

**THE NATIONAL INSTITUTE FOR MARINE RESEARCH AND
DEVELOPMENT „GRIGORE ANTIPA”
Department of ECOLOGY AND ENVIRONMENTAL PROTECTION**

MARINE ECOLOGY - PAST, PRESENT AND PERSPECTIVES

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The beginnings of the Romanian marine ecological research overlap on the oceanologic concerns and have a tradition of more than a century; at the end of the XIXth and the beginning of the XXth centuries, the first algological studies were carried out. Later, other biotic components of the marine ecosystems were taken into consideration.

In time, oceanology research went through several stages, marked by the different approaches of various persons of consequence in the field. A promoter of the Romanian biological research is Grigore Antipa, the first organizer of three scientific explorations in the Black Sea (1893 - 1895), dedicated to biological sampling. His attention was focused primarily on the fish fauna, the fish specimens collected by him enriching the collections of the Museum of Natural History in Bucharest, which now bears his name.

Another milestone in the development of marine ecology in Romania is the attempt to institutionalize marine research, reflected by the establishment of the Agigea Marine Zoological Station in 1926, by Professor Ion Borcea, followed by the creation, in 1932, in Constanta, of the Bio-Oceanographic Institute, by Dr. Grigore Antipa. These institutions were essential for the birth of the Romanian Marine Research Institute (RMRI) in 1970, whose anniversary we celebrate today. The two research institutions contributed to the formation of numerous specialists in the field of marine ecology, such as: Constantin Motaş, Zaharia Popovici, Sergiu Cărăușu, Mihai Băcescu, Eugen Pora, Maria Celan and others, whose contributions in pioneering the development of this field between the two World Wars were materialized in valuable publications.

After World War II, Romanian marine ecological research made remarkable progress, Professor Mihai Băcescu founding a true school of outstanding professionals. He considered that, in order to achieve a thorough ecological investigation in the marine aquatory, it is necessary to address the entire complex of abiotic and biotic conditions thereof. Therefore, training a specialist for each link of the marine food chain was considered a priority by him, thus linking the ecology to taxonomy, in the absence of which a good

specialist cannot explain the phenomena that occur in marine ecosystems. Thus, between 1950 and 1960, specialists in many systematic groups were trained, from protozoa to the most complex invertebrates in the benthic and pelagic ecosystems, including algology, as both micro- and macroalgae play an essential role in these marine ecosystems.

Carrying on the tradition of his illustrious predecessors, Professor Băcescu established the Marine Biology Laboratory in Constanta in 1954, under the aegis of the Romanian Academy, representing the third institution that contributed to the formation and subsequent operation of RMRI Constanța. The team of this laboratory distinguished through the fundamental research on the structure, dynamics and distribution of life in the Black Sea benthic and pelagic areas, materialized in the publication of over 100 scientific papers, essential being the five volumes of the *Marine Ecology* series published by the Romanian Academy.

After the establishment of RMRI, the marine ecological research, based on the rich tradition and background information obtained after unifying the above-mentioned institutions, shifted towards addressing the important issues at that time, when the effects of the eutrophication of marine environment began to be felt. Some environmental issues, such as enhancing the knowledge on pollution, eutrophication, algal blooms, planktonic biomass growth, biodiversity loss, the reduction of marine living resources drew the marine ecologists' attention, gaining important progress in their knowledge and explanation. Through research dedicated to marine flora and fauna, followed by qualitative and quantitative studies on the benthic and pelagic communities, an important amount of data was accumulated, that contributed to expanding the knowledge of marine ecosystems structure. These activities, carried on and supplemented annually, have played and will continue to play an important role in clarifying the functioning of marine ecosystems by using modern methods for the interpretation of data, including mathematical modelling.

It is worth mentioning that at the beginnings of RMRI, between 1973 and 1975, Romanian marine ecological research crossed the Black Sea boundaries, successfully investigating benthos, phytoplankton and zooplankton in the Libyan sector of the Mediterranean.

After 1990, with the passage of the Institute under the coordination of the Ministry of the Environment, the research was aimed at solving ecological requirements for management and environmental protection. For these reasons, the marine ecology laboratory, established in 1992, covered two main directions:

- the study of the state of the main components of the marine ecosystem and the assessment of the eutrophication impact on its structural

features, functionality and productivity. In this respect, in order to have a more complete picture of life in the Romanian marine sector, all biotic components of marine ecosystems are given equal importance: bacteria, fungi, macrophytobenthos, zoobenthos, phytoplankton, zooplankton and fish;

- the effects of pollution on the state parameters, physical, chemical, biological processes, and matter and energy flow in the marine ecosystem. Special attention was paid to the study of the pathology of organisms in environmental deadlock and to the possibilities of limiting the negative effects of diseases through actions directed to recovering the affected populations.

The results of these studies and research were materialized in numerous scientific papers published in the journal of the institute „Cercetări marine - Recherches marines”, and other prestigious publications and in researchers' taking part in ecology conferences organized nationally and abroad.

After 1999, when RMRI became, through reorganization, the National Institute for Marine Research and Development „Grigore Antipa” (NIMRD), the laboratory of marine ecology became the department of ecology and environmental protection, including in its composition, in addition to the ecology team, the biochemistry and radio-ecology teams. Consequently, the concerns, essentially the same, have diversified and completed. Thus, the marine ecology concerns included further on:

- The study of the effects of the micro-algal blooms on water and beach quality, through a project funded under the national RELANSIN research programme. Thus, new knowledge was gained related to some parameters with the help of which the interpretation of the complex relationship between biotic and abiotic components of the marine ecosystem could be explained: the state of benthic communities directly affected by algal blooms, the phytoplankton surplus size, the phytoplankton and zooplankton biomass ratio, the biochemical content of marine water, the amount of heterotrophic bacteria and the mutual relationships between their development and the phytoplankton's etc.

- In the field of marine microbiology, after the reorganization of RMRI into NIMRD, complex and interdisciplinary research approaches were developed, regarding the diversity and ecological significance of heterotrophic bacteria in the water and sediments of the Romanian Black Sea sector, under the influence of abiotic and biotic environment. Research was directed towards understanding and quantifying the important environmental factors for marine and coastal ecosystems and biogeochemical cycles. Using classical study techniques, significant data regarding the occurrence, abundance, dynamics and total number of the main bacteria groups (amylolytic, proteolytic and lipolytic bacteria) present in the organic matter flow from the water and

sediments of the Romanian marine sector strongly affected by eutrophication during the past decades, connected to the main environmental factors and global climate changes, were obtained. Beginning with 2001, the first genetic and molecular biology techniques to analyze bacterial populations in the Romanian sector of the North-Western Black Sea shelf have been applied. This was possible through the cooperation with research institutions from Germany (Max Plank Institute for Marine Microbiology) and Netherlands (Royal Institute of Sea Research). Using molecular techniques led to the isolation and identification of some sulphate-reducing bacteria with major environmental implications in anaerobic decomposition of organic matter, generating H₂S and developing hypoxia-anoxic conditions in the North-Western Black Sea (e.g. *Desulfovibrio acrylicus*, *Desulfobacterium autotrophicum*, *Desulfofrigus fragile*). Currently, in order to study the role of prokaryotic microorganisms in carbon and nitrogen cycles from the Romanian marine sector, genetic and molecular methods are used, with the purpose of obtaining high quality results and to overcome the limitations of conventional microbiology techniques.

- One concern, discontinuous for a while within the institute, refers to the assessment of macrophyte communities on the infralittoral rock, to their associated flora and fauna and conservation of key species at the Romanian seaside, which was the subject of a grant financed by CNCSIS. The concern in the study of macrophyte algae was driven by environmental events occurring after 2004, when the excessive development of the phytoplankton began to fall gradually, along with the scale of the development of macrophytes. This phenomenon, repeated annually during summer, is a challenge both for institutions involved in the study of special ecological events, and those with responsibilities in environmental protection. For this reason, our young professionals considered it appropriate to continue studying the macrophytes and the opportunities to exploit the deposits of algae on the beaches, by the means of another project funded by PNCDI 2 (NPRDI 2). The study of macrophytes in recent years has been materialized in an action plan for the protection and conservation of macrophyte communities and their associated flora and fauna, a published booklet "Underwater Vegetation from the Romanian Black Sea Coast" (Fig. 1) and a web page hosted by NIMRD website (Fig. 2), addressing the need for information and awareness about the state of benthic macrophyte communities and their ecological and economic importance.

- The study of marine biodiversity was dictated firstly by the need to meet the obligations under the international conventions in which Romania is a signatory party (the Rio Convention, Ramsar Convention, Bucharest Convention) and, secondly, by the international trend to gather more profound



Fig. 1 - Cover I and II of the information and public awareness brochure on the state of benthic macrophyte communities from the Romanian Black Sea coast



Fig. 2 - Web page of the project
(http://www.rmri.ro/RMRI/macrofite_conservare/Pagina_start.html)

knowledge on marine biodiversity through taxonomic studies using modern research methods, ecosystem functioning studies and others. To meet this need, an inventory of marine biodiversity components has been made, a deeper understanding of marine biodiversity by diversifying the assessment and monitoring methods has been sought, through the continuous ecological study of benthic and plankton communities on the Romanian sea shelf. A valuable support was the opportunity to partly renew research equipment, provided by such biodiversity projects. Thus, we managed to purchase a stereomicroscope provided with a system for image transmission to the computer, very useful to determine benthic and zooplankton species, and a fluorescence microscope, for the study of phytoplankton (Fig. 3). All these studies were materialized in the development of the marine species red list, the preparation of a draft strategy and action plan for the conservation of marine biodiversity, the marine quality indicators list, annual reports on the state of the marine environment and others. Given the threat posed by the intrusion of alien species in the Black Sea, special attention was paid to the study of immigrant species in various ways into the Black Sea, which has created and continues to create a series of imbalances in the structure and functioning of the ecosystems. Based on the results, a methodological guide for ballast waters monitoring and a draft for a guidance booklet of invasive species were developed.

- Presently, our research team is involved as a partner in the implementation of an international project aiming the integration of management based on the ecosystem approach in integrated maritime policies. The further implementation of the Marine Strategy Framework Directive (MSFD) is another concern of our activity in the near future.



Fig. 3 - Modern research equipment for plankton and benthos species identification

- the concerns of the ecology department have diversified with the inclusion of the marine biochemistry team, which, by its interdisciplinary nature and complex issues addressed, has been and continues to be a necessity since the establishment of RMRI. The activity in the marine biochemistry field followed several research directions, after 1990 having a self-determined and ecological vision and, together with other disciplines, having the mission to provide data and arguments to explain the condition and the functioning of the ecosystem. Under these circumstances, coastal brackish or hyper salty lakes of marine origin have been studied (especially Lake Techirghiol). However, the main direction in biochemistry research remains the exploitation of marine living resources, started off back in 1987, pursuit of various concerns, which included the main marine organisms in the Romanian waters. From the time sequence of research and following 2000, significant results with practical applications have been obtained, such as:

- ✓ Developing biotechnological processes to use marine natural resources for medical and industrial purpose (2000-2001) (Fig. 4);
- ✓ The accreditation, in 2003, of the Marine Biochemistry Laboratory from the Laboratory of Measurements and Physical-Chemical Analysis belonging to NIMRD „Grigore Antipa” Constanta, according to SR EN ISO/CEI 17025:2001;
- ✓ Developing biotechnologies for new dermato-cosmetic products based on the peptide-protein complex from marine resources unusable as food (2004-2006);
- ✓ Developing the pilot technology to obtain some medical and pharmaceutical products through biotechnologies applied to marine organisms (2004-2006).

Through the partnership between NIMRD Constanța and Medica LTD Laboratories Bucharest, within RELANSIN and BIOTECH research and development programs, some products of marine origin have been realized: Nazomer, Apimer, Nazomer forte; in these products, bioactive attributes of marine water were enhanced by the addition of various bioactive natural ingredients of different origin. These marine products have positive action on nasal and throat mucosa, being indicated in the prevention and treatment of nasal and mouth disease. Ions of calcium, magnesium and iron have been extracted from marine mollusc shells and fixed as chloride, lactate, levulinate and, together with other bioactive components, embedded in a food supplement called RĂDUCU, useful in the treatment of anaemia, rickets and tetanus related to lack of calcium. Bioactive components from the mussels of Romanian marine waters proved useful in the alimentary supplement Rheumamer, which, by the means of its nutrients, protects the conjunctive tissues, having, in the same time, anti-inflammatory properties. Sanogenetic

properties of marine fouling associated with the *Spirulina* alga in the BIO-MER product led to an adjuvant for physical capacity effort growth, fatigue state improvement and the treatment of hypocalcaemia and hypovitaminosis. This kind of products of marine origin will be expanded by diversifying both the existent and the yet undiscovered resources revaluation. Taking into account the diversity of the topics addressed by the research directions, the activity of the marine biochemistry staff, established in 1987, was materialized in numerous scientific papers published in national and international journals,

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Marea, sursa de sanatate

Adjuvante si suplimente nutritive de origine marina
Oferta Marii Negre si valorificarea acesteia
Apa si organisme marine



Compozitie: Apa de mare filtrata microbiologic, tinctura de propolis, tinctura de echinacee.
Recomandat in: Sangereni, diapa extracti cianide, sifa bucale, saracindaza infecti virale si microbiene orofaringiene, antiseptic, antitoxic, antiag, antiviral



Compozitie: Spirulina, epibioza marina.
Recomandat in: sindrom nevrotic, spasmofiliile rahitism, hipovitaminoze, malnutritie, cresterea performantelor la sportivi



Compozitie: Extract din peste marin.
Recomandat in: boli reumatismale cronice degenerative



Compozitie: Cartilej de rechin.
Recomandat in: Arthroze, retinopatie diabetica, adjuvant in terapia cu citostatice, osteoporoză imuno-depresă, psoriazis



Compozitie: Extract din alge marine.
Are rol: Antioxidant, tonic si vitaminizant previne boala in care sunt implicati radicalii liberi, cresterea performantelor sportive, adjuvant in tratamentul hepatitei cronice si acutei stari de fatigabilitate, carente de calciu si magneziu



Compozitie: extract de midi spacia Mytilus Galoprovincialis.
Recomandat in: Spondiloză, coxartroză, gaurtoză, adjuvant in parodontoză



Compozitie: Aqua de mare filtrata microbiologic, tinctura de echinacee.
Recomandat in: Obstrucții nazale în rinoșinuzite etiologice cauzate de rinită de origine inflamatorie, infecțioasă, alergică



Compozitie: Aqua de mare filtrata microbiologic, tinctura de echinacee.
Recomandat in: lavajul nazal al celor suferind de rinite alergice, rinosinuzite acute si cronice, polipi nazali



Compozitie: Aqua de mare filtrata microbiologic, tinctura de propolis.
Recomandat in: Rinite infectioase alergice, rinosinuzite, polipi nazali, ca lichid de lavaj nazal



Compozitie: Aqua de mar filtrata microbiologic
Recomandat in: Rinite alergice, rinosinuzite polipi nazali

GRUPUL MEDICA este constituit din cinci firme romanesti, cu capital integral privat, ce s-au nascut in urma studierii nevoilor observate pe piata nationala si internationala. Domeniul in care activeaza GRUPUL MEDICA este unul de interes general, promovand difuzarea tratamentelor alternative si suplimentelor nutritionale ieftine, fara efecte secundare si realizate conform celor mai inalte standarde de calitate, contribuind astfel la ridicarea nivelului de sanatate al populatiei, la cresterea sperantei de viata si la imbunatatirea actiunii medicale in Romania.

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Fig. 4 - Products of marine origin obtained in cooperation with MEDICA LTD

communications and practical applications (nutritive supplements of marine origin, presentation manual of marine origin products), some of them awarded at international inventions exhibitions (the shark liver oil received the Bronze Medal in Geneva in 2005). The greatest amount of scientific information resulted from 40 years of marine biochemistry research is contained in the NIMRD journal *Cercetări marine-Recherches marines*. We should also mention the involvement of the marine biochemistry in the Romanian higher education development, through student work and doctoral studies coordination.

- The Romanian radioecology team, created as a follow up of the establishment of the nuclear unit of RMRI in 1977, continued its activity, summarized at the 25th anniversary of the institute in 1995, through the filling in of the database on the radioactivity of the Romanian marine sector as a result of training stages, explorations, national and international research projects, scientific publications. Thus, for example, we can mention the professional trainings organized by IAEA regarding the measurement of radionuclides in environmental samples (Karlsruhe/Germany, 1997), the quality management in environmental applications of the analytical nuclear techniques (Karlsruhe/Germany, 1999) and the assessment techniques of the ecological risk (Monaco, 2009). Also, under the auspices of IAEA, a RMRI specialist participated in two scientific explorations, RADEUX, in the NW Black Sea sector, and Y2K, around the Black Sea, which had in view radioecological research (1998 and 2000, respectively). The main research projects concerning radioactivity measurements in the aquatic environment (marine and the cooling waters of the Cernavoda NPP) were MENER 004/2001 (2001 + 2004) and MENER 466/2004 (2004 + 2007), IAEA/RER/2/003 (1995 = 2000), CIESM/Mussel Watch (2004 – 2005), CH-RO ESTROM, to which the POS CCE, Axis 2, 0.2.2.1 “RDI development by modernizing of the nuclear technical infrastructure for environment and aquatic resource“ (TENUME) is to be added. A special importance had the successful participation in the intercalibration exercises for various radionuclides, e.g. K-40, Cs-134, Cs-137, also carried out under the auspices of IAEA. The present equipment of the nuclear unit will be considerably improved, in the near future, due to the sustained effort within the TENUME project. The results obtained in this field of work were also materialized in scientific publications, including ISI Thompson Reuters rated ones, two books, a dose assessment computational model, environmental studies and reports.

The international collaboration, initiated prior to 1989, continued and gained new dimensions especially after 1992, with the signing by Romania and the Black Sea countries of the Convention on the Protection of the Black Sea against Pollution, known as the Bucharest Convention. Thus, joint

research explorations from the countries in the region were organized in the Black Sea, both for sampling, but especially for the intercalibration of sampling and processing methodologies and for data interpretation. All these derived from the need to jointly report or to publish common scientific papers, giving a more complete picture of the phenomena and processes that occur in the marine ecosystems across the Black Sea.

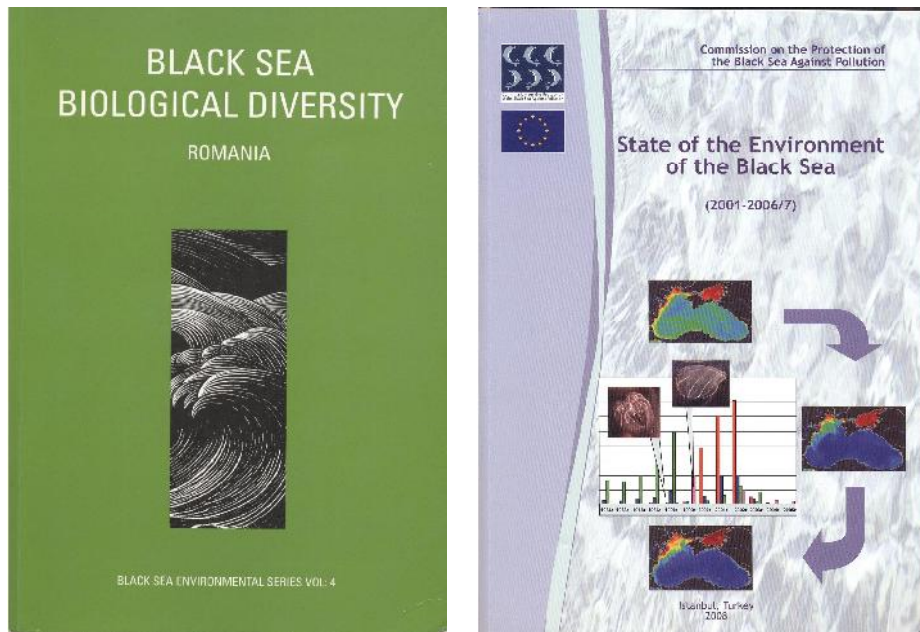


Fig. 5 - Results of regional cooperation within the Bucharest Convention

In the frame of the Bucharest Convention, advisory groups for some important issues have been established, one of them being the Advisory Group for Biodiversity (CBD AG). Beginning with 1992, the national focal point for biodiversity conservation hosted by marine ecology laboratory and, further, after the reorganization of RMRI into NIMRD, by the department of ecology and environmental protection, has carried out a sustained activity useful both for the institute, but especially for the Ministry of Environment. This has contributed to the elaboration of numerous documents necessary to implement the Bucharest Convention, including: the development of the Black Sea Action Plan (1996) and its updating (2009), the Black Sea Red Data Book (1999), the Black Sea Biodiversity and Landscape Conservation Protocol, the Black Sea Biological Diversity (Romanian Report), the Transboundary Diagnostic Analysis Report (2007), the State of the Environment of the Black Sea Report

2000 - 2006/7 (2009) and others (Fig. 5). Also, databases regarding the biotic components of marine ecosystems, supplemented by environmental data, have been prepared.

In addition, data, reports, summaries have been prepared and submitted to the European Environment Agency, both in pre-accession period and after Romania's EU integration.

At this anniversary, the ecology and environmental protection department, in spite of all drawbacks related to project financing, hopes not only to overcome all difficulties, but also to continue working in better conditions and, in addition to its concerns, to diversify its currently extremely undersized staff.