entire area, which remind as the consequences of anoxic conditions on the marine fauna.

Consequently, one can point out the following facts:

1.- In the near past, dense settlements of fucoids and *Cymodocea nodosa* have disappeared in the Banjole islet area.

2.- Perennial fucoid species were mostly substituted by settlements of annual Chlorophyceae, Sphacellariaceae, Dictyotaceae and especially by red algae i.e. Corallinaceae and Gelidiaceae.

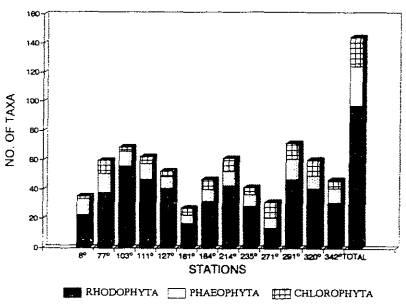

Fig. 2.- Total taxa and number of Rhodophyta, Phaeophyta and Chlorophyta at each study site

3.- The total flora at the thirteen sites studied consisted of 98 taxa pertaining to Rhodophyta, 27 to Phaeophyta and 20 to Chlorophyta. The R/P ratio was 3.6.

4.- It seems that reiterated short-time coverings of organic mucous materials did not have harmful effects to seaweeds as they had to sessile animals at the same habitats.

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A comparison among some suspended matter characteristics in two tidal inlets of the Marano Lagoon (Northern Adriatic Sea)

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Tidal inlets represent the points of exchanges of water and suspended sediment between lagoon basins and open sea. So here it may be easy to define fluxes and evaluate mass balances by means of appropriate surveys. In order to obtain these purposes, one should evaluate the temporal stability of suspended matter concentrations and of mineralogical and grain size characteristics, at the same tidal range conditions, spotting out and valuating the peculiarities of perturbing events.

In an Eulerian approach to the problem, two nearby tidal inlets (Lignano and S. Andrea) have been sampled along water column to verify the changes in concentrations and the different features of suspended matter in a same point of the tidal cycle.

During the central phase of flood and ebb tide, water sampling (with a Niskin-type bottle), and measurements of temperature, salinity and current speed have been carried out twice a day, for seven consecutive days (from the 27th July to 2nd August, 1991). In that period tidal range varied from 115 to 79 cm; maximum current speed was 1.2 m/s at Lignano inlet. For comparison, samples of sea water were also picked up at about 1 km from the coast.

The two lagoon basins and corresponding inlets show different charateristics. The Lignano basin has a surface of about 40 km2, and its inlet is 550 m width and 10 m depth. S. Andrea basin has a surface of 8 km2, the inlet is 350 m width and 7 m deep. This inlet is not periodically dredged.

During sampling time, weather conditions have been constantly monitored by the weather station of Lignano, which is run by the Physics Department of the University of Udine. It must be said that wind average hourly speed has exceeded 5 m/s in the following days: 27th and 31st July.

At Lignano inlet, total suspended matter concentration (TSM), measured gravimetrically using Whatman GF/F filters, shows an increase from surface to bottom. On the other hand, at S. Andrea inlet TSM values are quite uniform in the whole water column (Tab.I). In calm sea conditions and with wind speed lower than 5 m/s, TSM ebb concentrations are always higher than the flood ones (as reported in BRAMBATI *et al.*, 1983). Besides TSM concentrations show quite different values in the two inlets. This is probably due to the different surface, morphology and depth of the two basins, as well as their different behaviour in respect of wind waves. In windy weather conditions, TSM values in and out the inlet are clearly above the mean values of Table 1 (see also BRAMBATI *et al.*, 1990), with some flood concentrations higher than ebb ones.

The carbonates percentages of sea samples are nearly 30 %: in the Lignano inlet the values are uniform and range from 30 to 40 %. In S. Andrea inlet the values are unsteady and they often may exceed 60 %, expecially with rough sea. The higher values (directly correlated with TSM) measured in the S. Andrea inlet are to be related to mainly carbonate sandy shoals in front of the inlet.

	T.S.M.			% carbonate			median diameter				
	S	M	B	S	M	B	S	M	B		
Lignano	3.4	4.2	5.2	30.8	40.1	42.7	11.4	12.8	13.8	mean	
	0.8	1.6	2.2	5.7	6.9	5.8	1.3	2.5	2.9	st.d.	FLOOD
S. Andrea	2.4	2.1	2.3	29.8	34.0	34.6	10.7	11.3	10.3	mean	TIDE
	1.5	0.9	1.2	7.5	6.4	2.5	1.3	2.1	1.5	st.d.	
Lignano	4.3	6.2	7.7	38.7	39.5	39.7	13.3	14.1	15.1	mean	
	0.6	1.3	3.1	1.8	4.3	1.5	1.8	1.7	1.7	st.d.	EBB
S.Andrea	3.1	3.0	3.5	37.4	40.6	44.3	12.0	11.5	12.6	mean	TIDE
	0.7	0.8	1.1	5.4	6.7	10.3	2.2	1.4	2.3	st.d.	
sea	1.6			30.9			10.0			mean	
	0.5			9.1			0.9			st.d	

Table 1.- Mean and standard deviation values of total suspended matter (TSM, mg/dm^3), percentages of carbonates, median grain diameter (μm). S= surface; M= mid-detph; B= bottom. Data relative to windy days have been omitted from computation.

In order to determine the grain size, the samples were analyzed with a Coulter Multisizer in the range 2.8-90 μm. Reported values are the average of three analysis. There is a strong relationship between the median diameter and the 5th percentile (coarser). In Lignano inlet samples the median diameter always increases from surface to bottom (from 10 to 18 μm). The lower values, similar to sea-water values, are observed in flood surface water.

In S. Andrea inlet values range from 8 to 16 μm, with values lower than Lignano ones. In water column the trend is irregular: the higher value is often seen in medium depth; the lower value is observed, by turns, in surface or bottom water.

To complete the knowledge of composition of suspended matter, mineralogical analyses and organic C and N measurements have been working on.

Finally the repeatability of sampling w.s confirmed by stability of examined data, with the exception of periods during and immediately after rough sea due to wind waves.

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