

Historical Development of Marine Sciences in Romania

Alexandru Ș. BOLOGA*, Adrian BAVARU

Academy of Romanian Scientists / Constanța Branch

* E-mail: bologa1813@yahoo.ro

Abstract. Almost a century and a quarter passed since the first Romanian active participation in a major historical oceanographic research cruise, on board *Belgica*, in the Antarctic waters (1897). The following development of marine sciences in Romania is due to several scientists e.g. Emil Racovitza, Ioan Borcea, Grigore Antipa and others, and to their institutional establishments such as the Marine Zoological Station at Agigea-Constanța (1926), the Bio-oceanographic Institute in Constanța (1932), the National Museum of Natural History in Bucharest (1934) a.o. Various other professors, researchers and museographers contributed over time with their valuable achievements and results to the progress of this broad scientific field of investigations. Witness stands also Romania's affiliation to many regional and international scientific organizations and bodies, like the International Commission for the Scientific Exploration of the Mediterranean Sea (since 1925), UNESCO (since 1955), the International Ocean Institute (since 1996) etc. Romanian leading marine research and development institutes, as well as new created marine environment devoted NGOs, added their contributions to a variety of R-D-I programmes and projects at national, regional and international level in the last decades.

Keywords: Marine sciences, the Black Sea, Romania, research and development, quasiquicentennial.

The present Centenary of the Great Union in Alba Iulia in 1918 has to be honored also by evoking the development of marine sciences in maritime Romania. Before and after this event of national greatness and significance, marine research has evolved in research institutions, mainly in Dobrogea along the Romanian Black Sea coast and institutions of higher education in Bucharest, Iassy and Cluj-Napoca, thanks to great personalities. Various scientific achievements and contributions certifies the devolment of marine sciences in Romania.

A documented and illustrated initial booklet was published by Dr. Raoul I. Călinescu on the „*Insula Șerpilor – schiță monografică*” („*The Serpent Island - monographic outline*”), with 8 figures, 7 drawings and one map (Călinescu, 1931): I. Introduction, II. Petrographic structure and geological evolution, III. Climate, IV. Soil, V. Flora, VI. Fauna, VII. The man, VIII. The importance of the island, Summary, Zusammenfassung. It is the single major island in the Black Sea. As explained much later by Dr. Dominuț Pădurean in his comprehensive monograph „*Insula Șerpilor*” („*The Serpent Island*”), this island was lost by Romania, in favour of the USSR, militarily in 1944 and politically in 1948 (Pădurean, 2004).

Another interesting „page of economic history” constitutes the booklet „*Este Marea Neagră săracă în pești?*” („*Is the Black Sea poor in fish?*”), by Dr. economist

Oreste A. Anastasiu, with a Letter of former Minister Nicolae I. Ottescu, the motto „Nutrisco et extinguo”, and three chapters: I. Statement of the problem, II. The ancient age, III. Proposals for the future (Anastasiu, 1940).

A first specialized *Romanian bibliography*, up to the date of publication, attests most of the scientific contributions made in this field (Băcescu, 1965). This work includes the following chapters:

Introduction

Abréviations

I. Ecologie marine, faune benthique (poissons exclus)

II. Poissons et technique de la pêche maritime (la pêche de dauphins et des moules y compris), parasites des poissons, mammifères marins

III. Physiologie et anatomie des animaux marins

IV. Phytoplancton, phytobenthos, macrophytes et microorganismes

V. Zooplancton

VI. Comptes rendus divers, travaux de compilation ou bibliographiques sur la recherche marine

VII. Océanographie générale, physico-chimie, météorologie, géologie sous-marine, etc.

VIII. Lagunes, lacs littoraux (doux, saumâtres, sursalés), faune relicte et phréatique litorale

IX. Bibliographie roumaine concernant d'autres secteurs de la mer Noire que la côte roumaine

Index des auteurs.

Another bibliography, „*Contributions roumaines à l'étude de la mer Noire*”, prefaced by M.C. Băcescu, and containing 4 chapters and an afterword, followed soon (Semenescu, 1964):

1. Caractéristiques physiques de la côte et du fond de la mer Noire le long du littoral Roumain,

2. Études biologiques,

3. La pêche,

4. Le secteur prédeltaïque et les lagunes de la Mer Noire,

Postface.

After the original English-language version of the „*Black Sea Bibliography*” released by the Woods Hole Oceanographic Institution (USA) in 1974, covering the fields of geology, chemistry and biology, another similar extensive publication of more recent date, considering all six Black Sea coastal states, also reflects the Romanian contributions in oceanography between 1974 and 1994 (Mamaev *et al.*, 1995). “*Though this bibliography is not exhaustive, it does represent many of the major lines of research*”. Remarkably, a database for this book is available on diskette.

Another example of representative progress in Romanian marine biology is the *National Report* containing the following chapters (Petranu *et al.*, 1997):

List of tables

Acknowledgements

Introduction

Executive Summary

1. The geographical and socio-economic conditions of the Romanian Black Sea coast.
2. Types and features of coastal habitats
3. Main types of communities of the Romanian Black Sea Area
4. The biological diversity of Lake Sinoe
5. The impact of anthropogenic activities on the structure and productivity of the biota of the Romanian Black Sea
6. Problems related to exotic species
7. The status and management of protected areas
8. Education and public awareness
9. Conclusions
10. Recommendations for the monitoring, protection and restoration of the biodiversity of the Romanian coastal zone

Annex - I

Annex - II

Index

References.

Significant progress has been highlighted during the International Conference dedicated to the 135th anniversary of the prestigious Institute of the Biology of Southern Seas (INBIUM) in Ukraine, at present the Institute of Marine Biological Research „A.O. Kovalevskiy” of the Russian Academy of Science, in Sevastopol, between September 19 and 21, 2006 (Bologa, 2006), as well as in other publications (e.g. Bologa, 2004; Bologa and Charlier, 2011).

Romanian marine research was also stimulated by foreign personalities, within the institutional framework created by them over time, such as HRH Prince Rainier III of Monaco from the International Commission for the Scientific Exploration of the Mediterranean Sea (Monaco), Dr. Selim Morcos from UNESCO, Professor Elisabeth Mann Borgese from the International Ocean Institute (Malta), the Black Sea Commission (Istanbul) and others. The preoccupations continue at the moment through two main specialized institutes, the National Institute for Marine Research and Development “Grigore Antipa” in Constanța and the National Institute for Marine Geology and Geoecology in Bucarest-Constanța. The evolution of the oceanographic research vessels in Romania has been illustrated for the period 1893-1996 (Bologa *et al.*, 1999).

Professor Emil Racovitza

Emil Racovitza (November 15, 1868 - November 17, 1947) was a Romanian biologist, zoologist, speleologist, explorer of Antarctica and the first biologist in the world to study the arctic life. (Wikipedia)

Antarctic expedition with Romanian participation on board Belgica (1897-1899)

Together with G. Antipa, E. Racovitza was one of the most noted promoters of natural sciences in Romania. He was the first Romanian to have gone on a scientific research expedition to the Antarctic, aboard the ship *Belgica* (Fig. 1) (xxx, 1975; Marinescu, 1996, 1998, 2001, 2018; Bologa, 2010), as part of an international team. The expedition was led by the Belgian officer Adrien de Gerlache, who was also the ship's owner. The first mate of the vessel was Roald Amundsen (who was to conquer the South Pole in 1911).



Fig. 1. The *Belgica* anchored at Mount William

On August 16, 1897, under the aegis of the Royal Society of Geography in Brussels, Belgium, the former Norwegian wooden whaler, left the port of Antwerp, setting sail for the South. It was the ship that gave its name to the whole expedition. The three-mast ship was equipped with a 160 horse-power engine. The 19 members of the team were of various nationalities, a rare thing for that time.

Between March 10, 1898 and March 14, 1899, *Belgica* was caught between ice blocks, making it impossible to sail any further, and returned to Europe in 1899. Racovitza's diary, published in 1899, makes mention of the difficulties that the team-members had to endure. Photos of the time show that he was hardly recognisable after returning from the expedition. The results of his research were published in 1900, under the title „*La vie des animaux et des plantes dans l'Antarctique*” (“*The life of animals and plants in Antarctica*”).

A year after his return, Racovitza was appointed director of the Banyuls-sur-Mer resort and editor of the review *Archives de zoologie expérimentale et générale*. He was as well a remarkable professor, scholar and researcher, and full member of the Romanian Academy since 1920. Most of his scientific performances are reviewed in the book „*Emil Racoviță - Opere alese*” („*Emil Racovitza - Selected works*”) edited by C. Motaș *et al.* (xxx, 1964).

Internațional Commission for the Scientific Exploration of the Mediterranean Sea (1919)

Another eloquent example of the recognition accorded to Romanian marine research is the over ninety-year cooperation between Romania and the Mediterranean



Fig. 2. The premises of the International Commission for the Scientific Exploration of the Mediterranean Sea in Monte Carlo (Monaco).

Science Commission (CIESM) (Fig. 2), created by His Serene Highness Prince Albert I of Monaco in 1919 (Bologa, 1993, 2011, 2015, 2016; Bologa and Marinescu, 2002). Romania's official adherence and membership to this oldest, fruitful and long-lived European organization devoted to marine sciences dates back officially to 1925. It is owed primarily to the illustrious personalities of our national biological oceanography, Emil Racovitza and Grigore Antipa, the first and second National Delegate of Romania to CIESM, in 1925 and between 1926 and 1944, respectively; later on to numerous of their disciples and other scientists who supported and illustrated the remarkable level of this long-lasting cooperation. As a result of the contribution to the scientific life of CIESM, the 10th and 20th Congress and General Assembly, as well as the meetings of its Central Bureau, were organised in the capital of Romania, Bucarest, between October 15 and 19, 1935, and again in Bucharest-Constanța, between October 17 and 22, 1966, respectively.

The next National Delegates and simultaneously Vice-Presidents at CIESM and members, or some of them leading management positions, in various of its Scientific Committees were: Traian Săvulescu (1959), Theodor Bușniță (1961), Vasile Chiriac / Mihai C. Băcescu substitute (1966), Mihai C. Băcescu (1967-1993), Alexandru Ș. Bologa (1994-2011) and Tania Zaharia (2012-present).

According to the impetuous development of world oceanology, CIESM continuously diversified its wide range of research and collateral activities; it published its main results in *Rapports et Procès-verbaux des Reunions* (Fig. 3).

Romania continues its long standing membership to the Commission, after the difficulties and impediments suffered during the communist regime. These concerned the few permitted contacts and co-operations, as well as scarce sources of information for some decades. Nowadays considerable Romanian contributions enrich the scientific achievements of CIESM by the presence of specialists and their research within all six contemporary Scientific Committees.

Professor Ioan Borcea

Ioan Borcea (January 30, 1879 - July 30, 1936) was a Romanian zoologist. He received a scholarship to study in France. In 1903, he obtained an undergraduate degree from the natural sciences faculty of the Sorbonne. In 1905, the same institution awarded him a doctorate; his thesis dealt with the genitourinary system of the Elasmobranch. He performed research at the marine biology stations in the French villages of Banyuls-sur-Mer and Roscoff, as well as in Naples. (Wikipedia)

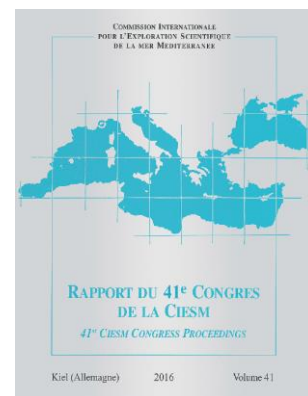


Fig. 3. The traditional publication of CIESM dating back 1926.



Fig. 4. The Marine Zoological Station „Professor Ioan Borcea”, Agigea.

***The Marine Zoological Station
„Professor Ioan Borcea”,
Agigea (1926)***

Professor I. Borcea held a prominent place among the creators of the Romanian oceanography and marine biology. In 1909, he became a member of the National Museum of Natural History in Paris, obtaining a similar position with the American Museum of Natural History in New York City in 1935. Borcea founded at Agigea the Marine Zoological Station (MZS), located on the Black Sea coast near Constanța (Fig. 4), and served as its director for the last decade of his life (xxx, 1975; Bologa *et al.*, 2013). From 1912 to 1936, he directed the Natural History Museum in Iassy. He was an honorary member of the Société zoologique de France, and edited the *V. Adamachi Scientific Magazine*. Already in 1919, he was elected a corresponding member of the Romanian Academy.

This first Romanian marine biological station was supported by King Ferdinand I, by Royal Decree No. 810, dated March 1st, 1926. The Station, which was later given his name, acquired a small research vessel at some point (Fig. 5). Its achievements were recorded in writings kept in the archives of the University „Alexandru I. Cuza” from Iassy, the State Archives / Constanța County Service and the „Ioan N. Roman” County Library Constanța; this establishment constitutes his most important professional achievement besides many other organizational, administrative and research merits (Bologa, 2014).



Fig. 5. The research vessel *Racovitza* of the MZS at Agigea.

The vigorous personality and the prolific career of the founder have marked the development of biological oceanography, ecology and general biology in Romania, as well as a remarkable international scientific co-operation for those times, especially with France and Italy. Many indigenous and foreign scientific personalities have visited the Station, among which Professor George E. Palade, later on Nobel laureate (USA). Borcea published over a hundred scientific

works on theoretical and applied entomology, oceanography, Black Sea fauna and the relicts of the Black and Caspian seas as well as the Lake Razim area, and museology. He introduced the concept of biologically countering agricultural pests in Romania. A volume was dedicated to him at his centenary of birth (xxx, 1979).

After WWII the Station remained under the tutelage of the University „Alexandru I. Cuza” from Iassy, later on part of the Romanian Institute of Marine

Research (RMRI) between 1970 and 1989. Valuable contributions were due to its researchers in various fields of marine biology, known in the country and abroad, such as Professor Sergiu Cărăușu, at the above mentioned university, an ichthyologist, Director of the Station between 1953 and 1960. Other Professors and/or Doctors excelled in various research fields: Maria S. Celan, Hilarius V. Skolka, Adrian Bavaru and Alexandru Ș. Bologa (macrophytobenthos), Nicolae Bodeanu (microphytobenthos and phytoplankton), Marian-Traian Gomoiu, later on full member of the Romanian Academy (zoobenthos), Geza-Iuliu Müller and Victoria Țigănuș, both of them later on successively Deans of the Faculty of Biology of the “Ovidius” University of Constanța (zoobenthos), Dr. Pia-Elena Mihnea (phytoplankton), Drs. Adriana Petranu and Florica Porumb (zooplankton); some of them co-authored the prestigious volumes „*Ecologie marină*” („*Marine Ecology*”), in five volumes (xxx, 1965).

All above mentioned scientists, activated after 1970 inside the RMRI, except Professor A. Bavaru, who became President of the „Ovidius” University Constanța between 1996 and 2004. He dealt in his doctoral thesis with a first presentation of the algal associations along the Romanian Black Sea littoral (Bavaru, 1979). Beside other studies concerning the Romanian marine algaeflora (Bavaru, 1970, 1977, 1980, 1990, 1992) he co-authored a complete list of these marine macrophytes (Bavaru *et al.*, 1991). Dr. A.Ș. Bologa, Scientific Director of the RMRI (1990–2011) and National Delegate to the CIESM (1994–2011), enlarged his research on algal physiology, marine radioecology and history of science; both co-authored, beside other specialists, the first Romanian „*Tratat de algologie*” („*Treatise of Algology*”) (xxx, 1976, 1977, 1979), and are members of the Academy of Romanian Scientists and the International Phycological Society. Among others, the „*Atlasul macrofitelor de la litoralul românesc*” („*The Atlas of Macrophytes from the Romanian littoral*”) was published by younger researchers more recently (Marin and Timofte, 2011).

Professor Grigore Antipa

Grigore Antipa (November 27, 1867 - March 9, 1944) was a Romanian Darwinist naturalist (disciple of his famous professors P. Poni, G. Cobălcescu, A.D. Xenopol and P. Missir), zoologist, ichthyologist, ecologist, oceanologist and professor. He is the scientist who totally renovated and installed in 1906 the National Museum of Natural History, which now bears his name, in its current building in Bucharest (Wikipedia). Full member of the Romanian Academy in 1910.

G. Antipa is another reference person in the study of the Black Sea and not only, a brilliant student of Ernst Haeckel (Popa *et al.*, 2017), the creator and promoter of ecology. He organized the first Romanian scientific expeditions



Fig. 6. The cruiser *Elisabeta* of the Romanian Royal Navy.

in the Black Sea, aboard the RRN cruiser *Elisabeta* in 1883, 1884 and 1884 (Fig 6). They proved particularly valuable through observations and measurements that have been carried out, as well as through the numerous collected samples, for further processing by various specialists.

During his prolific career, Antipa has enjoyed a deep estimation and friendship of the Romanian Kings Carol I and Ferdinand, and of the Prince Albert I of Monaco. His 70th anniversary was marked by the publication of a homage volume including 53 articles belonging to Romanian, French, Italian, German, British and American authors (xxx, 1938).

National Museum of Natural History „Grigore Antipa” (1934)

G. Antipa founded and became afterwards director of the National Museum of Natural History, in Bucharest, in 1934 (Fig. 7), which he led for 51 years, introducing for the first time the concept of <diorama>, artistically carried out, in museology, namely the presentation of the fauna in its natural environment; the way of organization was taken over mainly in North America (xxx, 1975; Zamfirache, 2018).



Fig. 7. The National Museum of Natural History „Grigore Antipa” in Bucharest.

International Commission for the Scientific Exploration of the Mediterranean Sea

The prestigious presence and affirmation of Romania beside Monaco and the other founding states, namely Austria, France, Great Britain, Russia and Spain, is obviously due to the outstanding personality and many-sided activities of Grigore Antipa, even if being not adequately enough pointed out by most of his biographers.

Dr. G. Antipa, Romania's second national delegate to CIESM, was nominated rapporteur for the Black Sea in 1927. As a result, this body has expanded its oceanographic research field by adding the Black Sea basin to the broad scope of its concerns. In 1928 he became a rapporteur for the entire Eastern Mediterranean, the Marmara Sea and the Aegean Sea (Bologa and Marinescu, 2002; Bologa, 2015).

As for example to Antipa's close scientific relationships to France, Professor J. Richard, Director of the Musée Océanographique Monaco dedicated him an article, in „*Grigore Antipa – Hommage à son œuvre*”, on the above mentioned museum (Richard, 1938).

Bio-oceanographic Institute (1932)

The Bio-oceanographic Institute was created by G. Antipa in Constanța in 1932 (Fig. 8); it became later on the Fisheries Research Station (1954). In 1954 it took his name. It belonged to the Romanian Marine Research Institute (now National Institute for Marine Research and Development „Grigore Antipa”) between 1970 and 1989.

As a scholar dedicated mainly to the fish survey, he has successively become the organizer, general manager and general inspector of the State Fisheries.

He is the author of the valuable monograph „*Marea Neagră, vol 1 Oceanografia, bionomia și biologia generală a Mării Negre*” („*The Black Sea, vol. 1 Oceanography, Bionomy and General Biology of the Black Sea*”) (Antipa, 1941), published by the Romanian Academy, in the "Vasile Adamachi" Fund.



Fig. 8 The Bio-oceanographic Institute in Constanța

Marine Biological Station at Caliacra

Kaliakra is a long and narrow headland in the Southern Dobrudja region of the northern Bulgarian Black Sea coast, 12 km east of Kavarna, 60 km northeast of Varna and 65 km southwest of Mangalia (Romania). (Wikipedia) The coast is steep with vertical cliffs reaching 70 m down to the sea. Kaliakra is a nature reserve, where dolphins and cormorants can be observed. It sits on the Via Pontica, a major bird migration route from Africa into Eastern and Northern Europe. Many rare and migrant birds can be seen here in spring and autumn and, like much of this coastline, is home to several rare breeding birds (e.g. pied wheatear and a local race of European shag); the rest of the reserve also hosts unusual breeding birds; saker falcon, lesser grey shrike and is a host to others.

When Caliacra county, together with that of Durostor, was part of Great Romania's south eastern part of Dobrogea called the 'Cadrilater' ('Quadrilateral'), lost to Bulgaria in 1940, G. Antipa founded a Marine Biological Station near Cape Caliacra (Fig. 9). There has not been much testimony left about the work and/or results of this obsolete Romanian scientific establishment.



Fig. 9. The former marine biological station of Caliacra currently in ruins.

Professor Emanoil C. Teodorescu

Emanoil Constantin Teodorescu (May 10, 1866 – April 26, 1949) was a Romanian botanist and plant physiologist, professor, and elected as titular member of the Romanian Academy in 1949. (Wikipedia) In his monograph on the whole Romanian algaeflora „*Matériaux pour la flore algologique de la Roumanie*”, elaborated at the k.k. Naturhistorisches Museum in Vienna, he was the one who mentioned for the first time marine pluricellular algae (Teodorescu, 1907). Thus, he mentions 36 species from the following families: Chlorophyceae (10), Phaeophyceae (8), Rhodophyceae (14), Schizophyceae (3) and Chlamydomonaceae (1). Among them, the 32 macrophytes originated along the Romanian littoral between Portița and Mangalia, as well as from the border of some lakes (mainly Razim and Babadag); along the approximately 120 km long shore, the richest sites in seaweeds, due to the existence of rocky bottoms, were at that time Cape Midia and the harbours Constanța and Mangalia (sic).

Professor George Emil Palade

George Emil Palade (November 19, 1912 - October 8, 2008) was a Romanian-American cell biologist (xxx, 1975). Described as "*the most influential cell biologist ever*", in 1974 he was awarded the Nobel Prize in Physiology and Medicine along with Albert Claude and Christian de Duve. The prize was granted for his innovations in electron microscopy and cell fractionation which together laid the foundations of modern molecular cell biology, the most notable discovery being the ribosomes of the endoplasmic reticulum - which he first described in 1955. (Wikipedia)

Palade also received the U.S. National Medal of Science in Biological Sciences for "pioneering discoveries of a host of fundamental, highly organized structures in living cells" in 1986, and was previously elected a Member of the US National Academy of Science in 1961. He was also elected a Foreign Member of the Royal Society in 1984.

His doctoral thesis „*The urinifer tube of Dolphin. Comparative study of morphology and physiology*”, headed by Professor Francis I. Rainer, dealt with the anatomical structure and physiology adaptation of dolphin kidney, the adaptation from terrestrial to sea life (Sârbu *et al.*, 2018). It remained unknown and outclassed by his research, considering his mile-stones in cell biology. The dolphin kidney, dissected in 1939 by G.E. Palade, exists in the Anatomy Laboratory of the Medical Faculty (Carol Davila University Bucharest); Palade thesis confirmed his and his Professor's ascertainment that dolphins descend from a terrestrial mammal, although further adapted to the sea life having short urinary tubs.

Lecturer Doctor Maria S. Celan

Maria S. Celan (November 20, 1898 - May 26, 1989) was the most important Romanian marine algologist (Bologa, 1989, 2017, in press). She was a contemporary and a disciple of G. Antipa and I. Borcea, who noticed her outstanding intellectual

aptitudes for research ever since her youth. Besides her didactic activity she felt a strong attraction for field and laboratory research work, that will compel her recognition as algologist both at national and European level.

She has completed her professional training at the Botanical Institute and the Museum of Natural History in Vienna. Afterwards she dedicate herself to a prodigious activity in France, at the Faculty of Sciences in Paris (Sorbonne) and at the National Museum of Natural History in Paris; she also paid several visits to the marine biological stations at Dinard, Roscoff and Villefranche sur Mer (France). Later on she was very appreciated by remarkable Soviet marine algologists being cited in different scientific publications (e.g. Zinova, 1967).

The early scientific results allowed the brilliant passing of a French state doctor's degree, with the dissertation „*Recherches cytologiques sur les Algues rouges*” (Celan, 1940/1941), completed with a second thesis same year (Celan, 1940). Professor A. Guilliermond stated: „... elle est certainement l'une des meilleures theses de botanique qui a été soutenue à la Sorbonne ces dernières années.”; he also wrote that the original contribution overtook „de beaucoup le cadre de l'Algologie et même de la botanique”.

Celan identified 157 marine macrophytes in all, out of which many are new for the Romanian shore, some of them are new for the entire Black Sea, and one represents a new species for science, a red alga dedicated to one of her mentors - G. Antipa, namely *Gelidiella antipae* (Celan, 1938; Zinova, 1967).

By her pioneer work in the Romanian marine algology, citology and histochemistry (xxx, 1975), her contributions to the enrichment of the patrimony of global science, Maria Celan belongs to the history of algology.

National Institute for Marine Research and Development „Grigore Antipa”, Constanța (1970)

The National Institute for Marine Research and Development “Grigore Antipa” Constanța (Fig. 10) is mainly involved in basic research and applied technology, crucial for the understanding, protection and management of coastal and marine environment in the economic exclusive zone of Romania at the Black Sea coast. NIMRD is entitled to propose the Ministry of Environment and Climate Changes regulations in the field and represents Romania with respect to marine science with different organizations and expert groups of international conventions. It is the technical operator of the national network of physical, chemical and biological monitoring and coastal erosion surveillance. (Internet).

The main responsibilities of NIMRD at national and international levels, carried aut with its research vessel



Fig. 10. National Institute for Marine Research and Development “Grigore Antipa” Constanța

Steaua de mare 1 (Fig. 11) and other modern equipments, are:

- presidency and secretariat of the Romanian National Oceanography Committee / RNC- UNESCO;
- Permanent Technical Secretariat of the National Coastal Zone Committee;
- coordinator and secretary of the International Secretariat for the South-Eastern Europe of the Balkan Environmental Association;
- coordinator and secretary of the Regional Activity Center for Environmental Aspects, Fisheries and Other Marine Living Resources Management, as well as five other national focal points (the Black Sea Commission);
- scientific representation of Romania in international bodies (UNESCO / COI, CIESM, FAO, CGPM, CECAF, ICES, NATO, GEF/ Black Sea, ACCOBAMS).



Fig. 11. Research vessel "Steaua de Mare 1".

The major activities of NIMRD are:

- oceanographic surveys in the Romanian marine sector and the related EEZ (approximately 60-80 days/year);
- programmes focused on areas of national and international interest (integrated monitoring of marine and coastal environment;
- marine ecosystem conservation and promotion of its sustainable use, protection and sustainable development of marine resources (National Agency of Fisheries and Aquaculture);
- protection and conservation of dolphins in Romanian marine waters - MECC, EC/LIFE NATURE, ACCOBAMS);
- marine radioactivity and radioecology (IAEA, MML Monaco).

It is the only R&D institute in Romania where research on marine aquaculture is conducted, as well as assessing the Total Allowable Catch for the main marine fish species of commercial interest. The Institute also performed, together with the National Agency for Fisheries and Aquaculture, the National Programme for Fisheries Data Collection, under which the fishing quotas are allocated by the EC.

National Institute for Research and Development of Marine Geology and Geoecology - GeoEcoMar, Bucharest - Constanța (1993)

The National Institute for Research and Development of Marine Geology and Geoecology – GeoEcoMar (Fig. 12) was founded in 1993 by Professor Nicolae Panin, geologist, full member of the Romanian Academy. It was initially named Romanian Centre for Marine Geology and Geo-ecology. Its administrative and scientific headquarters is in Bucharest; but the operational center, with the research vessels, mainly *Mare Nigrum* (Fig. 13), and other marine infrastructures, is in Constanța, an important harbor on the Black Sea. (Wikipedia) Professor Panin's successor in Constanța was for a while Dr. geologist Glicherie Caraivan.

GeoEcoMar is involved in European research programmes of hydrological river-delta-sea macro-systems. It has fathomed the study of coastal erosion and its correction and participates in European programmes to monitor potential hazards in the Black Sea. It explores the environmental effects of a dramatic decline due to the sediments collected by the upstream dams. Also, the institute is involved in carbon dioxide capture and storage studies.

Since 1996, GeoEcoMar has been formally authorized to develop impact studies and environmental evaluations in Romania. Since 2006 it has been certified ISO 9001 for research conducted in geology, geophysics and geo-ecology, and by Lloyd's Register Quality Assurance (Romania) in accordance with ISO 9001: 2008 and ISO 9001: 2008. The institute obtained the European status of excellence (Euro-EcoGeoCentre Romania).

GeoEcoMar is, alongside similar institutes from Italy, France, UK, Greece, Spain, Ireland, the Netherlands, Germany and Portugal, a member of the European Multidisciplinary Seafloor and water column Observatory (EMSO), a network of various institutes and companies monitoring the open ocean or shallow waters in order to prevent hazards, tsunamis or earthquake effects. It has initiated the *Évolution du littoral danubien: vulnérabilité et prévention* project which is to collect seismic data from the mouth of the river Danube, to study the morpho-sedimentary structure of the river-sea system.

Universities from Bucharest, Iassy, Cluj-Napoca, Constanța, Galați

Some research on physical, chemical, biological and fishery oceanography has been carried out in certain older or more recent Romanian Universities, such as the University „Constantin I. Parhon” Bucharest, the University „Alexandru I. Cuza” Iassy, the University „Babeș-Bolyai” Cluj-Napoca, the University „Ovidius” Constanța and the University Galați.

Professor Nicolae Botnariuc from the University Bucharest has authored the book „*Din istoria biologiei generale*” („*From the History of General Biology*”), which in the chapter „*Din istoria biologiei generale în România*” (“*From the history of general biology in Romania*”) by S. Ghiță contains references to the founders of the Romanian biological oceanography Ioan Borcea, Grigore Antipa, and Emil Racovitza (Botnariuc, 1961). Professor Constantin S. Antonescu, from the above mentioned university, has published a booklet „*Mamifere din mări și oceane*”



Fig. 12. National Institute for Research and Development of Marine Geology and Geoecology, its premises in Constanța.



Fig. 13. Research vessel *Mare Nigrum*.

(„*Mammals from the seas and oceans*”) (Antonescu, 1966), He has also dedicated in his book „*Biologia apelor*” („*The Biology of Waters*”), the chapters XVI, XVII and XVIII to the brackish waters and their biology, the Black Sea, and the marine waters, respectively (Antonescu, 1967). Professor Emil Vespremeanu, University of Bucharest, published most recently „*The Black Sea – Physical, Environmental and Historical Perspectives*” (Vespremeanu and Golumbeanu, 2018). Commander’s Romeo Boșneagu from the Maritime Hydrographic Directorate (Constanța) is in press.

The connections of illustrious Professors from the University „Alexandru I. Cuza” from Iassy, starting with I. Borcea, such as Gheorghe Mustață, with the development of indigenous marine biological research institutions, has to be acknowledged.

The development of higher education in biological sciences, with some reference to marine biology as well, can be exemplified also with respect to the creation of the Romanian University of Cluj immediately after the Great Union in 1918 (Fabian and Bologna, 2015). The most remarkable investigator from this University, on the physiology of Black Sea animal species, was Academician Eugen A. Pora; one of his valuable publication, in co-authoring with Ioan Oros, is „*Limnologie și oceanologie*” („*Limnology and Oceanology*”) (Pora and Oros, 1974); some of his collaborators have continued and completed his research work.

At the University „Ovidius” Constanța from example, Lecturer Dr. Daciana Sava has published a generously illustrated „*Atlas botanic*” („*Botanical Atlas*”) containing a chapter on algae, with reference to the marine species as well (Sava, 2007).

Academicians Mircea Malița and Mihai C. Băcescu edited in their book „*Viitorul mărilor și oceanelor*” („*The Future of Seas and Oceans*”), in collaboration with Romanian specialists, some major aspects regarding marine related matters in the ‘80ies, in five chapters (Malița and Băcescu, 1980):

- I. Climatology, energetica land mineral resources,
- II. Ocean bioresources (prospects, economy, organization),
- III. Marine environment protection for the benefit of mankind,
- IV. Marine physics and engineering,
- V. International legislation and cooperation.

National Museum of Natural History „Grigore Antipa”, Bucharest

Several museographers from the National Museum of Natural History „Grigore Antipa” have also carried out specific research on the flora and fauna along the Romanian Black Sea coast. Among them stood Professor Mihai C. Băcescu whose scientific work received international recognition, as well as Drs Modest Guțu, Dan Manoleli and Alexandru Marinescu. Nowadays the Museum is considering the strengthening again of its co-operation with the National Institute for Marine Research and Development „Grigore Antipa” in Constanța.

Romanian Non-Governmental Organizations with marine profile

After 1990, numerous NGOs were set up in Romania. Some of them concentrate on environment and environmental protection. They dedicate themselves to observations, monitoring and other activities of public awareness concerning the coastal and marine areas, giving them the possibility to develop and also promote one of the main goals: ensuring the sustainable development of the coastal zone and the responsible use of the marine resources.

Oceanic Club (1992)

Oceanic Club is a Romanian environmental NGO, located in Constanța, aiming to contribute to the protection of the natural and cultural heritage and to improve the scientific research in the field. (Internet). It is a team of biologists, researchers of biodiversity, and nature enthusiasts. The activity began in 1992. The main national programmes are:

- B-Watch: biodiversity assessment and monitoring of Dobrogea zone and continental shelf of the Black Sea in terms of two groups of species: Invasive species and threatened species, preparation and implementation of intervention projects;
- Dolphins in distress!: Research on the three species of dolphins in the Black Sea population status, assessment and development / implementation of the mechanism of restocking;
- E - 2000 environmental education projects and inventory action of pollution sources of the Black Sea environment;
- CeSt XXI: scientific research programme designed to support the development of natural and cultural heritage of Romania by museums, research centres and academic institutions.

Type of partner/expertise sought:

- Removing nets, fishing gear and other marine debris;
- Recycling marine debris.

Type of expertise/competence offered:

- biodiversity surveys and monitoring;
- field research for biodiversity projects.

Mare Nostrum Constanța (1994)

Mare Nostrum is another non governmental organization, located likewise in Constanța, funded in 1994 and comprises of citizens concerned about the severe degradation of the Romanian Coastal Environment, whose mission is to promote the transformation from the current unsustainable practices and attitudes towards more sustainable and environmentally conscious methods regarding the utilization of the Romanian Coastal Zone. (Internet)

It main goals are:

- to develop and diversify the organization's funding sources,
- to increase the awareness and to educate the community,
- to promote and ensure the sustainable development of the coastal zone,

- to assess the state of the environment,
- to contribute to the specific environmental policies,
- to establish partnerships with the community stakeholders.

The departments are:

- Black Sea Information, Education and Resources Centre,
- Environmental education/education for sustainable development,
- Waste management department,
- Biodiversity conservation department,
- Volunteering department.

International Ocean Institute (1972)

The International Ocean Institute (IOI) is an independent, non-governmental, international non-profit organisation incorporated in the Netherlands, with Headquarters at the University of Malta. It was founded in 1972 by Professor Elisabeth Mann Borgese (1918-2002). (Internet). She was offered a doctorate honoris causa by the University „Ovidius” in Constantza, two years before her death (Bologa, 2003).

The mission of the IOI consist of: to promote education, training and research to enhance the peaceful uses of ocean space and its resources, their management and regulation as well as the protection and conservation of the marine environment, guided by the principle of the Common Heritage of Mankind. The IOI's scope and presence is global. The IOI system operates by means of 23 Operational Centres spread worldwide. The IOI co-operates with the United Nations system, e.g. UNESCO-IOC, IMO, UNEP and with several other NGOs at local and regional level.

Pacem in Maribus (PIM) conventions started being organised annually by IOI since 1970. Malta hosted the first five conferences which then started being held in other countries. The importance of the oceans is recognised on a national, regional, international, transnational, and global level where oceans are considered as being the common heritage of mankind, a concept developed by Arvid Pardo. The conferences organised so far focused on international ocean affairs. Topics ranged from arms control and monitoring and surveillance in the oceans, to management and conservation of marine resources, to the feasibility of common shipping lines or on Ocean Development Tax. The results of the research projects, regional seminars and other studies carried out by IOI, are also discussed during *Pacem in Maribus* conferences. The conferences have mainly contributed to the development and formation of the UN convention on the Law of the Sea (UNCLOS).

The Black Sea Operational Centre was created by IOI through a *Memorandum of understanding* with the Black Sea University Foundation created by Academician M. Malița in Bucharest / Constanța, Romania (1993) and dates back to 1996 (Bologa, 2000). The Centre was hosted initially by the National Institute for Marine Reserach and Development „Grigore Antipa”, and transferred to the National Institute for Research and Development of Marine Geology and Geoecology in 2004.

The acceptance and promoting of BSOC by Elisabeth Mann has allowed developing and diversifying certain concerns and achievements of Romanian marine research.

The Black Sea Commission

Acting on the mandate of the Black Sea countries (Bulgaria, Georgia, Romania, Russian Federation, Turkey and Ukraine), which on April 21, 1992 signed and shortly thereafter ratified the Convention on the Protection of the Black Sea Against Pollution, the Commission on the Protection of the Black Sea Against Pollution (the Black Sea Commission) implements the provisions of the Convention and the Black Sea Strategic Action Plan.

Main Challenges

- Combating Pollution from land-based sources and maritime transport,
- Achieving sustainable management of marine living resources,
- Pursuing sustainable human development.

Main Policy Measures

- Pollution reduction from rivers, priority pollution sources, vessels; regulatory and legal tools
- Conservation of biological diversity, expansion of protected territories, promotion of responsible fisheries
- Introduction of ICZM, promotion of EIA environmental audit, ecologically sound technologies, public involvement in environmental decision making, green tourism and sustainable livelihood.

Romania's accession to the Commission has substantially contributed to scientific, operational and regional cooperation in the field of marine sciences; one example is the major contribution of Romania to the Commission's multinational periodical report State of the Environment of the Black Sea (e.g. CPBSAP; 2001-2006/7).

Black Sea related completed International RDI Programmes / Projects with Romanian / NIMRD participation and expertise (Bologa, 1998; Internet)

- Co-operative Marine Science Program for the Black Sea (CoMSBlack) (1991-1995).
- Environmental Management and Protection of the Black Sea, GEF (UNEP, UNDP, World Bank) (1992-1998).
- Ecosystem Modeling as a Management Tool for the Black Sea: A Regional Program of Multi-Institutional Co-operation (NATO TU-Black Sea) (1994-1997).
- Wave climate along Turkish coasts / Black Sea (NATO-TU-Waves) (1994-1998).
- The Investigation between the River Danube and the north-western Black Sea (EROS 2000) (1995-1997).
- Biogeochemical Interactions between the Danube River and the north-western Black Sea (EROS 21) (1997-1998).

- Black Sea Observation and Forecasting System, NATO/CCMS (1998-2000).
 - SESAME** - "Southern European Seas: Assessing and Modelling Ecosystem changes" (2006-2011).
 - GEF BSERP** - The Black Sea Ecosystems Recovery Project (2008).
 - UP-GRADE BS-SCENE* - "Up-grade Black Sea Scientific Network" (2009-2011).
 - NATO SfP Project #982678 - NATO Science for Peace Project "Bio-Optical Characterization of the Black Sea for Remote Sensing Applications" (2009-2012).
 - MSFD Project Harmonization with the Marine Strategy Framework Directive (2009-2012).
 - PEGASO* - "People for Ecosystem Based Governance in Assessing Sustainable Development of Ocean and Coast" (2010-2014).
 - ODEMM - "Options for Delivering Ecosystem-Based Marine Management" (2010-2013).
 - SEAS-ERA - "Towards Integrated Marine Research Strategy and Programmes" (2010-2014).
 - PERSEUS** - "Policy-oriented marine Environmental Research in the Southern European Seas" (2012-2015).
 - CoCoNET** - "Towards COast to COast NETworks of marine protected areas (from the shore to the high and deep sea), coupled with sea-based wind energy potential" (2012-2016).
- * - Projects participated or implemented by the Black Sea Commission (BSC)
** - BSC is either end user or member of Advisory Board of project

References

- Anastasiu O., Ottescu N.I., 1940, *Este Marea Neagră săracă în pește?*, Tipogr. „Ion C. Văcărescu”, București, 86 pp.
- Antipa G., 1941, *Marea Neagră*, Vol. 1, *Oceanografia, bionomia și biologia generală a Mării Negre*, Academia Română, Publ. Fond Adamachi, 10, 55, 313 pp.
- Antonescu C.S., 1966, *Mamifere din mări și oceane*, Ed. Științ., București, 165 pp.
- Antonescu C.S., 1967, *Biologia apelor*, Ed. Did. Ped., București, ed. A II-a rev., 515 pp.
- Băcescu M.C., 1965, *Bibliographie roumaine de la mer Noire*, Commission Nationale de la République Populaire Roumaine pour l'UNESCO, Bucarest, 122 pp.
- Bavaru A., Considerații generale asupra grupărilor vegetale algale din partea de N-V a Mării Negre, *Com. Hidrobiol.*, SSA, 27-35.
- Bavaru A., 1977, Adnotări la lista speciilor de alge din dreptul litoralului românesc al Mării Negre, *Hidrobiologie*, 15, 65-78.
- Bavaru A., 1979, *Fitocenozele algale de la litoralul românesc al Mării Negre (1968-1977)*, Teză de doctorat, Univ. București, 121 pp.

- Bavaru A., 1980, Endemiques et reliques ponto-caspiennes de la flore algale du littoral roumain de La Mer Noire, *J. Étud. System. Biogéogr. Méd.* (CIESM), 93-94.
- Bavaru A., 1990, Le spectre chorologique de la macroflore benthique du littoral roumain de la mer Noire, *Rapp. Comm. Int. mer Médit.*, 32, 1, 3.
- Bavaru A., 1992, Particularités écologiques du development de la vegetation algale macrophyte de la côte Roumaine de la mer Noire, *Rapp. Comm. Int. mer Médit.*, 33, 29.
- Bavaru A., Bologa A.Ş., Skolka V.H., 1991, Revision of benthic marine algae along the Romanian shore of the Black Sea, *Int. J. Biol. & Oceanogr. Oebalia*, 17, 2, 253-551.
- Bologa A.S., 1989, Hommage au Dr. Maria S. Celan, *Cryptogamie, Algol.*, 10, 1, Paris, 1-6.
- Bologa A.S., 1993, Romania and the International Commission for the Scientific Exploration of the Mediterranean Sea, *Noesis*, 129-138, Bucureşti, 129-138.
- Bologa A.S., 1998, Regional research and management developments in the Black Sea, *Cercet. mar. - Rech.mar.*, 31, 7-12.
- Bologa A.S., 2000, The IOI – Black Sea Operational Centre, in IOI – BSOC Leadership Seminar „Using Today’s Scientific Knowledge for the Black Sea Area’s development Tomorrow”, A.S. Bologa & R.H. Charlier (Eds.), *Proceedings*, 11-15.
- Bologa A.S., 2003, In memoriam Elisabeth Mann Borgese (1918-2002), *J. Coastal Res.*, 19, 4, West Palm Beach, Florida, 960.
- Bologa A.S., 2004, Development of marine biological institutions around the sea. in *Ocean Bridging the Millennia – A Spectrum of Historical Accounts*, UNESCO, China Ocean Press, 209-222.
- Bologa A.S., 2006, Review of the historical development of Romanian marine scientific research (1983-present), in *Proceed.Int.Conf. 135th anniversary INBIUM*, Sevastopol, September 19-21, 9.
- Bologa A.S., 2010, Emil Racovitza and the Belgica Antarctic Expedition in “Philatelic panorama of some Belgian Antarctic Marine Contributions, 19th-21st centuries: From Belgica to Princess Elisabeth”, R.H. Charlier, *J. Coastal Res.*, 26, 2, 359-376.
- Bologa A.S., 2011, România și Comisia Internațională pentru Explorarea Științifică a Mării Mediterane (CIESM) – scurt istoric. *Noema*, X, 333-338.
- Bologa A.S., 2014, Date arhivistice privind prima Stațiune de cercetări marine românești de la Agigea, *Noema*, XIII, 265-280 / idem, Archival data on the first Romanian Marine Research Station at Agigea, Constanta county (1926), *Noesis*, XXXVIII-XXXIX, 87-102.
- Bologa A.S., 2015, Cercetarea marină românească și cooperarea cu Comisia Internațională pentru Explorarea Științifică a Mării Mediterane (C.I.E.S.M.), *Rev. Pol. Șt. Scient.*, Serie nouă, 4, 325-328.
- Bologa A.S., 2016, Cercetarea marină românească la peste 100 de ani, în *Profesor universitar dr. Valentin Ciorbea la 70 de ani – O viață în siajul muzei Clio*, V. Coman, L. Stelian, N. (Grigore) Paraschiv (coord.), Ed. Etnologică, 547-552.
- Bologa A.S., 2017, 120 de ani de la nașterea conf. dr. biolog Maria S. Celan – I. Personalialia, *Stud. și com. / DIS*, X, 161-238.
- Bologa A.S., in press, 120 de ani de la nașterea conf. dr. biolog Maria S. Celan – II. Corespondența științifică, *Stud.și com. / DIS*, XI.
- Bologa A.S., Papadopol N.C., Nae I., 1999, Evolution des moyens nautiques de recherche océanologique en Roumanie (1893 - 1996) I. Recherches sur la mer Noire, *Noesis*, XXIV, Bucureşti, 161-172.
- Bologa A.S., Marinescu A., 2002, Romanian developmental contributions of E. Racovitza and G. Antipa to scientific exploration of the Mediterranean Sea, in *Oceanographic History. The Pacific and Beyond*, K.R. Benson & P.F. Rehbock (Eds.), Univ. of Washington Press, USA, 275-279.
- Bologa A.S., Charlier R.H., 2011, Romanian marine centennial. *J. Coastal Res.*, 27, 2, 364-367.

- Bologa A.S., Bologa A.F., Charlier R.H., 2013, Ioan Borcea and the first Romanian Marine Zoological Station at Agigea (1926), in *Places, People, Tools – Oceanography in the Mediterranean and Beyond*, Giannini Ed., Napoli 173-184.
- Botnariuc N., Ghiță S., 1961, *Din istoria biologiei generale*, Ed. Științ., București, 757 pp.
- Călinescu R., 1931, *Insula Șerpilor – schiță monografică*, Inst. Arte Graf. și Ed. “Glasul Bucovinei”, 15777, 63pp, 1 hartă, VII planșe.
- Celan M., 1938, Notes sur la flore algologique du littoral roumain de la mer Noire. IV. Deux Rhodophycées nouvelles pour la flore de la mer Noire: *Gelidiella Antipae* et *Phyllophora Brodiaei* (Turn) J. Ag., *Bull. Sect. Sci. Acad. Roumaine*, 19, 76-79.
- Celan M., 1940/1941, *Recherches cytologiques sur les Algues rouges.*, Thèse pour obtenir le grade Docteur es sciences naturelles, Botanique, Paris, Masson et Cie édit., 168 pp, avec 7 planches hors texte, dont quatre en couleur.
- Celan M., 1940, 2e Thèse: *La coloration vitale* (Proposition donnée par la Faculté).
- Commission on the Protection of the Black Sea Against Pollution, *State of the Environment of the Black Sea (2001-2006/7)*, Istanbul, Turkey, 2008, 448 pp.
- Fabian A.P., Bologa A.S., 2015, Învățământul științelor biologice la Universitatea românească din Cluj după Marea Unire din 1918. *Columna*, 4, 67-110.
- Malița M., Băcescu M.C., (sub coord.), 1980, *Viitorul mărilor și oceanelor*, Ed. Acad. R.S. România, 270 pp.
- Mamaev V.O., Aubrey D.G., Eremeev V.N. (Eds.), 1995, *Black Sea Bibliography, 1974-1994* (Romania - A. Bologa), UN Publ., New York, 364 pp.
- Marin O.A., Timofte F., *Atlasul macrofitelor de la litoralul românesc al Mării Negre*, Ed. Boldăș, Constanța, 169 pp.
- Marinescu A., 1996, Le journal antarctique d'Émile Racovitza, naturaliste de l'expédition "Belgica", *Travaux du Muséum National d'Histoire Naturelle "Grigore Antipa"*, 36, 473-495.
- Marinescu A., 1998, Émile Racovitza. De Banyuls aux glaces antarctiques: son journal, *Annales du Muséum d'Histoire naturelle de Perpignan*, 8: 25-39.
- Marinescu A., 2001, Emil Racovitza, naturalist aboard the Belgica: his unpublished manuscripts, in: *The Belgica Expedition Centennial*. Proceedings of the Belgica Centennial Symposium, 14-16 May 1998, 7 Figs. VVB Brussel University Press, 143-152.
- Marinescu A., 2018, An original document about the history of the Antarctic Expedition „Belgica”, in *Diversity in Coastal Marine Sciences: Historical Perspectives and Contemporary Research of Geology, Physics, Chemistry, Biology, and Remote Sensing*, C.W. Finkl and C. Makowski (Eds.), A Festschrift in honor of Ass. Prof. Dr. Alexandru S. Bologa, Coastal Research Library 23, Springer Int. Publ., 593-597.
- Pădurean D., 2004, *Insula Șerpilor*, Ed. Muntenia, Constanța, 557pp.
- Petranu A. (Comp.), 1977, *Black Sea Biological Diversity – Romanian National Report*, UN Publ., New York, 314 pp.
- Popa O.P., Petrescu A.M., Falcan D., Falcan A., 2017, 150 de ani de la nașterea savantului Grigore Antipa, *Historia*, XVII, 190, Noiembrie, 12-33.
- Pora E.A., Oros I., 1974, *Limnologie și oceanografie*, Ed. Did. Ped., București, 424 pp.
- Richard J., 1938, Le Musée océanographique de Monaco, in *Grigore Antipa – Hommage à son œuvre*, M.O., Imprim. naț., Bucuresti, 453-462.
- Sava D., 2007, *Atlas botanic*, Ed. Steaua nordului, Constanța, 216 pp.
- Sârbu V., Melihov R., Costea D.O., 2018, The Black Sea dolphin nephron studied by Romanian Nobel laureate George Emil Palade, in *Diversity in Coastal Marine Sciences: Historical Perspectives and Contemporary Research of Geology, Physics, Chemistry, Biology, and Remote Sensing*, C.W. Finkl and C. Makowski (Eds.), A Festschrift in honor of Ass. Prof. Dr. Alexandru S. Bologa, Coastal Research Library 23, Springer Int. Publ., 485-493.

- Semenescu M. (Réd. resp.), 1966, *Contributions roumaines à l'étude de la mer Noire*, Comité d'État des Eaux, Bucarest, 112 pp.
- Teodorescu E.C., 1907, Matériaux pour la flore algologique de la Roumanie, *Beihefte Bot. Centralbl.*, 21, 2, 103-219.
- Vespremeanu E., Golumbeanu M., 2018, *The Black Sea – Physical, Environmental and Historical Perspectives*, Springer Geography, IX + 150 pp.
- Zamfirache C., 2018, Ce moșteniri inestimabile a lăsat Grigore Antipa românilor, *Adevărul*, 5-7 ian., 12-16.
- Zinova A.D., 1967, *Opredelitel' zelenykh, burykh i krasnykh vodoroslei iuzhnykh morei SSSR*, Izd. „Nauk”, Moakva – Leningrad, 398 pp.
- xxx, 1938, *Grigore Antipa – Hommage à son œuvre*, M.O. Imprim. Naț., București, 727 pp.
- xxx, 1964, *Emil Racoviță – Opere alese*, C. Motaș și colab. (sub red.), Ed. Acad. R.P.R., București, 810 pp.
- xxx, 1965, *Ecologie marină*, M.C. Băcescu și colab. (sub red.), Ed. Acad. R.P.R., București, vol. I, II, III, IV, V., Ed. Acad. R.P.R., 344, 293, 325, 357, 349 pp.
- xxx, 1975, *Istoria științelor în România – Biologia*, E. Pop și R. Codreanu (sub red.), C.R.I.F.S.T., Ed. Acad. R. S. România, 285 pp.
- xxx, 1976, 1977, 1979, *Tratat de algologie*, Șt. Péterfi și Al. Ionescu (sub red.), vol. I, II, III, Ed. Acad. R S. România, 587 pp, 298 pp, 374 pp.
- xxx, 1979, Centenarul nașterii Profesorului Ion Borcea 1879-1979, Manifestare înscrisă în calendarul aniversărilor UNESCO pe anul 1979, Muzeul de Științele Naturii Bacău, 125 pp.
- Internet, NGO Mare Nostrum
- Internet, NGO Oceanic Club
- Internet, National Institute for Marine Research and Development „Grigore Antipa”, Constanța
- Internet, The Black Sea Commission
- Wikipedia, Grigore Antipa
- Wikipedia, Ioan Borcea
- Wikipedia, George E. Palade
- Wikipedia, Emil Racovitza
- Wikipedia, Emanoil C. Teodorescu
- Wikipedia, National Institute for Research and Development of Marine Geology and Geoecology
- Wikipedia, Kaliakra