

**PRELIMINARY NOTES OF THE MARINE FOULING AT THE PORT  
OF MAR DEL PLATA ARGENTINA**

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## SUMMARY

Reference is made in this note to the qualitative and quantitative composition of the benthic communities of the Mar del Plata Harbour (Argentina). Researchs on the fouling organisms were carried out based in our former studies of the area. This is the first time that fouling studies are being done in our country.

Studies in detail of the fouling organisms constitute the present stage of the investigations, and are made over an experimental raft.

As at the present time we have only reached up to the 6th month of observations we are given a preliminary idea of the fouling development.

We include the diagrams of the monthly main species frequency. Data of the accumulative panels are excluded.

Preliminary conclusions on monthly fouling obtained through half-year researchs are given below:

a) There are alternative periods of intense and weak fouling

attachment during summer and winter respectively.

b) The fouling organisms succession follows the same mechanism as in other latitudes. It starts with bacteria-diatoms-protoczoa complex, finishing with higher organisms associations.

c) Many of the organisms show an accentuated growth and the vital cycle is completed in a short period of time. This involves a great possibility of substitution which is proved in practice since many organisms die before a month of attachment and are substituted by others.

d) The fact that it can be observed the attachment of organisms on the accumulative panels, not recorded on monthly panels, proves that certain species requires an established community to continue their development after the attachment.

These studies have relations with a research about properties of antifouling points which is made simultaneously.

## INTRODUCTION

The studies on marine biology of this american South Atlantic area deal mainly with the taxonomic aspects, in spite that many plant and animal groups are practically unknown.

On the other hand it must be considered that benthic-ecological studies have going on for only a few years. Initially the investigations were carried out in the patagonic coasts and lately in the Mar del Plata area.

This is the first time that fouling studies are being done in our country.

## LOCALITY

The Mar del Plata harbour is located at 38°08'17" S. and 57°03'18" W. For its construction and naval traffic it ranks as one of the most important ports of Argentina.

From the biological and hydrological points of view it has specific characteristics which differentiates it from the neighbour ports.

Some variations of the sea water of this area are noticeable throughout the year. During winter-months the Malvinas Current, which flows along this coastal region of the Buenos Aires province, brings cold waters very rich in nutrients. During summer-months this current sinks to deeper zones remaining at a certain distance from the coast and some branches of the northern warm-waters from the Brazil Cur-

rent affect the coastal area. The later is not a pure mass of sea water as it is exposed to the influence of fresh water apports, to the differential heating produced by shallows depths and to the many other factors which have a great influence over the coastal regions. It modifies among other things salinity and temperature.

Even though the harbour area is affected by the dynamics surrounding waters it shows, because of its sheltered construction, special characteristics which make it different from the natural neighbour localities.

The surface water temperature suffers an annual variation of about 14°C (7-21°C). Temperatures tend to be higher in summer and lower in winter in 1 or 2°C than those of surface waters beyond the harbour entrance.

Salinity ranges from 32 to 34 ‰ and the pH is of about 7.7.

The pollution is appreciable because of the industrial discharged sewage and other apports of water which are common in ports. For its influence over the organisms it has to be always under control.

The surface water oxygen contents ranges among normal values decreasing somehow during those periods of maximum pollution intensity.

The vertical range of tide is of about 90 cm and practically there are not conspicuous currents.

Turbulence is minimum compared with the one of the outside harbour area, but is anyway more important than that of the Mediterranean.

TABLE I

RESULTS OF THE BENTHIC COMMUNITIES STUDIES AT THE PORT OF MAR DEL PLATA, ARGENTINA  
(February 1964)Key: R Rare  
C Common  
VC Very common  
A Abundant

SAMPLES		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
ALGAE :	<i>Ulva lactuca</i>	C	VC	A	A	C	R	R	R	R	-	-	-
	<i>Ectocarpus</i> sp.	C	VC	VC	-	-	-	-	-	-	-	-	-
	<i>Bryopsis</i> sp.	-	-	-	-	C	C	C	VC	R	R	-	-
	<i>Ceramium</i> sp.	-	-	-	-	C	VC	VC	VC	-	R	-	-
COELENTERATA :	<i>Tubularia</i> sp.	-	-	-	10	-	-	-	-	-	-	-	-
BRYOZOA :	<i>Bugula</i> sp.	-	-	-	-	-	C	A	VC	VC	A	-	-
MOLUSCA :	<i>Pachysiphonaria lessona</i>	3	16	1	-	-	-	-	-	-	-	-	-
	<i>Mytilus platensis</i>	-	10	217	208	134	90	58	30	10	9	9	1
	<i>Brachydontes rodriguezii</i>	-	-	-	54	71	42	18	8	3	2	2	-
ANNELIDA :	Polychaeta	-	-	-	-	2	9	15	11	7	6	4	2
	Serpulidae	-	-	-	-	3	27	27	10	10	2	6	1
	Spionidae	-	1	-	-	4	-	-	-	-	-	-	-
	Polychaeta errantia	-	-	-	-	40	40	74	74	27	82	15	-
PYCNOGONIDA :	<i>Anoploleptus</i> sp.	-	-	-	-	1	15	23	8	2	-	5	2
CRUSTACEA :	<i>Balanus</i> spp.	670	590	500	450	285	370	421	280	150	193	29	140
	<i>Exosphaeroma calcearia</i>	-	393	390	477	5	5	2	-	-	-	-	-
	<i>Cyrtograpsus angulatus</i>	-	-	25	19	5	-	2	1	1	-	-	1
	<i>Halicarcinus planatus</i>	-	-	-	-	-	-	1	-	-	-	-	-
	<i>Cyrtograpsus altimanus</i>	-	-	3	27	9	9	16	10	5	13	7	8
	Amphipoda	-	-	-	-	15	56	75	50	24	34	6	10
	<i>Cosmophtalmus tridentatus</i>	-	-	-	-	-	-	-	-	-	-	1	1
<i>Platyxantus crenulatus</i>	-	-	-	-	1	-	-	-	-	-	-	1	
TUNICATA :	<i>Molgula robusta</i>	-	-	-	-	41	30	41	25	14	18	14	12
	<i>Giona intestinalis</i>	-	-	-	-	-	280	420	330	125	358	317	152

## PRELIMINARY COMMUNITIES STUDIES

Earlier observations on harbour communities were carried out by the author in 1964. On that occasion quantitative and qualitative records on the organisms attached to the harbour breakwaters were made from the high tide line to 3.50 m depth, close to the bottom. For this purpose the aid of SCUBA equipment was necessary.

Samples were taken over a 25x25 cm square frame. Values thus obtained are reported in table I.

These data show the evidence of marked quantitative and qualitative differences with data of the outside harbour communities. These differences are due in part to the vertical condition of the substratum which limits the inter-tidal zone to the harbour environmental characteristics.

The Mytilidae communities: *Brachydontes rodriguezii* and *Mytilus platensis* covers the rocks of the inter-tidal zone except inside the harbour where they have a less importance since they are not dominant species. By other way there is a conspicuous inversion in the vertical distribution of these two species, since in the harbour *Mytilus platensis* appears at higher levels than *Brachydontes rodriguezii*, while on coastal shores *B. rodriguezii* is the one who covers the upper zones.

At a later date a buoyant substratum kept submerged

from October 1964 to October 1965 was used.

Fouling samples were taken over three 20x30 cm panels vertically placed from surface to 1.20 m depth. Data thus obtained are reported in table II. In table III are also included volume, ashes, dry and wet weight determinations data from the principal species.

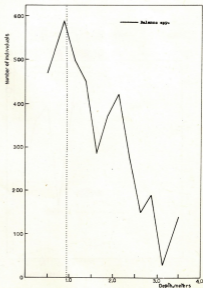
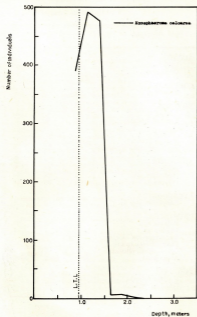
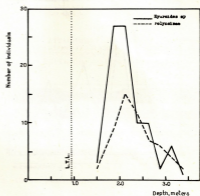
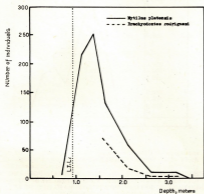
The results obtained differs in some aspects from those of the former essay. This differences are due to the substratum buoyant condition, which eliminates the tide influence and to the fact that the attachment surface was isolated from the bottom.

## STUDIES ON EXPERIMENTAL RAFT

Studies on experimental raft constitute the present stage of our investigations based on a community biological view as seen through preliminary studies.

The following research plan of investigations has been carried out by members of two institutions, Laboratorio de Ensayo de Materiales e Investigaciones Tecnológicas (LEMIT) and the Instituto Interuniversitario de Biología Marina (IIBM), with the economic aid of the Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET).

VERTICAL DISTRIBUTION BASED ON THE RESULTS REPORTED IN TABLE I



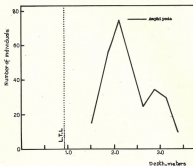
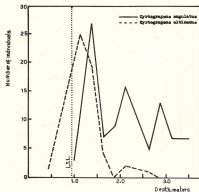
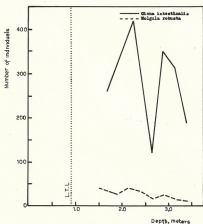


TABLE II

RESULTS OBTAINED ON THE ANNUAL FOULING (OCTOBER 1964/OCTOBER 1965) ATTACHED TO A BUOYANT SUBSTRATUM AT THE MAR DEL PLATA HARBOUR (ARGENTINA)

Key: the same of table I



Panel	A	B	C
ALGAE :			
Ulva lactuca	VC	—	—
Ceramium sp.	C	A	C
COELENTERATA :			
Tubularia sp.	5	—	—
BRYOZOA :			
Bugula sp.	VC	A	A
Membranipora sp.	VC	A	A
MOLLUSCA :			
Mytilus platensis	7	35	21
Brachydontes rodriguezii	1	22	9
ANNELIDA :			
Polynoioae	6	12	6
Hydroids sp.	2	28	40
Polychaeta erantia	30	39	48
PYCNOGONIDA :			
Anoplodactylus sp.	1	5	1
CRUSTACEA :			
Balanus spp.	30	49	99
Isoetes sp.	5	1	1
Exosphaeroma calcarea	2	—	—
Pachyachates haigue	1	—	—
Cyrtograpsus altimanus	—	5	9
Amphipoda	3000	5000	3000
TUNICATA :			
Megala robusta	123	200	181
Gona intestinalis	13	57	250

TABLE III

WEIGHT AND VOLUME OF SOME OF THE SPECIES REPORTED IN TABLE II

	Wet weight g	Dry weight g	Ashes g	Volume ml
<i>Ulva lactuca</i>	4,130	0,680	0,120	4
<i>Bugula</i> sp.	7,010	0,780	0,430	3
<i>Membranipora</i> sp.	4,130	1,150	0,980	2
<i>Amphipoda</i> (for 500 individuals)	—	2,400	0,645	2
<i>Molgula robusta</i>	83,400	5,710	1,291	100
<i>Cloosia intestinalis</i>	24,320	1,500	0,160	30

The first part of the plan consists in monthly investigations throughout a year (september 1966/september 1967) which will give an idea of the development of the fouling community from its initial attachment and also a monthly attachment information for each species.

At the same time periodical records of the medium abiotic conditions are being carried out.

## METHODOLOGY

Thirteen frame panels contains from the raft for biological studies were used. The rest of them were kept for paint tests.

Each frame holds four 30 x 40 cm sanded acrylic panels vertically placed from surface to 1.50 m depth. Twelve of the frames are used to record the annual accumulative fouling and the remaining one is used for monthly attachments. Before sampling each panel, photographs are taken to document the distribution of the principal species.

At present we have only reached up to the 6th month of attachment investigations (september/march). For this reason we are only giving a general scheme with diagrams showing the monthly attachment for the main species while the data on the community development obtained from the accumulative panels, which are still incomplete, are excluded.

A great number of the organisms recorded through these investigations are rather unknown in our country. The systematic work presents some difficulties because of the lack of specialists in this subject. For this reason many of the organisms are included in the present paper as genus or in higher taxonomic categories. Their definitive taxonomic place will be determined at the end of the investigations.

## CONCLUSIONS

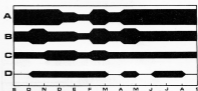
Preliminary conclusions on monthly fouling obtained through half-year researches are given below:

- There are alternative periods of intense and weak fouling attachments during summer and winter respectively.
- The fouling organisms succession follows the same mechanism as in other latitudes. It starts with bacteria-diatoms-protzoan complex, finishing with higher organisms associations.
- Many of the organisms shows an accentuated growth and the vital cycle is completed in a short period of time. This involves a great possibility of substitution which is proved in practice since many organisms die before a month of attachment and are substituted by others.

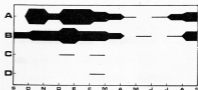
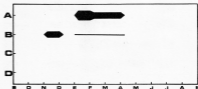
- The fact that it can be observed the attachment of organisms on the accumulative panels, not recorded on monthly panels, proves that certain species requires an established community to continue their development after the attachment.

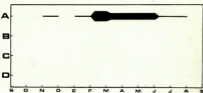
## APPENDIX

MONTHLY ATTACHMENT FREQUENCY OF MAIN ORGANISMS ALONG FOUR VERTICAL PANELS (ABCD), PLACED ON EXPERIMENTAL RAFT FROM SURFACE TO 1.50 m DEPTH [Mar del Plata, September 1966/September 1967].

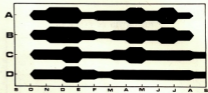


1. ALGAE: Bacillariophyta.

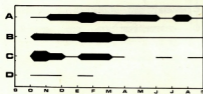
2. ALGAE: Chlorophyta - *Enteromorpha intestinalis*3. ALGAE: Chlorophyta - *Ulva lactuca*.



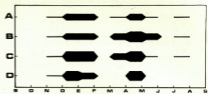
4. ALGAE: Chlorophyta - *Bryopsis plumosa*.



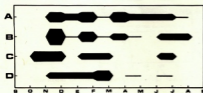
8. NEMATODA.



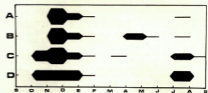
5. ALGAE: Rhodophyta - *Polysiphonia* sp. + *Ceratium* sp.



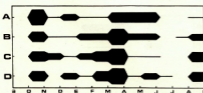
9. BRYOZOA - *Bugula* sp.



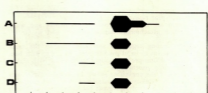
6. COELENTERATA - *Tubularia crocea*.



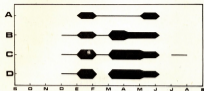
10. BRYOZOA - *Bowerbankia gracilis*.



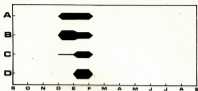
7. COELENTERATA - *Gonyothraea inornata* + *Obelia angulosa*.



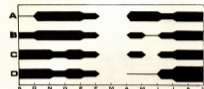
11. MOLLUSCA - *Eubranchus* sp.



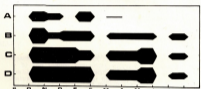
12. ANNELIDA - *Eupomatus* sp. + *Hydroides norvegica* + *Mercierella enigmatica* + *Serpala verticularis*.



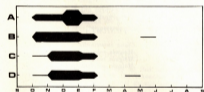
16. CRUSTACEA: *Decapoda* - *Cyrtograpsus angulatus*.



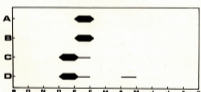
18. CRUSTACEA: *Copepoda* - *Tighe furcata* + *Harpacticus* sp.



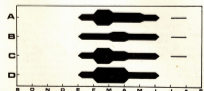
17. TUNICATA - *Ciona intestinalis*.



14. CRUSTACEA: *Anchipsida* - *Cerophium* sp.



18. TUNICATA - *Molgula robusta* + *Molgula manhattensis*.



15. CRUSTACEA: *Cirripedia* - *Balanus trigonus* + *Balanus amphitrite*.

LIST OF SPECIES SETTLED MONTHLY DURING SEPTEMBER 1966/SEPTEMBER 1967.

ALGAE  
*Bacillariophyta*  
*Amphora* sp.  
*Cocconeis* sp.  
*Gracilatorophora* spp.

*Liosiphonia lyngbyei* fa. *elongata*  
*Liosiphonia lyngbyei* fa. *abbreviata*  
*Liosiphonia lyngbyei* fa. *minor*  
*Nannocula* spp.  
*Nitzschia closterium*  
*Nitzschia longissima*



*Pinnularia* sp.  
*Plagiogramma* sp.  
*Thalassiothrix nitidicoides*  
*Pleurosigma* sp.  
*Synedra affinis*  
*Coccolithus* sp.  
*Melosira radiata*

#### Cyanophyta

*Lyngbya lata*  
*Microcoleus tenerinus*  
*Phormidium corium*

#### Chlorophyta

*Cladophora* sp.  
*Enteromorpha intestinalis*  
*Ulva lactuca*  
*Bryopsis plumosa*

#### Rhodophyta

*Polysiphonia* sp.  
*Ceramium* sp.

#### PROTOZOA

*Peridinium* sp.  
*Amoeba* sp.  
*Zoothamnium* sp.  
*Forficella* sp.  
*Euplotes* sp.  
*Frontonia* sp.  
*Trachetonema* sp.  
*Lacrymaria* sp.  
*Mesodinium* sp.

#### COELENTERATA

*Tubularia crocea*  
*Gonothyrea incornata*  
*Obelia angulosa*

*NEMERTEA* (in litt.)

*ROTIFERA* (in litt.)

*NEMATODA* (in litt.)

#### BRYOZOA

*Bugula* sp.  
*Bowerbankia gracilis*  
*Membranipora* sp.

#### MOLLUSCA

*Eubranchus* sp.  
*Siphonaria lessoni*  
*Buccinanops* sp.  
*Saxicava solida*

#### ANNELIDA

*Eupomatus* sp.  
*Hydroides norvegica*  
*Mercierella enigmatica*  
*Serpula oermicularis*  
*Polydora ciliata*  
*Syllis robertianae*

#### CRUSTACEA

*Copepoda*  
*Tisbe farcata*  
*Harpacticus* sp.

*Amphipoda*  
*Corophium* sp.

#### Cirripedia

*Balanus amphitrite*  
*Balanus trigonus*

#### Decapoda

*Cyrtograpsus angulatus*  
*Cyrtograpsus altimanus*

#### TUNICATA

*Ciona intestinalis*  
*Molgula robusta*  
*Molgula manhattensis*  
*Molgula occidentalis* (?)