# ECOLOGICAL STUDY OF VAGILE FAUNA DISTRIBUTION FROM THE BLACK SEA SHALLOW WATER AT VAMA VECHE

# STUDIU ECOLOGIC AL DISTRIBUTIEI FAUNEI BENTALEVAGILE DIN APELE DE MICA ADANCIME ALE MARII NEGRE DE LA VAMA VECHE

**Gabriela-Mihaela PARASCHIV, Manuela-Diana SAMARGIU, Daciana SAVA**

*University Ovidius, Constanta, Romania*
*Corresponding author: Gabriela-Mihaela PARASCHIV, e-mail:gmparaschiv@gmail.com*

***Abstract:*** *This study of the shallow water littoral zone from Vama Veche regards the vagile psammophile and phytophile/iliophile fauna from the midlittoral stratum and superior infralittoral (0 – 2 meters deep) and it is based on 62 quantitative biological samples, taken in July and the first part of October 2005. Representatives from 15 supraspecific taxonomical groups were identified: 44 species in the psammon and 32 species in habitats from the hard substrate with vegetation; a relatively reduced number of species are encountered in both types of habitats, which is owed mostly to their euritropism and capacity to move or to the fact that they are drawn by the water masses; however, most species manifest an accentuated positive tropism for different types of habitat, such as certain species of psammic Turbellaria and Polychaeta: Archilina endostyla, Monocelis lineata, Saccocirrus papillocercus, Namanereis pontica or the species of phytophile crustaceans from the group of Harpacticida and Gammaridae Amphipoda or of Isopoda: Eurydice pontica-psammic, Sphaeroma pulchellum and S. serratum-iliophile, Idotea and Naesa bidentata phytophile. The coarse midlittoral sediments are dominated by species of Turbellaria, Polychaeta, and Harpacticida. Representatives from 13 supraspecific taxonomical groups were encountered in these habitats; representatives from eight supraspecific groups were identified in the mid-fine sediments from the sheltered zones of the infralittoral, the dominant ones being nematodes and species of psammic copepods. A large number of species from 15 groups were identified in the habitats with macro algal vegetation, the most frequent and abundant of them being the Peracarida crustaceans from the group of Isopoda and Amphipoda.*

***Rezumat:*** *Acest studiu al zonei litorale de mica adancime de la Vama Veche se extinde asupra faunei vagile psamofile si fitofile/iliofile din din etajul mediolitoral si infralitoralul superior (0 – 2 m adancime), avand la baza un numar de 62 probe biologice cantitative prelevate in lunile iulie si prima decada a lunii otombrie 2005. Au fost identificati reprezentanti din 15 grupe taxonomice supraspecifice: 44 specii in psamon si 32 specii in habitatele substratului dur cu vegetatie; un numar destul de redus de specii sunt intalnite in ambele tipuri de habitate fapt datorat in mare parte euritropismului si capacitatii lor de deplasare sau antrenarii lor de catre masele de apa; cele mai multe specii insa manifesta un tropism pozitiv accentuat pentru un tip sau altul de habitat, cum sunt de exemplu unele specii de turbelariate si polichete psamice: Archilina endostyla, Monocelis lineata, Saccocirrus papillocercus, Namanereis pontica sau speciile de crustacee fitofile din grupul harpacticidelor si amfipodelor Gammaridae sau a isopdele: Eurydice pontica-psamica, Sphaeroma pulchellum si S. serratum-iliofile, Idotea si Naesa bidentata fitofile. Sedimentele grosiere mediolitorale sunt dominate de speciile de turbelariate, polichete si harpacticide, in aceste habitate fiind intalniti reprezentanti din 13 grupe taxonomice supraspecifice; in sedimentele medii-fine din zone mai adapostite ale infralitoralului au fost identificati reprezentanti din 8 grupe supraspecifice, dominante fiind nematodele si specii de copepode psamice iar in habitatele cu vegetatie macroalgala au fost identificat un numar mare de specii din 15 grupe, cele mai frecvente si abundente fiind crustaceele peracaride din grupul isopodelor si amfipodelor.*

***Key words*****:** *zoobenthos, psammon, vagil-, phytal- and iliophile-fauna, tropism, epifauna, infauna*;
***Cuvinte cheie:*** *zoobentos, psamon, fauna vagila, fitofila si iliofila, epifauna si infauna;*

## INTRODUCTION

Given the fact that studies regarding the benthos, especially from the north-western continental platform of the Black Sea, constitute the object of research for many national and international projects, and also considering the reaffirming of changes that have occurred at the level of benthal associations and of biodiversity decrease, the indications of gaps in the knowledge regarding the structure and distribution of populations that make up the benthal system, we consider that the investigation of these communities in the shallow water littoral zone is opportune, especially as they are more exposed to anthropogenic pressures in the shore line. For a better understanding of the processes that occur at the level of benthos, it is necessary to understand the processes that occur at this level and the interconnections that happen between the different subsystems (Friedrich et al., 2002), and to develop spatial and temporal evolution patterns of the subsystems on the basis of the knowledge accumulated in time (Gomoiu, 2004), but especially in the last decades.

The 2 Mai-Vama Veche regions are located at the southern extremity of the Romanian littoral. It is characterized by the presence of seawalls that border the relatively narrow beaches that are interrupted from time to time by limestone platforms that extend into the sea. The sediments are mostly biogenous in nature, as the dominant granulometric fraction is coarse. However, there are also sediment deposits with a medium and even fine granulometry, especially in the infralittoral stratum. The limestone platforms have most of the times been covered by specific macro algal vegetation, which sometimes formed a compact blanket; the macro algal species that occur constantly belong to the *Enteromorpha* and *Ceramium* genera.

## MATERIAL AND METHOD

This study aims at determining the structure of the benthal communities, of vagile zoobenthal population's distribution and of the extent to which they are influenced by the particular habitat conditions; by habitat conditions, we mean that that we are limited to the sediment granulometry and the dynamics of water masses (Gomoiu, 1968). From this point of view we have identified the following types of habitat: midlittoral psammic (where the wave activity is important), with coarse sediments made up of shell fragments; psammic, in the relatively sheltered zones, with medium and even fine granulometry in the infralittoral; rocky midlittoral, most of the times covered by a relatively dense vegetal blanket made up of *Enteromorpha* species and also characterized by an increased dynamics of the water masses; and rocky infralittoral, permanently submersed and blanketed by clusters of *Enteromorpha* or *Ceramium*.

The biological samples taken from psammon were drawn according to the specimen method, with the help of a corer type probe, while the samples taken from the hard substrate were obtained through the integral scraping of the epibiosis (phyto- and zoo-) from the substrate corresponding to the "sample square;" the samples from the infralittoral stratum, from depths exceeding 1 meter, were drawn through immersion in apnoea. Samples were taken from the wave breaking zone: the maximum advance and retreat limits of waves mark the midlittoral stratum – 2 situs at the extreme limits of the stratum and one situs in the "threshold" zone (Fig. 1); 3 situs were established in the infralittoral stratum: at depths of 0.5 m, 1 m and 2 m, respectively.

The processing and identification of the biological material was realization in the laboratory while the data processing and calculation of the ecological indexes were realized with the help of the EstimateS program.

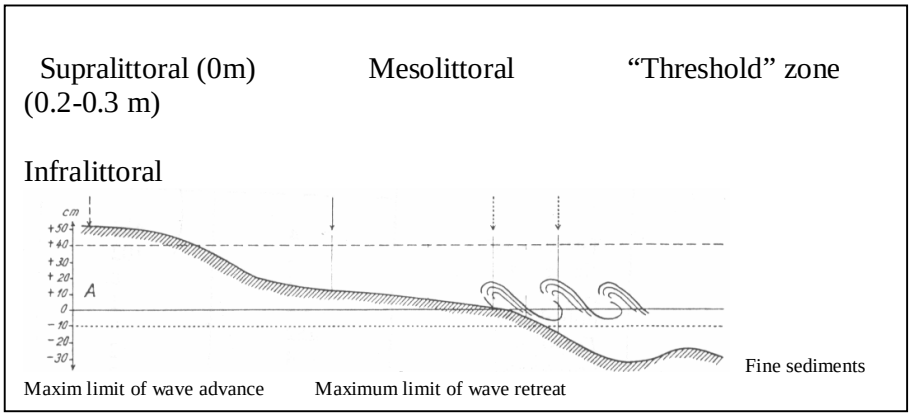


Figure 1. The profile of the littoral transect where the biological samples were taken from, the shallow water zone in Vama Veche (modified by Bacescu et. al., 1968)

## RESULTS AND DISCUSSIONS

The laboratory analysis of biological samples allowed us to group the vagile fauna existing in the habitats from the Vama Veche shallow water littoral zone into two main categories: the association of species with affinity for sediments and that with affinity for rocky substrate – phytal; we must mention the fact that the attached species were not included (from which, the bivalve mollusks are dominant – *Mytilus galloprovincialis* and *Mytilaster lineatus*) and that the phytophile vagile fauna was practically inseparable from the typically iliophile one because the rocky substrate was permanently covered by macro algal vegetation during the analysis period.

In literature (Bacescu et. al., 1971), in the midlittoral stratum of the southern sector of the Romanian littoral, the following are cited as leading species: the Polychaeta *Ophaelia bicornis*, considered extinct in the recent years in these habitats (and at the Romanian littoral) and the *Donacilla cornea* bivalve, which has been reported more rarely during the latest years (living individuals) but in the infralittoral habitats.

A number of 44 species were identified from 15 supraspecific taxonomical groups in the sediment deposits (of different granulometry) from depths between 0 and approximately 2 meters; 32 species from 12 supraspecific taxonomical groups in the associations of the hard substrate, habitat type which lacked representatives of actinulidae hydrozoans (*Halammohydra* sp., typical interstice species reported in these habitats for the first time in 2000, (Paraschiv and Gomoiu, 2001) and crustaceans from the Mysida group. We must specify that the *Halammohydra* species populate the coarse sediments exposed to an increased dynamics of waves, in which the interstice water is not loaded with detritus particles. The species is predatory (its favourite prey being the Harpacticida copepods and occasionally Nematoda or Tubellaria (Swedmark and Teisser, 1957); the movement of the individuals through the interstices of the sediments is of little proportion.

Representatives from the worm group with important effectives were registered in all types of habitats (the maximum number of species reported in the macro algal thickets, Fig. 2),

with the contribution of species of Tubellaria, Nemertea, Nematoda but especially of Polychaeta; among the psammic Tubellaria, the following species have populations with considerable effectives: *Archilina endostyla*, *Monocelis lineata* and *Plagiostomum ponticum*; they are typical to the midlittoral sedimentary biocoenosis with coarse sediments. The maximum values of the effectives are reported during the first part of the warm season, sometimes even towards the end of June.

The Polychaeta group, with a considerable number of species, is also registered in the psammic systems: 12 species, from which 7 are found in both types of habitats (sedimentary and ilio-phytal), 4 typically prefer sediments and 2 have affinity for hard substrate. The Polychaeta populations are found in sediments all over the studied zone: the coarse sediments in the superior extremity of the midlittoral are dominated by *Saccocirrus papillocercus*, while *Nerilla antennata* (both adults and juveniles) occupy the median and inferior region of the midlittoral stratum (even though in smaller effectives, the latter species is also encountered in the macro algal thickets of the inferior midlittoral, up to a depth of 1.5 meters); both species prefer habitats with increased dynamics of the water masses and have a herbivorous-detritivorous feeding regime.

Populations of the following species are reported in the infralittoral sediments that are sheltered and have a mid-fine and fine granulometry (depths of over 1 meter): *Namanereis pontica* and *Pygospio elegans* (Spionida), *Fabricia sabella* and seldom *Spio filicornis* or *Capitelides giardi*, (exclusively detritivorous); the population of the *Namanereis pontica* species registers very large effectives in the fine midlittoral sediments with a big load of vegetal detritus in Eforie Sud (the sheltered break-water zone). A large number of Polychaeta species is registered in the habitats of the rocky substrate, where the predatory forms of the Syllida family are frequent: the species of the genus *Grubea*, *Sphaerisyllis bulbosa* (the most euritop of them; it can also be encountered in the sediments) and *Syllis hyalina*, *S. gracilis*. Also among the predatory species, we report the presence of the *Nereis rava* species (Nereidae).

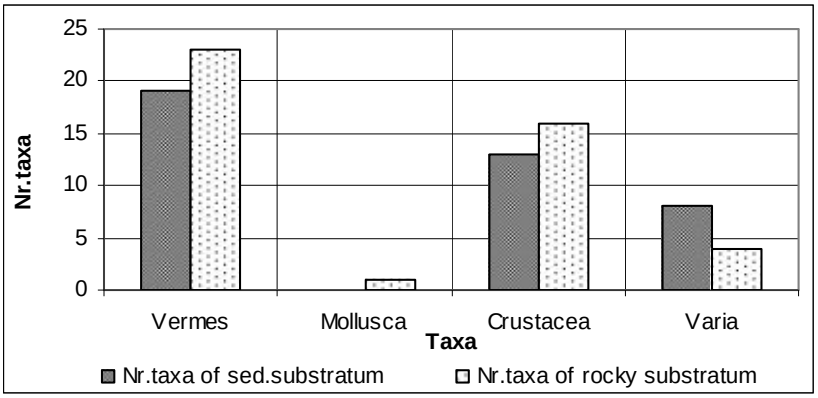


Figure 2. Species number variation in the zoobenthal communities from the Vama Veche shallow water littoral

Crustaceans too are richer in species in the habitats of the rocky substrate as well, especially through species of Amphipoda and Isopoda; the Gammaridae Amphipoda is ilio-phytophile, with the exception of the *Ampelisca* species, which is cited as euritopic.

Among the Isopoda, as exclusively psammic, we cite *Eurydice pontica*, among the iliophile ones, it can be considered the species of the genus *Sphaeroma* and among the phytophile ones, *Idotea baltica* and *Naesa bidentata*; the populations of copepod crustaceans have higher densities especially in the coarse sediments (Fig. 3) and to a lesser extent in the phytal ones.

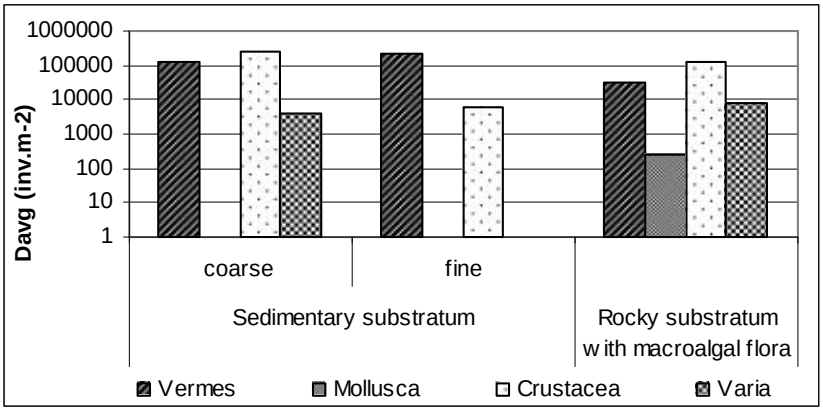


Figure 3. Average density variations of shallow water zoobenthal populations from Vama Veche

The Halacaridae are included in the Varia group and they are reported especially in the phytal zone – 3 species (in the infralittoral with low wave dynamics) and the *Lepidura riparia* and *Podura aquatica* (Insecta) species that prefer sediments, in infralittoral at a depth of 1 meter.

Important values of the average density of different groups representatives are registered in the ilio-phytal and sedimentary habitats with coarse granulometry (Fig. 3); thus, it is observed that coarse sediments with great water mass dynamics have allowed for the presence of small organisms that live mostly in the interstice: the Actinulidae hydrozoans, Tubellaria, Nematoda, Harpacticoida copepods (with very large effectives) and small Polychaeta (mostly under 1 mm) with the exception of the *Saccocirrus papilocercus* species, which is big but longest.

This allows it to develop in the interstice system (Fig. 4). In this context, we must specify the fact that, at the level of the mentioned habitats, this situation is found over the entire southern sector. We had already reported this fact between 1997-2002 (Paraschiv and Gomoiu, 2001).

In the shallow water infralittoral zone (around 0.5 meters deep) with waves, the sediments are more mixed, better circulated and therefore, more compact. The zoobenthal association includes small and medium forms and the dominant ones are the detrivorous worms and the *Ampelisca diadema* from Amphipoda.

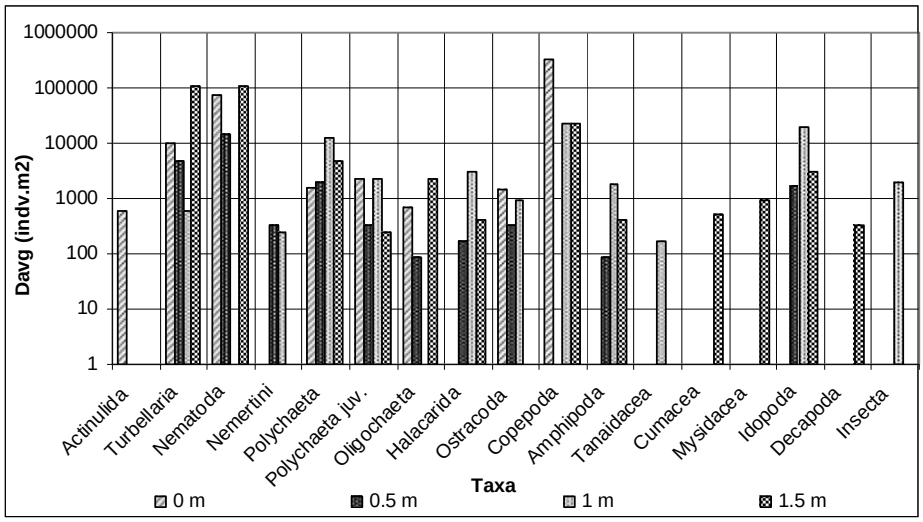


Figure 4. Distribution of taxonomic groups populations from Vama Veche shallow water

However, we report the presence of Nemertea and Halacaridae as predatory forms. The sheltered sedimentary habitats are dominated by Polychaeta, Halacaridae, but mostly by crustaceans: ostracods, copepods, and isopods.

As the hard substratum is covered by rich vegetation, it permitted the existence of more stable conditions specific to a microhabitat. Thus, regardless of the water mass dynamics, the phytophile benthal fauna is the same. Even though the maximum diversity (Hmax) is bigger within the ilio-phytal association, we have observed that the calculated diversity index H is bigger for the sedimentary habitats, in spite of the low equitability in both cases (Fig. 5).

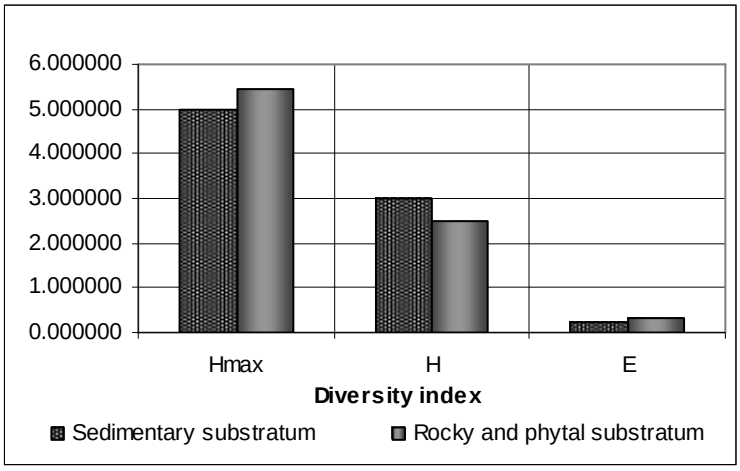


Figure 5. Diversity Shannon-Wienner index variations

## CONCLUSIONS

A complex study is needed for the evaluation of the structure of zoobenthal communities in the shallow water zone and of the population distribution in different habitats. This study should extend over the phytocoenoses, but also over the identification of impact factors from the anthropogenic sphere. We consider that our researches can be seen as a starting point for such a complex study.

In conclusion, we would like to point out a series of aspects that are important for the objectives of our research:

- The analysis of parameters that can have limitative action at the level of the investigated area (from a depth of 0 to 2 meters) has permitted the identification of several types of habitats, according to the water mass dynamics and the sediment granulometry: midlittoral habitats with biogenous, coarse sediments characterised by wave activity (0-0,25 meters); infralittoral habitats with well-sorted sediments, exposed to the waves (the "threshold" zone – 0,5 meters); infralittoral habitats with mid-fine sediments in the sheltered zones (1-2 meters deep) and the habitats of the hard substrate covered with macro algal vegetation from the mid and infralittoral (being sheltered by the macro algal blanket, the associations of organisms at this level generally have the same qualitative structure, both in the midlittoral – exposed to the waves – and the infralittoral – where wave activity is not felt very much in serene conditions.
- On the basis of the 62 quantitative biological samples taken in 2005, representatives of 15 supraspecific taxonomical groups were identified: 44 species in the psammon and 32 species in the habitats of the hard substrate with vegetation; the sedimentary habitats are populated mostly by representatives of the worms group: -small (under 1 mm) in the coarse midlittoral sediments – interstice fauna or infauna, even though the medium values of density point to the Harpacticoida as the most numerous; -bigger sizes as the depth grows and water mass dynamics and sediment types modify (medium granulometry, well sorted and more compact); this fauna forms what is defined as epifauna; most of the in- or epifauna associations of the sedimentary habitats are dominated by detrivorous species or microbenthophage ones (bacterial associations, microphytobenthos)
- The associations of the hard substratum are dominated by the populations of relatively big crustaceans (the Gammaridae Amphipoda and Isopoda). However, we report a better representation of predatory species, both in the worms group (Syllidae and Nereidae among the Polychaeta) and in the Halacaridae or Nemertea group. In the case of these habitats, the presence of the vegetal blanket leads to the creation of stable microhabitat conditions, regardless of the water mass dynamics (in serene conditions, as in storm conditions these organisms are quite agile and can move and take shelter in "safer zones," under limestone platforms or in deeper areas).

## LITERATURE


1. BACESCU, M., GOMOIU, M. – T., DUMITRESCU, ELENA, "*Quelques considerations sur la dynamique des organismes de la zone mediolittorale sableuse en mer Noire*", Rapp.Comm.int.Mer Medit. 19,2/1968, pg.117-119.
2. BACESCU, M., GOMOIU, M. – T., , "..", Rapp.Comm.int.Mer Medit. 19, 2/1971, pg.117-119.
3. FRIEDRICH, JANA, ET. AL., "B*enthic nutrient cycling and diagenetic pathways on the north-western Black Sea shelf*", Estuareine Costal and Shelf Science 54(3)/2002, pg. 369-384.

4. GOMOIU, M. – T., "*On the effects of the water motion marine organisms in the mesolittoral and infralittoral of the Romania shore of the Black Sea*", Sarsia 34/1968, pg. 95-108.
5. GOMOIU, M. – T., "*New approaches in the assessment of the Black Sea Ecosystems*", Geo-Eco-Marina 9-10/2003-2004, pg. 3-7.
6. PARASCHIV, GABRIELA – MIHAELA, GOMOIU, M. – T.,"N*ew species of Cnidaria in the Black Sea: Halammohydra sp and Stylocoronella sp., interstitial forms at mid-littoral sandy beaches*"" Geo-Eco-Marina 5-6/2000-2001, pg. 53-58.
7. SWEDMARK, B., TIESSIER, G., "*Variation Morphologique des differentes populations regionales d'Halammohydra"*, Ann. Biol., 33,3-4/1957, pg. 183-189.