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SOME FAUNISTIC AND ECOLOGICAL OBSERVATIONS ON THE BRYOZOA GYMNOLAEMATA ASSEMBLAGES FROM THE COAST OF PUGLIA (ITALY)

Abstract - The taxonomic, zoogeographic and bionomic characteristics of Bryozoa assemblages collected during a general survey of the benthos off the coasts of Puglia along 13 transects at depths ranging from 0.5 to 28 m are illustrated and discussed. Among the 55 species of Gymnolaemata identified, 12 are new for Puglia, 5 for the Adriatic. Atlantic, Cosmopolitan and Endemic elements are dominant. The structural (abundance and specific richness) and morpho-functional (zoarial type) features of the assemblages collected in the five biocoenoses present in the area are linked to their ecological characteristics. The Coralligenous biocoenosis shows the richest and more varied assemblages, thanks to its micro-environmental heterogeneity.

Key words - benthos, biogeography, bryozoan assemblages, zoarial form, Mediterranean sea.

Riassunto - *Osservazioni faunistiche ed ecologiche su comunità di Bryozoa Gymnolaemata delle Coste pugliesi (Italia).* Lo studio di una serie di campionamenti effettuati nel corso di una ricerca generale sul benthos in un tratto di costa pugliese, lungo 13 transetti a profondità da 0.5 a 28 m, ha fornito 55 specie di Gymnolaemata: 12 sono nuove per la Puglia, 5 per l'Adriatico. Dal punto di vista biogeografico sono dominanti gli elementi Atlantici, Cosmopoliti ed Endemici. La composizione dei popolamenti nei diversi transetti appare determinata dalla eterogeneità ambientale (presenza di biocenosi diverse, condizioni della prateria di *Posidonia*, situazione di «stress» nell'area portuale). Gli aspetti strutturali (abbondanza e ricchezza specifica) e funzionali (forma zoariale) dei popolamenti a Briozoi associati alle 5 biocenosi individuate nell'area in esame dipendono dalle caratteristiche ecologiche delle biocenosi: i valori più alti di abbondanza e di ricchezza specifica e la maggior varietà di tipi zoariali si riscontrano nel Coralligeno, grazie alla presenza di numerosi microambienti.

Parole chiave - benthos, biogeografia, briozoi, Mediterraneo.

INTRODUCTION

Faunistic and bionomic studies of Bryozoa along the Adriatic coasts have been somewhat fragmentary; investigation in the northern Adriatic has been fairly frequent (for the italian coasts see Heller, 1867; Hincks, 1886, 1887; Neviani, 1938; Poluzzi, 1979; Occhipinti Ambrogi, 1980, 1981, 1983), but the central area appears to have been ignored, while, as far as the southern Adriatic is concerned, Occhipinti Ambrogi (1986) has examined Bryozoa fauna in six *Posidonia* meadows along the coast of Puglia and Poluzzi & Coppa (1991) have observed the assemblages of St. Andrea Island. Further, predominantly faunal data have been yielded by more general research on the benthos (Parenzan, 1983; Pastore & Vannelli, 1983; Tursi *et al.*, 1985).
Examination of samples collected during a general survey of the benthos off the coast of Puglia will help fill the gaps in our bryozoological fauna list for the Adriatic coasts and extend our bionomic and biogeographic knowledge of this taxon.

MATERIALS AND METHODS

Samples were collected along a stretch of the Apulian coast about 30 km long between Brindisi and Casalabate, along 13 transects (8 perpendicular to the coast and 5 radial) at depths ranging from 0.5 to 28 m (Fig. 1).
The biocoenoses present in the area were illustrated by Parenzan (1983) and Bedulli *et al.* (1986). For the purpose of our work the following biocoenoses were taken into consideration (following the terminology of Pérès & Picard, 1964): Photophilic Algae (Pa) and Fine Well Sorted Sands (Fs) near shore; *Posidonia oceanica* (Po), Coarse Sands under Bottom Currents (Cs) and Coralligenous (Cr) biocoenoses further offshore; these biocoenoses often display a mosaic structure along all the transects, with a few exceptions, which we shall examine later.
The Coralligenous assemblage is of the «infralittoral type» described by Sara' (1968). The *Posidonia* meadow, in condition of regression, is reduced to a dead «matte» almost everywhere. The Fine Well Sorted Sands are often colonized by *Cymodocea nodosa.*
Sampling was carried out in July 1987 by Scuba divers by subjecting the hard substrates (Photophilic Algae and Coralligenous biocoenoses) to total scraping of three 20 x 20 cm areas per station; by removing material from three 30 x 30 cm areas per station in the *Posidonia* meadow; and by applying a 50 l Charcot dredge (as illustrated by Picard, 1965) to the soft bottom material (Fine Well Sorted Sands and Coarse

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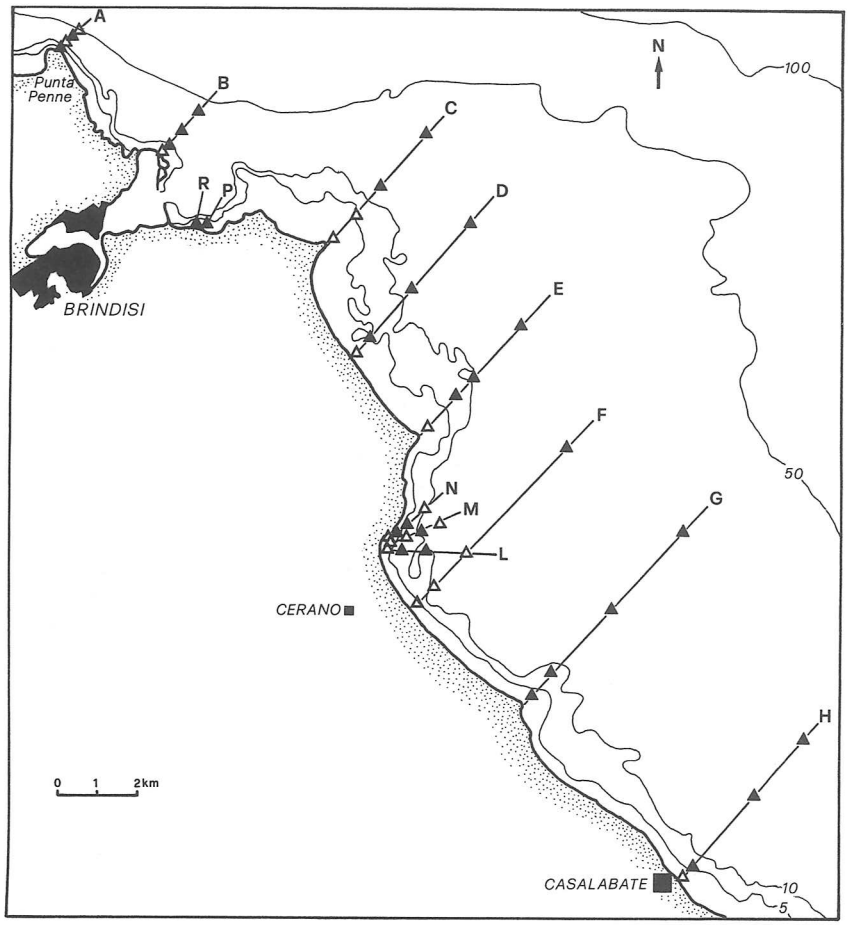


Fig. 1 - Sampling area, with indication of transects and stations. The stations in which Bryozoa have been found are marked with black triangles.

Sands under Bottom Currents biocoenoses).
After species identification, the following parameters were calculated: total number of species (S) in each sample, transect and biocoenosis; abundance of each species, as coverage (Co) in sq cm, measuring the surface covered by the encrusting species and the projection surface of the erect ones on the horizontal plane; percent abundance of each species (Co%=Co x 100/sampling area sq cm); total coverage in sq cm (TCo=ΣCo) of each sample, transect and biocoenosis; quantitative dominance of the species collected in each biocoenosis (Co x 100/TCo).
All the species were assigned to nine zoarial types, adding to the types described by Boyer *et al.* (1986) - namely Thick-Membraniporiform, Thin-Membraniporiform, Petraliiform, Creeping, Erect-flexible (or Tuft-like), Celleporiform and Reteporiform - the types Cellariiform (Stach, 1936) and Erect-Rigid (including Vinculariiform Stach, 1936 and Adeoniform Brown, 1952).
For the zoogeographical analysis the following categories were chosen: Endemics E (*sensu lato*, i.e. either restricted to the Mediterranean or extending beyond the Straits of Gibraltar southwards to Madera and at times to the coast of Mauretania); Cosmopolitan or widely distributed (C); Atlantic-Mediterranean AM (present both in the Mediterranean and in the Eastern Atlantic, from the English Channel to Capo Blanco); Atlantic Boreal AB (north of the English Channel); Atlantic-Tropical AT (extending as far as Capo Verde); Circum-Tropical or warm water (CT) and Indo-Pacific (IP).
Identification was based mainly on Zabala (1986) and Zabala & Maluquer (1988), classification on Gordon (1989).
For Scanning Electron Microscopy observations the colonies were dehydrated, gold coated and examined with a Cambridge microscope.

Results

Out of a total of 144 samples collected, 56 contained Gymnolaemata Bryozoa; 55 species were identified, consisting of 48 Cheilostomatida and 7 Ctenostomatida.

Taxonomic remarks

Table 1 lists all the species oberved in the sampled biocoenoses; 12 species are new for the Puglia coasts, 5 are new for Adriatic. Some of these species (which are

	transect	A			B					C				D					E				F				G					H					L				M		N				P	R
	station	1	3		2		3			3				2	3			4	2		3	4	3	4			1			2	3			4			2	3			3		2	3				
	sample	2	2	3	1	3	1	2	3	1	2	3	4	1	2	1	2	3	1	2	3	4	2	3	2	1	3	4	1	2	3	1	2	3	4	1	2	3	1	2	3	1	2	3	1	2	3	1	1
	depth m	5	13		6		11			20	11			21	6	11			21				7			12	21	13	21			2				8	15			28		7	15			10		7	10			.5	.5
	biocoenosis	Pa	Pa	Pa	Pa	Pa	Pa	Pa	Pa	Cr	Po	Po	Po	Po	Fs	Po	Po	Po	Cr	Cr	Cs	Po	Cs	Cs	Cs	Pa	Cr	Po	Po	Pa	Pa	Pa	Pa	Po	Po	Po	Cs	Cs	Pa	Pa	Po	Po	Cr	Cr	Fs	Po	Po	Po	Cs	Cr	Po	Pa	Po	Po	Po	Pa	Pa
	P. tubulosa													1																																			
#*	*N. dilatata*									2																												1											
	N. stipata						1																						3												1	1			1				
	V. uva									1																																							
	M. gracilis																															1						1											
	Z. verticillatum																																															5
	B. gracilis																																														2	
	A. lepadiformis																																					1	1										
	A. truncata															1		1														1				1	1											
*	*C. planum*																															1						1	1										
	C. tenuirostre											1								1																													
	P. curvirostris														1			1	1															1					1										
*	*M. coriacea*																		1																														
	C. nobilis		1									1				1														1	1	1	1	4				2	5		1	4	2		1	1				
*à	*M. circumcincta*																	1	2								1											2											
	C. boryi																		1															1														
	S. bertholleti																					1																										
	S. delilii																		1																													
*	*S. aegyptiacum*										1										1			1																								
	B. hirtissima												1	1		1								1										1											1			
	B. mirabilis																							1															1	1								
	B. robusta		1	1										1			1			1										1	1	1			1													
	C. balzaci																1																			1												
	P. gattyae																1																														
	P. radiata																																				2	1										
	R. violacea		1		1		2					1		1				1	2	1				1	1			1		1				1	1				2	2		1	1		2	2	2			
	C. pallasiana																												1																			
*	*P. ottomulleriana*													1																																		
	H. depressa							1						1					3	1					4		1						1						2	2			1		2	2	1			
	S. cervicornis																																1						4										
#*	*P. inerma*																		1																													
#*§	*H. multispinata*																																1															
	E. variolosa																		1														1							1								
	E. vulgaris																						1										1							1								
	S. sanguinea			2			1	2		2						1				1															2									3	1				
	S. auriculata																		1	4	1																		4	2			5	5						
	S. discoidea																		1																													
	S. linearis																																						1										
#*	*S. dunkeri*											1																			1	1										1						1		
	S. longirostris																																1															
	S. magnifica																																1					1	1									
	H. kirchenpaueri									1									1																		1				1	1		1		1	1	1	
	H. impressum																																					1										
	M. pseudomarsupiata		1									1							1																													
	C. brongniartii																																1															
#*	*Rhynchozoon sp.1*		1																														1		1								1	1	1			
	Rhynchozoon ind.																			1																												
	S. serratimargo																1	1	1	1				1			1						1				1	1	1			1	4							
	S. couchii																									1	1						1	1	1														
	M. cereoides											1																																					
	C. caminata																1	1															1	1	1						1	2							
*	*C. turrita*		1																														1															
	T. coronopus																																1															
	T. magnicostata	1																																														
*	*T. torquata*																																1	1					1	1									
	Turbicellepora ind.					1																																										
	M. truncata																		1	1													2						3										
	n. species/sample	1	6	2	1	1	3	1	1	4	1	6	2	5	1	3	4	2	14	9	4	4	1	1	13	1	5	1	3	2	1	1	1	2	4	6	7	20	8	2	2	2	4	11	12	1	4	6	7	1	6	5	4	3	2	1	1

Tab. 1 - distribution of the species in the 13 transects. Pa: Photophilic Algae biocoenosis; Po: *Posidonia* meadows; Cr: Coralligeno; Cs: Corse Sands under Bottom Currents; Fs: Fine Well Sorted Sands.

Percentual Abundance (Co%= Co x 100/sampling area sq cm) expressed as 1: Co%≤1; 2: 1<Co≤5; 3: 5<Co%≤10; 4: 10<Co%≤20; 5: Co%>20. A conventional value of 1 was assigned to the species collected in the Fs and Cs biocoenoses.

*: species new for the Apulian coast; #: species new for the Adriatic.

illustrated in pls. 1-4) require a few word of comment.
Prenantia inerma (pl. 1): our specimen matches with descriptions and illustrations of Zabala & Maluquer (1988).
Hemyciclopora multispinata (pl. 2, A, B): our specimen agrees with descriptions and drawings of Norman (1909) and Zabala & Maluquer (1988). This species, found in the eastern Atlantic (see Norman, 1909, and Cook, 1968) was hikherto reported in the Mediterranean sea only by Di Geronimo *et al.* (1990).
Microporella pseudomarsupiata (pl. 2, C): our specimens can be ascribed to this species, following Zabala & Maluquer (1988).
Hippopodinella kirchenpaueri (pl. 2, D): following Zabala & Maluquer (1988) we have applied this name to the Brindisi specimens, all encrusting gastropod shells, which show a very distal orifice and a well developed umbo; nevertheless, we think that the specific identity of the Mediterranean specimens of *Hippopodinella* needs to be checked, on the grounds of the statement of Schmid (1991) concerning the conspecificity of *H. kirchenpaueri* with *H. lata*.
Rhynchozoon sp. 1 Hayward 1974: as can be seen in pl. 3, the orifice shows a shallow concave sinus, as in Hayward (1974), unlike that illustrated by Zabala & Maluquer (1988).
Cigclisula turrita (pl. 4): finding it at Brindisi means that its northernmost limit of distribution, till now placed near Cabo Nao (d'Hondt, 1979), has shifted further North.

Zoogeographic remarks

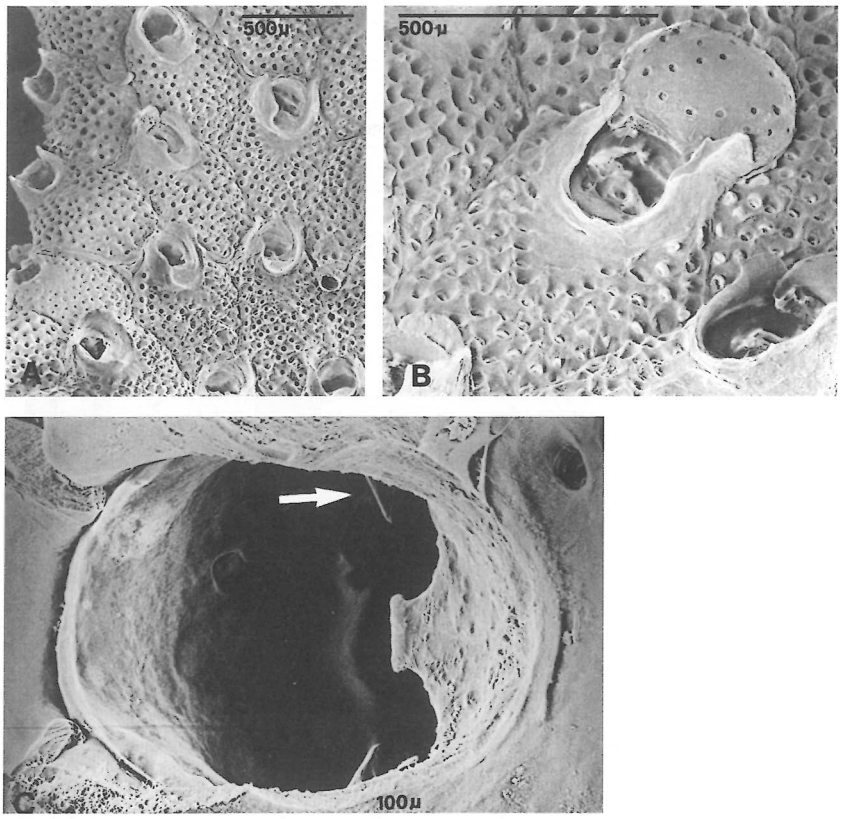
In the zoogeographic composition of the assemblage as a whole (Tab. 2), a preponderance of atlantic elements (29%, adding up AM and AB species) was found, followed by C (23.6), E (21.8) and CT (18.2) species; AT and IP represent 5.4 and 1.8% respectively. These data, compared with those reported by Zabala (1986) for the Adriatic, show a lower percentage of atlantic species and a higher percentage of the whole of the species adapted to warm water (AT, CT and IP), as well as of those widely distributed (C) and - to a lesser extent - the endemic ones (keeping in mind however that this Author had no data at his disposal on the southern Adriatic area). Regarding the Mediterranean, the percentages of E, AT and IP fall within the range reported by Zabala (1986, pgs. 143-144), while the percentage of the atlantic species is lower and that of C and CT is higher.

Tab. 2 - zoogeographic composition in percent. Brindisi: this paper; Adriatic: Zabala (1986). C: Cosmopolitan or widely distributed; CT: Circum-Tropical or warm waters; AT: Atlantic-Tropical; AM: Atlantic-Mediterranean; AB: Atlantic- Boreal; E: Endemic *sensu lato*; IP: Indo-Pacific.

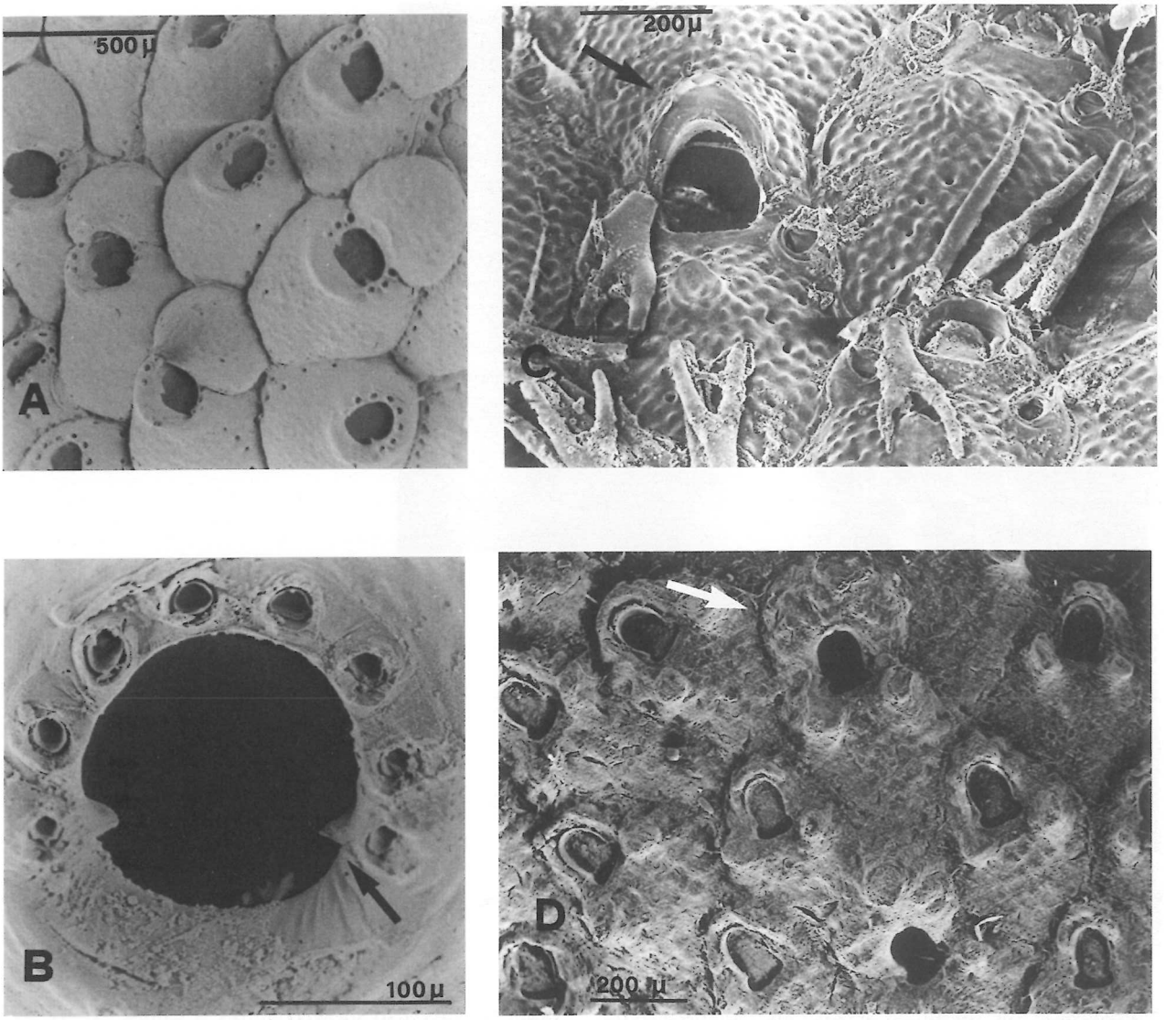
Zoogeogr. category	C	CT	AT	AM	AB	E	IP
Brindisi	23.6	18.2	5.4	18.2	10.9	21.8	1.8
Adriatic	16.1	14	1.1	38.7	8.6	19.3	1.1

Ecological accounts

As regards the distribution along the transects perpen-

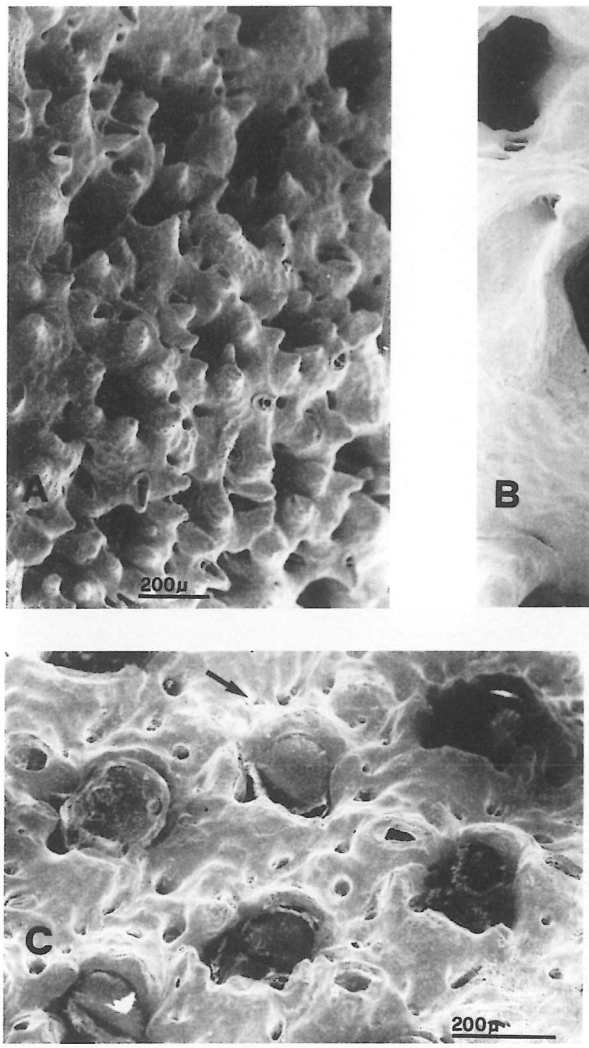


Pl. 1 - *Prenantia inerma*. A: group of zooids; B: ovicellate zooid; C: orifice with lyrula and condyles (arrowed).



Pl. 2 - *Hemicyclopora multispinata*. A: group of ovicellate and non-ovicellate zooids; B: orifice with condyles (arrowed). *Microporella pseudomarsupiata*. C: one ovicellate (arrowed) and one non-ovicellate zooid. *Hippopodinella kirchenpaueri*. D: group of zooids (the arrow shows one ovicell).

dicular to the coast-line, the highest values of specific richness S, usually accompanied by the highest values of total coverage TCo, can be observed in transects D, G and H; the remaining transects show much lower values of S and TCo; the lowest TCo values were recorded in the transects A and E. Amongst the radial transects, those of the port of Brindisi (P and R) are characterized by the presence of one species each (respectively *Bowerbankia gracilis*, with low Co, and *Zoobothryon verticillatum*, with very high Co); the others (L, M, N) have a fairly low S, with a rather high TCo (Tab. 3). As regards the distribution of the species in the various biocoenoses (Tab. 4 and fig. 2), in the first instance, the presence of a group of common species can be observed: of these, six species alone account for over 83% of total coverage (*Calpensia nobilis, Schizomavella auriculata, Reptadeonella violacea, Hippaliosina depressa, Z. verticillatum, Schizobrachiella sanguinea*. Apart from these species, each biocoenosis is characterized by the presence of exclusive stocks of species (Tab. 4) and by different values of S and TCo. The 18 samples of the Photophilic Algae biocenosis yielded 14 species (of which 4 exclusive), for a TCo of about 313 sq cm, about 4.3% of the total available substratum surface (sampling area x number of samples). Of this area, two species, *Z. verticillatum* and *B. gracilis*, present in the port of Brindisi exclusively, accounted for 206.5 sq cm. After elimination of the port stations, in that they are not comparable with the other, open water stations, the remaining 12 species take up an area of 106.5 sq cm, that is nearly 1.7% of the total available susbtra-



Pl. 3 - *Rhynchozoon* sp. 1. A: group of zooids; B: primary orifice; C: group of zooids (the arrow shows one ovicell).

tum surface; the dominant species are *Nolella stipata*, *R. violacea* and *S. sanguinea*, followed by *Cryptosula pallasiana* and *H. depressa*; the dominant zoarial type is the Thin-Membraniporiform, followed by the Thick-Membraniporiform, Creeping and Celleporiform (fig. 2, Pa).

Thirty species were found in the 22 samples of the *Posidonia* meadow, for a TCo of 333 sq cm, corresponding to nearly 1.4% of the total available substratum area (sampling area x number of samples). *C. nobilis* was particularly abundant, followed - at a much lower, but by no means negligible, Co level - by *R. violacea*, *H. depressa* and *H. kirchenpaueri*. A group of 14 species was exclusively present in this assemblage. Of the seven zoarial types present, the Thick Membraniporiform showed a marked predominance, followed by the Thin-Membraniporiform (fig. 2, Po).

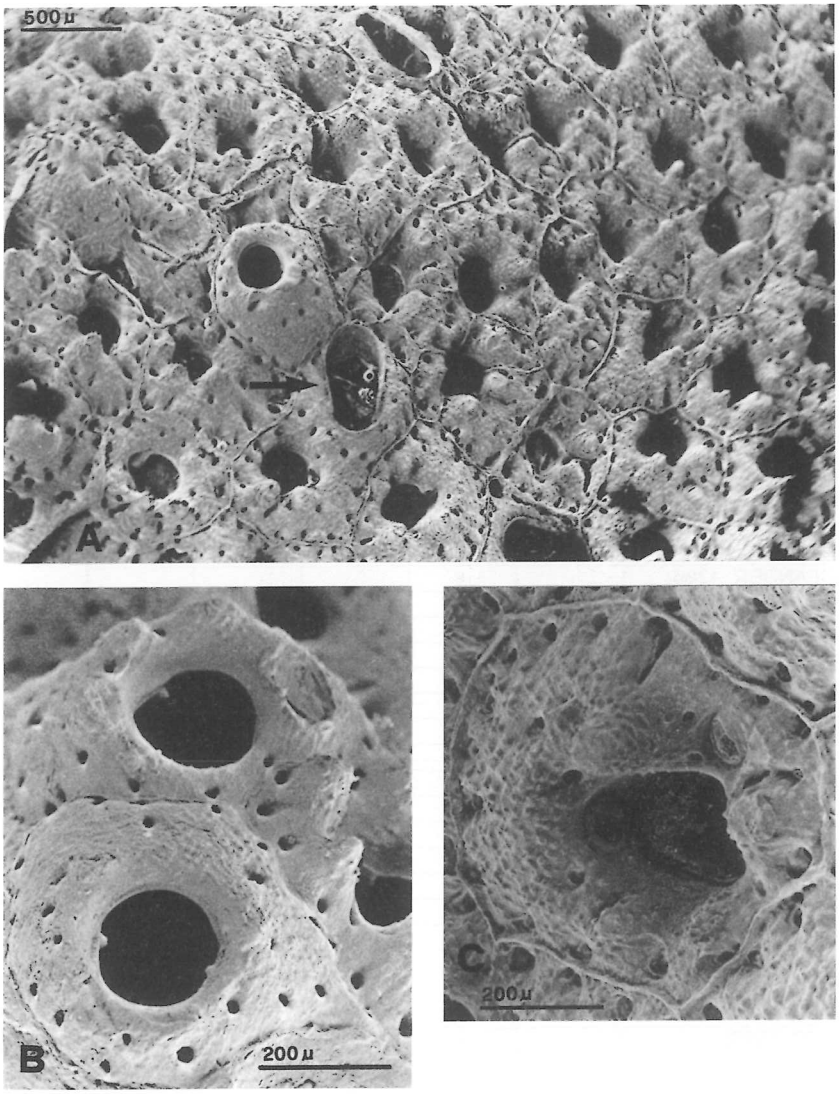
Thirty species and the highest Tco value (about 1050 sq cm, corresponding to 29% of the total available area of the 9 samples) were shown by the Coralligenous. *S. auriculata, C. nobilis* and *H. depressa* were found in considerable abundance, while many other species also showed high Co values. A stock of 16 species was exclusive to this assemblage. The predominance of Thick- and Thin-Membraniporiform among the 8 zoarial types found can be put down to the species cited above; the Erect-Rigid type was also fairly common (fig. 2, Cr).

In the 6 samples of the Coarse Sands under Bottom Currents biocenosis 14 species (of which two are exclusive) were found, with a low Tco (13 sq cm) (fig. 2, Cs).

Finally, the Fine Well Calibrated Sands biocoenosis yielded *Parellisina curvirostris* alone, for a Co of 0.7 sq cm.

Discussion

Firstly, our research allowed new faunistic and biogeographic data on the bryozoan assemblages of the southern Adriatic to be acquired. As already stated, 12 species were reported for the first time in the coastal area of Puglia and 5 were new for the Adriatic (Tab. 1). The area of distribution of species hitherto reported



Pl. 4 - *Cigclisula turrita*. A: group of zooids (the arrow shows one vicarious avicularium); B: detail of the orifice; C: peristomial avicularium.

in only a few locations, such as *Rhynchozoon* sp. 1, *Hemyciclopor multispinata* and *Prenantia inerma*, has been extended. The northernmost limit of *C. turrita* has been shifted further North.

The number of species recorded, not very large if the heterogeneity of the sampled biotopes is considered, is not so easy to explain: the data from the zoobenthos on the whole (Bedulli *et al.*, 1986; Enel-Ecosud, 1988; Guzzini, Somaschini & Ardizzone, 1992; Chimenz, Tosti & Cottarelli, 1993) do not seem to indicate a particularly degraded environmental situation, apart from the port area of Brindisi and the state of regression of the *Posidonia* meadows. On the other hand, according to Cormaci & Furnari (1991) the vegetal assemblages seem to indicate a certain alteration, suggested by the regression of the associations with *Cystoseira* sp. pl. and of the *Posidonietum oceanicae*, which are replaced by associations of euryvalent and

Tab. 3 - structural features of the assemblages of the 13 transects. TCo% was referred to the sampling area and was not calculated in the transects including Cs and Fs biocoenoses.

transect	A	B	C	D	E	F	G	H	L	M	N	P	R
n. species (S)	8	8	13	23	8	6	32	23	11	7	9	1	1
n. samples	3	6	4	7	4	4	10	6	4	2	4	1	1
TCo sq cm	16.3	50.1	28.4	141	6.1	61.1	248	584	199	92.4	93	6.5	200
TCo %	1.4	2.1	0.6	-	-	2.3	-	13.6	-	3	-	1.6	50

Tab. 4 - distribution of the species in the five biocoenoses. Pa: Photophilic Algae; Po: *Posidonia*; Cr: Coralligenous; Cs: Coarse Sands under Bottom Currents; Fs: Fine Well Sorted Sands.
Zoarial types. Tk: Thick Membraniporiform; Tn: Thin Membraniporiform; P: Petraliiform; Cr: Creeping; EF: Erect-Flexible; ER: Erect-Rigid; Cl: Cellariiform; C: Celleporiform; Re: Reteporiform.

	Biocoenosis	Pa	Po	Cr	Cs	Fs
	Depth m	0,5-13	7-21	10-28	6-27	6
EF	*Zoobothryon verticillatum* (DELLE CHIAJE, 1828)	+				
Cr	*Bowerbankia gracilis* LEIDY, 1855	+				
Tn	*Cryptosula pallasiana* (MOLL, 1803)	+				
C	*Turbicellepora magnicostata* (BARROSO, 1919)	+				
Cr	*Nolella stipata* GOSSE, 1855	+	+		+	
Tk	*Calpensia nobilis* (ESPER, 1796)	+	+	+	+	
P	*Beania robusta* (HINCKS, 1881)	+	+			
Tn	*Reptadeonella violacea* (JOHNSTON, 1847)	+	+	+	+	
Tn	*Hippaliosina depressa* (BUSK, 1854)	+	+	+		
Tk	*Schizobrachiella sanguinea* (NORMAN, 1868)	+	+	+		
Tn	*Hippopodinella kirchenpaueri* (HELLER, 1867)	+	+	+		
Tk	*Microporella pseudomarsupiata* ARISTEGUI, 1984	+	+	+		
Tk	*Rhynchozoon* sp. 1 HAYWARD, 1974	+	+	+		
C	*Cigclisula turrita* (SMITT, 1873)	+			+	
Tn	*Parellisina curvirostris* (HINCKS, 1862)		+	+		+
EF	*Pherusella tubulosa* (ELLIS & SOLANDER, 1786)		+			
EF	*Mimosella gracilis* HINCKS, 1851		+			
Cr	*Aetea lepadiformis* WATERS, 1906		+			
Cr	*Aetea truncata* (LANDSBOROUGH, 1852)		+			
Tk	*Copidozoum planum* (HINCS, 1880)		+			
Tk	*Copidozoum tenuirostre* (HINCKS, 1862)		+			
Tn	*Collarina balzaci* (AUDOUIN, 1826)		+			
Tn	*Puellina gattyae* (LANDSBOROUGH, 1852)		+			
Tk	*Pentapora ottomulleriana* (MOLL, 1803)		+			
Tk	*Schizoporella dunkeri* (REUSS, 1848)		+			
Tn	*Haplopoma impressum* (AUDOUIN, 1826)		+			
Tn	*Chorizopora brongniartii* (AUDOUIN, 1826)		+			
Cl	*Margaretta cereoides* (ELLIS & SOLANDER, 1786)		+			
Tk	*Rhynchozoon ind.*		+			
Cr	*Nolella dilatata* (HINCKS, 1860)		+	+		
Cr	*Synnotum aegyptiacum* (AUDOUIN, 1826)		+		+	
P	*Beania hirtissima* (HELLER, 1867)		+		+	
Cr	*Beania mirabilis* (JOHNSTON, 1839)		+		+	
ER	*Schizotheca serratimargo* (HINCKS, 1886)		+	+	+	
Re	*Sertella couchii* (HINCKS, 1878)		+	+	+	
Cr	*Valkeria uva* (LINNE', 1758)			+		
Tn	*Micropora coriacea* (JOHNSTON, 1847)			+		
P	*Mollia circumcincta* (HELLER, 1867)			+		
EF	*Caberea boryi* (AUDOUIN, 1826)			+		
EF	*Scrupocellaria delilii* (AUDOUIN, 1826)			+		
Tn	*Puellina (Cribrilaria) radiata* (MOLL, 1803)			+		
ER	*Smittina cervicornis* (PALLAS, 1766)			+		
Tn	*Prenantia inerma* (CALVET, 1906)			+		
Tn	*Hemicyclopora multispinata* (BUSK, 1861)			+		
Tn	*Escharella variolosa* (JOHNSTON, 1838)			+		
Tk	*Escharina vulgaris* (MOLL, 1803)			+		
Tk	*Schizomavella discoidea* (BUS, 1859)			+		
Tk	*Schizomavella linearis* (HASSALL, 1841)			+		
Tk	*Schizoporella longirostris* HINCKS, 1886			+		
Tk	*Schizoporella magnifica* HINCKS, 1886			+		
C	*Turbicellepora torquata* HAYWARD, 1978			+		
Tk	*Schizomavella auriculata* (HASSALL, 1842)			+	+	
C	*Celleporina caminata* (WATERS, 1879)			+	+	
ER	*Myriapora truncata* (PALLAS, 1766)			+	+	
EF	*Scrupocellaria bertholletii* (AUDOUIN, 1826)				+	
C	*Turbicellepora coronopus* (WOOD, 1844)				+	
	n. samples	18	22	9	6	1
	n. species	14	30	30	14	1
	Total Coverage sq cm	313	333	1050	13	0,7

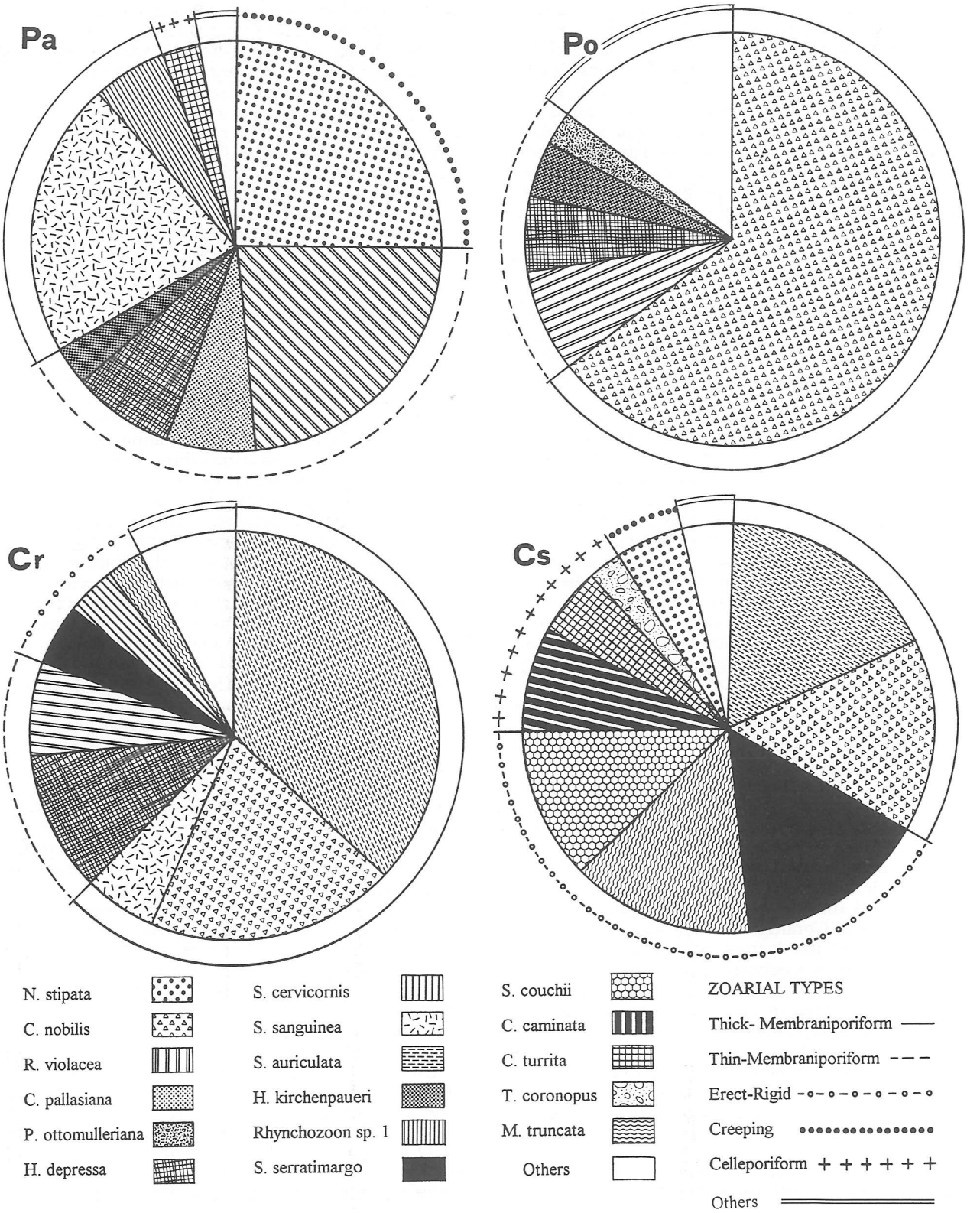


Fig. 2 - quantitative dominance of the assemblages of the biocoenoses (=Co sq cm x 100/TCo sq cm): Photophilic Algae (Pa), *Posidonia* (Po), Coralligenous (Cr) and Coarse Sands under Bottom Currents (Cs).

sciaphilic species; in particular, the notable abundance and frequency of sciaphilic species denotes a constant turbidity of the waters. The high rate of sedimentation, particularly unfavourable to the Bryozoa (Zabala, 1986), and the regression of *Posidonia*, with the consequent decrease in characteristic species, could cause a certain impoverishment of the Bryozoa assemblages. Combining our data with those of Parenzan (1983), Tursi *et al.* (1985) and Occhipinti Ambrogi (1986), after having excluded some problematic taxa, the total number of species recorded on the Apulian coasts is 106, corresponding to about one-third of the Bryozoa of the whole Mediterranean (Zabala & Maluquer, 1988).

The comparison with available ecological and bionomic data for the area in question is made difficult by the difference in the aims and methods of the individual investigations. Tursi *et al.* (1985) used asbestos panels immersed near Taranto for 30 months at a depth of 17 metres in the Coralligenous and in a *Posidonia* meadow to record 38 species of Gymnolaemata, with a high degree of affinity between the two assemblages: in both types of environment eurytopic, hard bottom erect species such as *Savignyella lafontii* and *Aetea truncata* were dominant, together with encrusting species such as *S. sanguinea*; at the same time, the elements considered typical of the respective biocoenoses were absent (e.g. in the leaf stratum species of *Posidonia*) or else have a low Co (e.g. Coralligenous). The structure of the assemblages thus differs from that generally reported in the literature and from our findings in the relevant environments, as they are dependent both on the type of substrate used and the short immersion time.

In the bryozoan fauna of the Puglia *Posidonia* meadows observed by Occhipinti Ambrogi (1986) there is a substantial similarity between the fraction present on the rhizomes and the assemblage we found in the Po biocoenosis (shared species 59%). In our case, the species characteristics of the leaf stratum (*Electra posidoniae*, *Collarina balzaci*, *Puellina gattyae*, *Haplopoma impressum*) are absent or have very low Co. This may be accounted for by the state of the meadow, which in the area sampled by us had been reduced to a dead «matte», with only a few leaf shoots.

In the Apulian Coralligenous Parenzan (1983) found 53 species of Gymnolaemata, of which 44% shared by our list for this biocoenosis. The lower faunistic richness shown by our assemblage may be ascribed both to the smaller area of coast sampled and the lower number of samples taken.

The smaller number of species (30 instead of 57) found by us in comparison with the Coralligenous of Albères (Laubier, 1966) may mainly be due to both the lower bathymetric range investigated and the lower number of samples.

The interpretation of the zoogeographic composition of the Brindisi assemblage is complicated by the taxonomic incertainty still affecting many species, by the incompleteness of the distributional data and mainly by the different criteria followed by the various authors (different meaning of Endemic, Atlantic-Mediterranean and Atlantic-Boreal species: see Gautier, 1962; Hayward, 1974; Zabala, 1986; Lopez de la Cuadra & Garcia-Gomez, 1994). As regards the high percentage of wide distributed species, we agree with what was said by Lopez de la Cuadra & Garcia-Gomez (1994) that some wide distributed species are fouling components dispersed by ships and - first of all - «that the number of reported wide distributed bryozoans decreases with the increase in taxonomic accuracy». Therefore, we think it's correct to postpone any further consideration and to wait for both a taxonomic revision of the questionable species and an agreement on the meaning of the zoogeographic categories.

As regards the characteristics of the transects, the high values of S and TCo in transects D, G and H depend on the higher environmental heterogeneity due to the presence of several biocoenoses and to the wider bathymetric range; instead, the low values in transects A and E are due to the presence of only one or two biocoenoses. The presence in the transect R of *Z. verticillatum*, a species adapted to calm water environments with a high rate of sedimentation, such as ports or brackish waters, reveals conditions of environmental alteration, typical of port areas.

Examination of the samples leads to some considerations concerning the relations between specific composition and respective zoarial spectra of the various assemblages and their bionomic distribution. In the first instance, it is significant that six species alone account for 83% of the total area covered: except for *Z. verticillatum*, which we have already discussed, the other species are referred to in the literature as eurytopic, diffuse on more varied substrates, both mineral and vegetable. Their (both Thick and Thin) Membraniporiform zoarial type, encrusting and extremely plastic, enables them to colonize irregular substrates. Thanks to these characteristics, the abovementioned species are the most abundant and widespread in the hard bottom stations, i.e. in the Photophilic Algae, *Posidonia* and Coralligenous biocoenoses, although with different ratios (fig. 2). On this subject it should be borne in mind that also Poluzzi & Coppa (1991) found the same dominant species in the assemblages of St. Andrea island.

Apart from these common species, the three hard bottom biocoenoses may be distinguished, as already stated, by the presence of different specific stocks (Tab. 4): the Coralligenous contains species with a preference for hard mineral and organogenic bottoms and with Thick-Membraniporiform zoaria; also species with Reteporiform and Erect-Rigid zoaria, which are typical of environments with unidirectional or weak hydrodynamism, are well represented. The Thin-Membraniporiform zoarial form, typical of species adapted to the plant substrates, is well represented in the deep stations of the Photophilic Algae and in the *Posidonia* meadows, although in the latter, because of the regression of the meadows, it is present to a much lesser extent than elsewhere, in denser meadows (see Occhipinti Ambrogi, 1986). The soft bottom stations (Fine Well Calibrated Sands with *Cymodocea* and Coarse Sands under Bottom Currents) are characterized by low TCo and S, due to environmental condi-

tions unfavourable to Bryozoa (e.g. hydrodynamic regime and lack of substrates suitable for settlement). Their assemblages do not appear to have a biocoenotic identity of their own: the species present are actually tributaries of the surrounding hard substrates.

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REFERENCES

BEDULLI D., BIANCHI C.N., MORRI C., ZURLINI G. (1986). Caratterizzazione biocenotica e strutturale del macrobenthos delle coste pugliesi. Indagine ambientale del sistema marino costiero della Regione Puglia. ENEA, Centro Ricerche Energia Ambiente, S. Teresa, La Spezia, 227-255.

BOYER M., MATRICARDI G., PISANO E. (1986). Variazioni dello spettro zoariale in una comunità infralitorale di Briozoi. *Boll. Mus. Ist. Biol. Univ. Genova*, **52** suppl., 301-316.

BROWN D.A. (1952). The Tertiary Cheilostomatous Polyzoa of New Zealand. *Trust. British Museum (Nat. Hist.)*, London, I-XII, 1-405.

CHIMENZ C., TOSTI M., COTTARELLI V. (1993). Taxonomical and ecological observations on Pycnogonida from Apulian coasts (southern Italy). *Boll. Zool.*, **60**, 339-347.

COOK P. L. (1968). Bryozoa (Polyzoa) from the coast of tropical West Africa. *Atlantide Report* **10**, 115-262, pls. VIII-XI.

CORMACI M., FURNARI G. (1991). Phytobenthic communities as monitor of the environmental conditions of the Brindisi coastline. *Oebalia*, XVII - 1 suppl., 177-198.

DI GERONIMO I., GIACOBBE S., ROSSO A., SANFILIPPO R. (1990). Popolamenti e tanatocenosi del Banco Apollo (Ustica, Mar Tirreno meridionale). *Atti Quarto Simposio Ecologia e Paleoecologia delle comunità Bentoniche*, Sorrento, 1-5 novembre 1988, 698-729.

ENEL-ECOSUD (1988). Studio sull'ecosistema costiero del tratto di mare antistante la costa pugliese da Punta Penne a Casalabate (Brindisi), con riferimento alle zone prospicienti la centrale termoelettrica di Brindisi e la costruenda di Cerano, 1-310.

GAUTIER Y.V. (1962). Recherches écologiques sur les Bryozoaires Cheilostomes en Méditerranée Occidentale. *Rec. Trav. Stat. mar. Endoume*, **24** (38), 1-434.

GORDON D.P. (1989). The Marine Fauna of New Zealand: Bryozoa: Gymnolaemata (Cheilostomida Ascophorina) from the Western South Island Continental Shelf and Slope. *New Zealand Oceanographic Institute Memoir* **97**, 1-158.

GUZZINI A., SOMASCHINI A., ARDIZZONE G.D. (1992). I Tanaidacei del litorale di Brindisi. *Oebalia*, **17** (2), suppl., 359-361.

HAYWARD P. J. (1974). Studies on the Cheilostome Bryozoan fauna of the Aegean island of Chios. *J. Nat. Hist.*, **8**, 369-402.

HELLER G. (1867). Die Bryozoen des Adriatischen Meeres. *Verhandl. Zool. Bot. Gesellschaft, Wien*, **17**, 77-136.

HINCKS T. (1886). The Polyzoa of the Adriatic: a supplement to Prof. Heller's «Die Bryozoen des Adriatischen Meeres, 1867». *Ann. Mag. Nat. Hist.*, pt. 8, Ser. 5, **17**, 254-271, pl. IX, X.

HINCKS T. (1887). The Polyzoa of the Adriatic: a supplement to Prof. Heller's «Die Bryozoen des Adriatischen Meeres». *Ann. Mag. Nat. Hist.*, pt. 8, Ser. 5, **19**, 302-316, pl. IX.

D'HONDT J.L. (1979). Briozoos del Levante espanol. *Boletin R. Soc. Esp. Hist. Nat. (Biol.)*, **77** (3-4), 457-471.

LAUBIER L. (1966). Le coralligène des Albères. Monographie biocénotique. *Ann. Inst. Océanogr. Monaco*, **43** (2), 137-317.

LOPEZ DE LA CUADRA C.M., GARCIA-GOMEZ J.C. (1994). Zoogeographical study of the Cheilostomatida from the Straits of Gibraltar. In: Biology an Palaeobiology of Bryozoans. Hayward P.J., Ryland J.S. & Taylor P.D. (eds), 107-112. Olsen & Olsen, Fredensborg.

NEVIANI A. (1938). I Briozoi Adriatici del Museo Civico di Storia Naturale di Venezia. *Mem. R. Ist. Ven. Sc. Lett. Arti*, **30** (4), 1-131.

NORMAN A.M. (1909). The Polyzoa of Madeira and Neighbouring Islands. *J. Linn. Soc.* (Zool.), London, **30**, 275-314, pl. 33-42.

OCCHIPINTI AMBROGI A. (1981). Osservazioni sui Briozoi di ambienti lagunari Nord-Adriatici. Atti V Conv. Gr. «G. Gadio», Varese, 171-183.

OCCHIPINTI AMBROGI A. (1981). Contributo alla conoscenza dei Briozoi della Laguna Veneta Settentrionale. *Boll. Mus. Civ. Venezia*, **31**, 95-109.

OCCHIPINTI AMBROGI A. (1983). Elementi per una bionomia dei Briozoi della Laguna Veneta centro-meridionale. *Atti Mus. Civ. Stor. Nat. Trieste,* **35**, 207-224.

OCCHIPINTI AMBROGI A. (1986). Osservazioni sul popolamento a Briozoi in praterie di *Posidonia oceanica* del litorale pugliese. *Boll. Mus. Ist. Biol. Univ. Genova*, **52**, suppl., 427-439.

PARENZAN P. (1983). Puglia marittima. Congedo editore, Vol. III, 1-688.

PASTORE M., VANNELLI M.A. (1983). Biologia del Cistoseireto nell'infralitorale superiore lungo la costa neretina (Golfo di Taranto). *Thalassia Salentina*, **12-13**, 82-117.

PERES J.M., PICARD J. (1964). Nouveau manuel de Bionomie Benthique de la mer Méditerranée. *Rec. Trav. St. Mar. Endoume*, **31** (47), 1-137.

PICARD J. (1965). Recherches qualitatives sur les biocoenoses marines des substrats meubles dragables de la région marseillaise. *Rec. Trav. St. Mar. Endoume*, **36** (52), 1-160.

POLUZZI A. (1979). I Briozoi dei fondi mobili tra Ancona e la foce del fiume Reno (Adriatico settentrionale). *Giornale di Geologia* (2), **43** (1), 137-156.

POLUZZI A., COPPA M.G. (1991). Zoarial strategies to win substratum space in *Calpensia nobilis* (Esper). *Bull. Soc. Sci. Nat. Ouest Fr., Mém. HS* **1**, 337-360.

SARA' M. (1968). Un coralligeno di piattaforma (coralligène de plateau) lungo il litorale pugliese. *Arch. Oceanogr. Limnol.* Suppl., **15**, 139-150.

SCHMID B.M. (1991). Recent Bryozoan species from the Miocene of Nussdorf (Vienna) and their use for ecological interpretation. *Bull. Soc. Sci. Nat. Ouest. Fr., Mém* HS**1**, 399-408.

STACH L.W. (1936). Correlation of zoarial form with habitat. *Jour. Geol.*, **44** (1), 60-65.

TURSI A., MATARRESE A., SCALERA LIACI L., COSTANTINO G., CAVALLO R., CECERE E. (1985). Colonizzazione di substrati duri artificiali immersi in una biocenosi coralligena ed in un Posidonieto. *Oebalia*, **11**, N.S., 401-416.

ZABALA M. (1986). Fauna dels Briozous dels Paisos Catalans. Institut D'Estudis Catalans, Barcellona, Romargraf, S.A., 1-833.

ZABALA M., MALUQUER P. (1988). Illustrated Keys for the classification of Mediterranean Bryozoa. *Treb. Mus. Zool. Barcelona*, **4**, 1-294.

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