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COMPARISON BETWEEN THE MACROALGAL QUALITATIVE STRUCTURE IN NORTHERN AND SOUTHERN PART OF THE ROMANIAN BLACK SEA COAST

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Key words: *Romanian Black Sea coast, macroalgae*

INTRODUCTION

The submerse vegetation from the Romanian Black Sea waters represents a very important ecosystem component, being a substrate for the epiphytic algae, feeding and breeding area for invertebrates and fish, which carry-out their vital processes within the thickets formed by macrophytes. Macroalgae have a role in protecting the fauna against the disturbing water action, due to their flexible structure; they also offer a shelter against predators and excessive light. Regarding the associated fauna, for the sessile organisms the most important is the rigidity and the thallus width, so the more rigidly and wider are the ramifications, the more diversified is the sessile fauna. Thus, sessile fauna will be better represented on *Phyllophora* than on the lamellar *Ulva* thallus. In contrast, for the vagila fauna is more important the degree of branching. Thus, this type of fauna will be better represented along filamentous thalli that form reticular spatial structures (eg. *Ceramium, Polysiphonia, Cladophora, Cystoseira* with epiphytes). The macroalgal substrate is particularly important and needs protection because it has a role in the survival of sessile larvae, especially those of bivalve, preventing their sediment silting. Also, being under the direct anthropogenic action, macrophytes areas are among the first to react to changes in water quality, thus are considered bioindicators of marine environmental quality (Tigănus, 1979).

MATERIAL AND METHOD

The present study focus on the qualitative analysis of the collected samples during 2012, in order to provide an overall aspect of the phytobenthic structure from the Romanian Black Sea coast. Samples were collected from the upper horizons (0-3 m depth), 3 replicates at each depth. Also some observations on the shore macroalgae deposits were conducted, both in summer season and during cold season after the storms. The collected samples were placed in labeled plastic bags (date, station and sampling depth are noted) and introduced in refrigeration box in order to avoid samples damage caused by high temperatures during summer. Subsequently, the collected samples were brought fresh to laboratory, where they were subjected to a careful qualitative analysis.

The fresh macroalgae samples were washed for sediments and associated fauna and separated per phylla – green algae (Chlorophyta), brown algae (Phaeophyta) and red ones (Rhodophyta). After this operation it passed to the identification to species level using algological handbooks, scientific literature and inverted microscope (Fig.1.). Some difficult genera (*Ulva, Cladophora, Ceramium*) required detailed measurements of the cells, in order to a correct systematic classification. Particular attention was given to epiphytic species (small algae that have developed on the surface of other macrophytes) which are manually removed and studied separately.

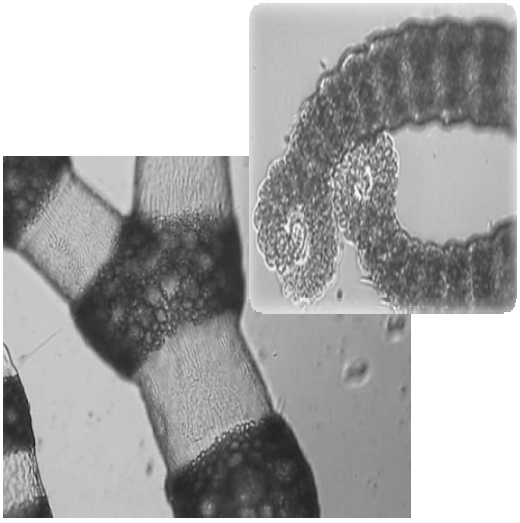

Fig. 1. Aspects from the microscopic analysis (*Ceramium* species) (photo INCDM)

The samples were collected from the following stations, considered representative for the algal flora: Năvodari, Pescarie Constanța (in the northern sector), Cazino Constanța, Eforie Nord, Tuzla, Costinești, Mangalia, and the stone platform between 2 Mai and Vama Veche, in the southern part (Fig.2.). Only the natural hard substrate was analyzed, which allow the development of algae, naturally, spontaneously. In some cases, the substrate was covered by mussel colonies (*Mytilus galloprovincialis*), so a secondary substrate for macrophytes development is created and samples were also taken from the surface of the mussel shells.

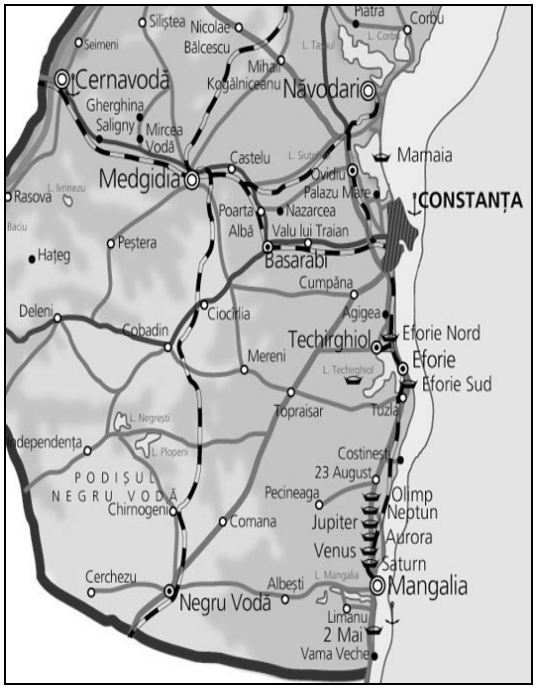

Fig. 2. Sampling stations map (http://www.rotravel.com/Harti-ale-Romaniei/Litoralul-Marii-Negre)

In order to a correct systematic classification, algological handbooks were consulted:

- Algologie Treaty – a synthesis in four volumes, of which only the first three deals with macroalgae. Problems of morphology, structure, reproduction and taxonomy are approached (xxx, 1977-1979).
- Macrophyte algae from the Romanian coast. An Illustrated Field Guide that includes descriptions of the general characteristics of the macroalgae, ecology aspects and economic importance of this resurse, being illustrated with numerous figures (Sava, 2006).
- Marine plants of the Black Sea. An illustrated field guide, provides a detailed description of the species, with reference to their biology, ecology, and economical importance (Milchakova, 2011).

RESULTS AND DISCUSSIONS

Qualitative analysis

During the study period (2012) based on the qualitative analysis, 27 taxa were identified, assigned to the following phyla: 11 taxa of Chlorophyta, 4 of Phaeophyta, and 12 of Rhodophyta (Table 1)

In the southern coast of the Romanian Black Sea coast, as a result of favorable conditions, the specific diversity is higher (Fig.3.).

Table 1. Species list (2012)

Northern sector	Southern sector
CHLOROPHYTA	
Bryopsis plumosa	*Bryopsis plumosa*
Cladophora sericea	*Cladophora albida*
Cladophora vagabunda	*Cladophora laetevirens*
Ulothrix implexa	*Cladophora sericea*
Ulva intestinalis	*Cladophora vagabunda*
Ulva rigida	*Ulva compressa*
Urospora penicilliforms	*Ulva flexuosa*
	Ulva prolifera
	Ulva intestinalis
	Ulva rigida
	Urospora penicilliforms
PHAEOPHYTA	
	Cystoseira barbata
	Ectocarpus siliculosus
	Punctaria latifolia
	Scytosiphon lomentaria
RHODOPHYTA	
Callithamnion corymbosum	*Callithamnion corymbosum*
Ceramium diaphanum var. *elegans*	*Ceramium diaphanum*
Ceramium virgatum	*Ceramium diaphanum* var. *elegans*
Pyropia leucosticta	*Ceramium rubrum* var. *barbatum*
	Ceramium rubrum var. *tenue*
	Colaconema thuretii
	Ceramium virgatum
	Hildenbrandia rubra
	Lomentaria clavellosa
	Pyropia leucosticta
	Polysiphonia elongata
	Coccotylus truncatus

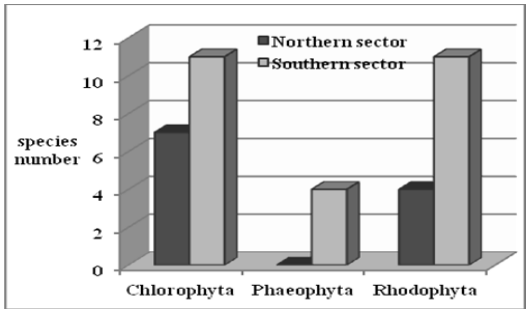

Fig. 3. Comparison between the northern and southern part regarding the species number

The Romanian coastline between Cape Midia and Vama Veche provides optimal conditions for benthic marine algae (perennial or with short life cycle) development, on natural rocky and artificial substrate (Sburlea, Bologa, 2006). There is a difference between the northern and southern part of the Romanian coast, so that in the north, the reduced areas with natural hard substrate and the higher level of eutrophication does not provide favorable conditions for macroalgae development. The presence of opportunistic species and the reduced number of species, compared with the southern part, can be noticed, one cause being also the Danube influence. In the northern sector predominates the sandy substrate, unfavorable to the development of macroalgae, while in the southern part, the rocky substrate, occupied a most extended area. The differences concerning the development of algal flora derives from the fact that the northern sector is submitted to the influences of polluted water, which means: large amounts of suspensions, reducing light penetration and depositing on the substrate surface, prevent spore germination and macroalgae subsequent development (Sava, 2000).

Marine macrophytes respond to environmental factors variations, the substrate quality, and quantity of light radiation permeated into the water column represent the primary factors necessary for their occurrence. Various anthropogenic activities (hydrotechnical constructions, accidental pollution with chemicals) have a negative influence, noticed first in the coastal algal belt (Sburlea, Bologa, 2006). The substrate is the key environmental factor in the development of macroalgae. The roughness of the substrate and lack of sediments are decisive for the installation and subsequent existence of macroalgae, particularly for the sensitive species (e.g. *Cystoseira barbata*). But opportunistic species can also install on dykes, or other types of substrates, but a substrate that degrades under wave action, generating turbidity is unfavorable for macroalgal development (Sava, 2006). Being photosynthetic organisms, light is an important factor in the development of their fundamental processes and macrophytes are divided into photophyles species (located in the shallow water) and scyaphyles (present at deeper horizons).

The most important change over the decades, suffered by the algal flora along the Romanian shore, is the qualitatively decline. In the past years a quantitative development of a small genera (*Ulva, Cladophora* and *Ceramium*) can be noticed. Over the decades, at the Romanian coast, the perennial species have reduced their number and distribution area, due to the negative influence of adverse factors, both natural and anthropogenic. Among the natural factors, particularly cold winters in the years 1971/1972, 1984/1985, the formed ice layers and extremely low water temperatures led to the extinction of many algal species and also their associated flora and fauna. The high water turbidity, eutrophication and even pollution of marine waters, favored the disappearance of many macrophyte and marine phanerogams, resulting in a drastic reduction of specific biodiversity. The eutrophication led to the increasing of the nutrients amount, phytoplankton blooms, impaired oxygen regime, hypoxia phenomena, impaired light regime and reduced water transparency (Sava, 2000).

During summer of 2012, along the Romanian coast, the eurithermal and opportunistic species belonging to phylum Chlorophyta (characterized by a fast development cycle and abundant proliferation) have quantitatively dominated, influenced by seasonal environmental conditions, respectively a high temperature water, a large amount of nutrients and a water transparency, suitable for the photosynthesis process. As a general remark, during the study period, *Cladophora* and *Ulva* species were constant presences, both in the northern and southern part and were also main components of the deposits formed on the shore during the summer season. Due to waves, currents, storms, in summer, macroalgal species were detached from the substrate and floated on the water surface, so from shore up to a few meters at sea, sometimes a belt of algae is formed.

Although these deposits create discomfort during the summer season, *Ulva,* and *Cladophora* species can be used as organic fertilizer in agriculture. They contain bioactive substances capable of being chemical and pharmaceutical valorified: vitamins, substances with antibiotic spectrum. Red Algae - *Ceramium, Polysiphonia, Pyropia* contain vitamins, carotenoid pigments, substances with antimicrobial activity, applicable in various areas (Bavaru, 1978). The studies of the algal material from Romanian coast showed that amino acids are present in algae (especially in green algae, such as *Ulva rigida*), among which, 8 are essential for human organism and impossible to be synthesized: izoleucine, leucine (essential in nutrition), lizine (indispensable for growth process), metionine (contains large quantities of sulfur, used as a medicine for the treatment of some liver diseases), fenilalanine, treonine, triptofan (heterocyclic amino acid present in hemoglobin), valine (with an important role in nutrition, in nervous system activity and the maintenance of muscle tone) (Sârbu et.al., 2007).

With the onset of cold season 2012, the installation of stenothermal macroalgae vegetation, characteristic of this period, both in the north and the south, has been noticed. This characteristic vegetation maintained until late spring when the water temperature increase and an abundant development of green opportunistic algae manifested. Thus, in the northern area (Pescărie Constanța, Năvodari) shallow rocks were dominantly populated by *Urospora penicilliformis* and *Ulothrix flacca*; at a greater depth also *Pyropia leucosticta* was identified. *U. penicilliformis* has a particular physiological

resistance to prolonged emersion, can develop during cold season on hard substrate at considerable distances from water, needing only a simple wave splash (Marin, Timofte, 2011).

In the southern sector a higher species diversity compared to the northern sector can be noticed during the cold period, a fact maintained also during the warm season. This is due to the high water transparency, favourable light regime, and also to the heterogeneity of the substrate, which provides favourable conditions for development of a higher number of macrophytes. The following taxa were reported: *Urospora penicilliformis*, *Ulva compressa, Bryopsis plumosa, Punctaria latifolia*, *Ceramium virgatum*, *Pyropia leucosticta*, *Ectocarpus siliculosus*, *Scytosiphon lomentaria. Hildenbrandia rubra* (an encrusted, perennial species found on the shore stones, in the southern part, at Cazino Constanța). This species is particularly resistant to waves action, due to its strong adhesion to the substrate and can withstand extended emersion periods, salinity and temperature variations, and also provides more complexity to the rough substrate, favoring attachment of the others organisms (Marin, Timofte, 2011).

Some of these species, with the onset of warm season, showed an interesting stenothermy behavior. Thus, as the water temperature increased, these species have retreated to deeper horizons where the environment was still favorable to their physiological processes. It is the case of *Scytosiphon lomentaria, Bryopsis plumosa,* sometime *Punctaria latifolia*, that were identified between 3 and 5 m depht, in early summer, or passed to epiphytism on larger species (on *Polysiphonia denudata, Ceramium* sp.), as a protection method against waves action. When the seawater temperature reached higher values, these species have disappeared, only to reappear later when conditions are suitable to their existence, this being the cycle of benthic vegetation. So, at Năvodari and Cazino Constanța, in early June, *Bryopsis plumosa* thalli were identified in samples, but with a very different aspect from those observed in winter (much lower branches and smaller dimensions).

With the onset of the warm season (May-June) can be noticed the presence of opportunistic species, capable of developing considerable biomasses during summer. In the northern part, a reduced number of species appear - *Ulva intestinalis, U. rigida* (found only as sparse thalli). *U. intestinalis* can withstand contaminated water, even polluted (Sava, 2006) and was sometimes identified even in discharge areas. *Ulva rigida* has depigmented areas (mainly around the edges) under stress conditions (Marin, Timofte, 2011). In the southern part, at Mangalia, 2 Mai and Vama Veche, *Ulva rigida* forms the association *Cystoseira barbata - Ulva rigida,* particularly important for the marine ecosystem, enriched with various faunal elements (xxx, 2011). As a result, those underwater thickets so necessary for the survival of marine organisms are formed. Also in the south have been reported other ulvaceous species: *U. flexuosa, U. compressa U. prolifera,* sometimes in association with specimens of *Cladophora*, thus forming the association *Ulva – Cladophora*, in the shallow waters.

Analyzing the specialized literature, it can be said that genus *Ulva* is among the first to cover the substrate in coastal waters with a high nutrients content. This may due to their simple morphology and high reproductive capacity (Sava, 2006). Another genus that experienced a notable development in the summer of 2012 was *Cladophora*, with *Cladophora vagabunda* and *C. sericea* in the northern part of the shore. During cold season, *Cladophora* is present along Romanian shore only as small specimens, this abundant development is recorded during summer, due to favorable environmental conditions. In Mangalia, *C. laetevirens* and *C. albida* were identified, as associated species to *Cystoseira*. Sometime, during warm season, these species have a negative effect on the development of *Cystoseira*, suffocating and preventing the photosynthesis process of this key species. Most of the *Cladophora* species are able to find a suitable habitat almost everywhere: in basins and less hydrodynamic lagoons, but also in exposed areas, in sunny or heavily shaded areas, on hard substrate, but sometimes even on sandy or muddy substrate (Vasiliu, 1984). Hence the opportunism of these species, which sometimes can be considered good indicators of water loaded with nutrients, sometimes polluted.

In summer in the northern sector (Navodari and Pescarie), although the substrate was covered mostly by green algae, also some Rodophytes were identified - particularly exemplary of *Ceramium virgatum*. In fact, red algae are dominated at the Romanian shore, in present by *Ceramium* genus, annual elements that develop abundantly on rocky substrate. *Ceramium diaphanum* var. *elegans* and *C. diaphanum* are constant presences in the southern sector. *Ceramium* forms during summer season an association characteristic for the shallow zone (0.5-3 m) with *Ulva* species: with *Ulva intestinalis* at Năvodari and *U. rigida*, *U. compressa* at Costineşti, Eforie Nord and in the area between 2 Mai and Vama Veche. In the southern part, some varieties were reported - *Ceramium rubrum* var. *barbatum* and *C. rubrum* var. *tenue* (along the rocky platform from 2 Mai-Vama Veche)

During summer season, both in the north and south part, a belt of green algae is formed, in the shallow area, with many *Ceramium* thalli, species with a high reproductive capacity, both asexual and sexual. The opportunism of these species derives from the fact that several types of substrate are preferred for development, so in addition to the rocky one, they can grow on mussel shells (both living and dead), on dams and even on vegetal substrate (other

algae). The epiphytism is preferred by this genus, growing on *Cystoseira* thalli, *Zostera* leaves and even on the surface of smaller species such as *Ulva* or *Cladophora* species. Switching to epiphytism provides also protection for this species against the effect of waves and currents. Epiphytes play an important role, their occurrence leading to a higher degree of complexity of the algal substrate, a key condition for the fixation of the epibiotic diatoms and for sheltering the associated fauna. Although these species can sometimes hinder the physiological processes of some important species (*Cystoseira barbata, Zostera noltei*), the numerous fine branches of the *Ceramium* thalli represent a suitable environment for micro and meiofauna (Müller et al.,1969).

Polysiphonia denudata is a perennial species that was observed throughout the study, at depths between 2-5 m, but only in the southern sector. Another constant presence throughout the study was *Callithamnion corymbosum*, a small species commonly recorded at depths between 3 to 5 m**,** both on hard substrate and as epiphyte in the apical part of *Cystoseira barbata* thallus and along *Zostera noltei* leaves. An important occurrence during the study was *Lomentaria clavellosa,* a species identified in the southern sector, at Cazino Constanţa and 2 Mai. The occurrence of this species, considered rare for the Romanian waters, which in the past used to form a complex association, is particularly important indicating a slight regeneration of the benthic vegetation. In the past, these red algae had larger dimensions and formed the association *Lomentaria clavellosa - Antithamnion cruciatum,* which used to mark the lower limit of the attached algal macrophyte vegetation in the Romanian coastal waters. This lower depth varies from 7-8 m down to 13-15 m in the southern part of the Romanian Black Sea. The indicative species was *Lomentaria clavellosa* and below 11 m, where this species no longer appears, *Antithamnion cruciatum* was present. Within this group, a single association was present - *Lomentaria clavellosa - Antithamnion cruciatum* - enriched by seasonal elements: *Bryopsis hypnoides, Ceramium elegans* f. *longearticulata* (for the northern sector) and for the sector Mangalia - Vama Veche - *Bryopsis hypnoides* and *Callithamnion granulatum*. At Tuzla and Costineşti, at depths of 10-12 m, fragmented populations of *Phyllophora nervosa* were identified. On stones and mussels, two encrusted red algae - *Dermatolithon cystoseirae* and *Cruoriella dubyi* were found (Bavaru, 1978). The disappearance of this complex association led also to the disappearance of these species from the Romanian waters. The fact that this species occurs in samples in the past years, may sustaines the idea of a slight recovery of this symbolic association at the Romanian shore.

A key species is considered, according to the definition used by the Black Sea Commission, to be a species that influences the structure and functioning of benthic communities, serving as a substrate for other plants and refuge, feeding and breeding place for the associated fauna. On the Romanian coast is currently included into this category, the perennial brown alga *Cystoseira barbata*, identified during the study (2012) at Mangalia, in a sheltered area, where well developed thickets were observed, epiphyted by *Cladophora vagabunda, Ceramium diaphanum* var. *elegans* and *Callithamnion corymbosum* during summer season. The microscopic analysis revealed the presence of the small epiphyte *Colaconema thuretii* along the thallus surface.

Cystoseira barbata was present at Mangalia at depths between 0.5 to 2 m, on rocky natural substrate. After 2 metres depth the sandy substrate begins, favorable for the development of another key species - the marine phanerogame *Zostera noltei* (xxx, 2011). The dominant epiphyte during the summer was *Ceramium diaphanum* var. *elegans*, and during the cold season, the main branches are epiphyted by *Pyropia leucosticta* and sometimes by the brown algae *Punctaria latifolia.*

The simple qualitative analysis (both macroscopic and microscopic) of this perennial algae sustaines the afirmation – ***Cystoseira barbata*** is a key element in the development of marine life. Thus, the thallus surface was covered by mussel colonies and briozoans, and along the branches, *Rapana* egg mats were observed. *Cystoseira barbata* forms fields also in the marine reserve 2 Mai - Vama Veche (Natura 2000 site - ROSCI 0269), where a strictly protected area is proposed in order to protect the prioriar habitat 1170-8 - infralittoral rock with photophyles algae. Nowadays the species is in a regeneration period in the southern part, where marine waters of superior ecological quality exists (xxx, 2011). The brown alga *Cystoseira barbata* has a particular ecological importance for the marine ecosystem, as it constitutes protecting environment, feeding and breeding place for fish juveniles, and also for many marine invertebrates. The elastic substrate and yet firm enough represented by *Cystoseira* thalli, the complex structure of branches offers an ideal fixing place for various macrophytes, both photophyles and scyaphyles (Müller et al., 1969).

Reporting the present situation with the one existing in the past decades, it can be said that this species has suffered a severe quantitative decline (Fig.4.), as a consequence of the unfavorable natural factors (the sea ice occurred in 1971/1972, 1984/1985). After these episods, from the thalli of more than 1 m remained only a small portion with the holdfast. Some powerful storms followed, which threw huge amounts of mussels on the shore (measured at 20 - 25,000 tons) and tore out the *Cystoseira* thalli. During that period, only rare exemplares, not exceeding 52 cm height were identified, very small compared to those identified in previous studies. Due to extreme low temperatures, the formation and maturation of reproductive

elements was delayed until summer period, when also a development of opportunistic species occurs, which slowed the process of rebuilding stocks (Vasiliu, 1978).

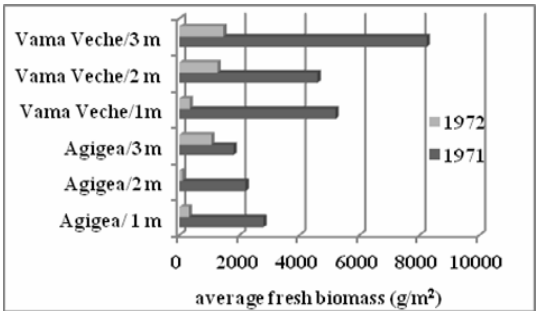

Fig. 4. *Cystoseira* stocks decline in northern and southern Romanian part between 1971-1972 (Vasiliu, 1978)

Although there were sea ice phenomena in the past, the *Cystoseira* fields (*C. barbata* in asociation with *C. crinita*) used to recover, but after this episode this perennial species was not able to regenerate anymore due to the intense anthropogenic pressures manifested at the beginning of the 1970s. The germs and young plants were unable to develop and restore the destroyed vegetation in coastal waters with high turbidity as a result of discharging at sea the excavated soil from various constructions or from unconsolidated cliffs affected by erosion (Bavaru, 1981). In present, an economic exploitation of this species is excluded, as stocks are very reduced, and the species is included in the Red List as protected species, emphasizing its ecological importance.

Cystoseira fields had an important role in the amortization of shock waves and its reduction favoured the increased in water turbidity, with negative effects especially to sensitive organism. Another consequence of this species decline was the reduction in macroalgae biodiversity, as *Cystoseira* represented the host plant for the epiphytic species, that could only develop on its elastic thalli. As a result, species such as *Sphacellaria cirrhosa, Feldmannia irregularis, Stilophora rhizoides, Corynophlaea umbellata, Cladostephus verticillatus*, *Kylinia* ssp. disappeared. The disappearance or reduction of *Cystoseira* fields also led to the decline of some fish species which used to find here shelter and feeding habitat. Thus, in that period one of the main links of life in shallow littoral zone was almost destroyed (Bavaru, 1972) and also the specific diversity was reduced. Another important role of this species is given by the branched appearance of the thallus, which attenuates the wave action, also the vertical position in water prevents the sediment silting of diatoms, thus allowing the development of colonial microphytes (Müller et al., 1969).

An entire chain was created with consequences more or less immediately. Some effects can be seen even nowadays. *Cystoseira* represented the host plant for many epiphytic species, that could only develop on its elastic thalli, As a result, species such as *Sphacellaria cirrhosa, Feldmannia irregularis, Stilophora rhizoides, Corynophlaea umbellata, Cladostephus verticillatus*, *Kylinia* (*K. parvula, K. hallandrica, K. secundata*) disappeared, and no longer can be encountered at the Romanian shore (Bavaru, 1972).

Another genus that has been affected by these extreme natural phenomena and but also by the water turbidity, was *Laurencia*, species with great ecological importance, support for the development of other macroalgae species, shelter and breeding place for many marine invertebrates. *Laurencia* were particularly robust species, with a cartilaginous texture that could resist to waves action, but with a high sensitivity to low temperatures, destroyed at water temperatures between 2-3° C. The ices blocks from the previous decades were a possible explanation of *Laurencia* disappearance from the Romanian shore. The genus was well represented at the Romanian coast - *L. pinnatifida, Laurencia coronopus, Laurencia obtusa*, developing in areas with high water transparency (Marin, Timofte, 2011).

In 2012 were observed only stranded *Coccotylus truncatus* thalli, along the shore, on mussel shells, in the southern sector (Cazino Constanța, 2 Mai), but with small dimensions. *Phyllophora* genus is included in the Red List of endangered species. *Phyllophora* is one of the main biological characteristics of the continental shelf and one of the particular features of the Black Sea benthos, and used to form the "Zernov's *Phyllophora* field". The field used to shelter a rich flora (about 40 species of macroalgae) and fauna, so this was a unique area of great ecological importance. Dredging operations, eutrophication and reduced water transparency were factors that have led to a drastic decline of *Phyllophora* population. On our coast, Sf. Gheorghe was in the past a particularly important area, due to the *Phyllophora* species development (part of the famous Zernov's *Phyllophora* field). Some dredging operations along the Romanian continental shelf in 1971 at depths between 10 and 56 m, showed that at Sf. Gheorghe, *Phyllophora nervosa* has disappeared, its place being 100% occupied by *Coccotylus (*syn*. Phyllophora) brodiei*. The presence of *Coccotylus brodiei* in this area has been mostly facilitated by the massive development of calcareous red algae of the genus *Lithothamnion*. The colonies of these algae developed on the molluscs shells and created a rough, irregular substrate, favorable to the development of *Coccotylus brodiei*. Along Romanian continental shelf, of all *Phyllophora* species, the dominant one during 70ies was *Coccotylus brodiei,* that prevailed in the northern part, in proportion of almost 100%, while the central and southern part of the coast was dominated by *Phyllophora crispa* (Marin, Timofte, 2011).

CONCLUSIONS

Macroalgae–particularly important elements in the development marine life;
During the study period (2012) based on the qualitative analysis, 27 taxa were identified, assigned to phyla as follows: 11 of Chlorophyta, 4 of Phaeophyta and 12 Rhodophyta;
The most important change over the decades is the qualitatively decline;
In 2012 the opportunistic Chlorophyta species (*Cladophora* and *Ulva*) dominated along the Romanian coast of the Black Sea;
Ceramium was the dominant genus among the red algae;
Notable presences reported during the study period were the perennial brown alga *Cystoseira barbata* and the red alga *Lomentaria clavellosa*.
The southern sector of the Romanian Black Sea coast is more favourable to phytobenthos development due to a favourable substrate and a high water transparency comparing to the northern sector.

ABSTRACT

As a general conclusion, under the current environmental conditions, in the southern sector of the Romanian shore, a more diverse macroalgal flora develops comparing with the northern part. In the mediolittoral area dominates the green algae belt, composed of opportunistic species: genera *Ulva* and *Cladophora* during warm season, respectively *Urospora* and *Ulothrix* during the cold period.

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