

THE NATIONAL INSTITUTE FOR MARINE RESEARCH AND DEVELOPMENT „GRIGORE ANTIPA” CONSTANȚA - HISTORICAL HIGHLIGHTS

Alexandru Ș. BOLOGA¹

¹ Prof., PhD, Full member of Academy of Romanian Scientists (bologa1813@yahoo.ro)

Abstract. *This bilingual monograph has been published by the Publishing House of the Academy of Romanian Scientists, Bucharest, 414 pp, in 2022. The Foreword belongs to Ph.D. biologist Valeria Abaza, Director General of the National Institute for Marine Research and Development “Grigore Antipa” Constanța.*

Content: Introduction, **1.** The Black Sea - About scientific research on the Black Sea, *Brief general characterization, Water balance, currents and vertical distribution, Eutrophication, Fishing, Biodiversity, Invasive species, Political guidelines, Final considerations, Selective bibliographic marks, Some aphorisms*, The main contemporary research institutions around the Black Sea, International organizations that also target the Black Sea and Sea of Azov, **2.** Founders of Romanian marine research - Emil Racovitza, Grigore Antipa, Ioan Borcea, Maria S. Celan, Ileana Cautiș, **3.** Marine research structures along the Romanian littoral prior to the establishment of the National Marine Research Institute at Constanța - „Professor Ioan Borcea” Marine Zoological Station (Agigea), Bio-Oceanographic Institute / „Dr. Grigore Antipa” Fishery Research Station Constanța, Biology sector of „Traian Săvulescu” Institute of Biology (Bucharest-Constanța), Hydro-meteorological Station Sulina, Marine sedimentology laboratory, **4.** The National Institute for Marine Research and Development “Grigore Antipa” - The Romanian Marine Research Institute, Rear Admiral Eng. Constantin Tomescu, Commander Jacques-Yves Cousteau at Constanța, The visit of the delegates of the Romanian Marine Research Institute in the USA, Hopes for new naval equipment, The creation of the National Salvation Front at the Romanian Marine Research Institute from Constanța on December 25, 1989, The National Institute for Marine Research and Development ”Grigore Antipa” and its Semicentennial (2020), **5.** The Romanian research at over 100 years, **6.** Romania and the cooperation with the International Commission for the Scientific Exploration of the Mediterranean Sea, **7.** The Bystroe navigation canal in relation to the Danube Delta Biosphere Reserve and the Black Sea ecosystem, Stories from abroad, References, Selective bibliography in the mass media, Acknowledgements, Index of authors, Index of terms, 5 Annexes.

The volume is illustrated by 89 black / white and colored figures.
It is followed by reviews in Romanian and English.

Keywords: The Black Sea, marine sciences, National Institute for Marine Research and Development “Grigore Antipa”, Romania, Constanța.

DOI <https://doi.org/10.56082/annalsarscibio.2022.2.7>

Motto

*To our illustrious predecessors Emil
Racovitza, Grigore Antipa and Ioan Borcea*

Introduction

Man has always wanted to know, face and enjoy the beauty, challenges and riches of the seas and oceans of the world that obviously seemed endless to him.

The name of the Pontic basin comes from the double name: Pontus Euxinus in antiquity and the Black Sea in modern times, both having a common and analogous source. The ancient peoples knew the Iranian term *akhšaena*, meaning "dark", "gloomy", "black". Sailing in the Black Sea, the Greeks took from the natives the word *akhšaena*, which they took for the insufficiently known sea at first as *Pontos axeinos* (inhospitable sea), an ominous name which they later replaced with *Pontos euxinos* (friendly sea), as the Storm Head will later become the Head of Good Hope. The Romans emphasized the word *pontus*, which characterizes the sea in general. Westerners, who entered this sea after the Mongol conquests, named it *Mare Majus*, *Mar Maggiore* or *Mer Maiour*, the greatest sea, instead of the Black Sea. The name of the Greatest Sea was taken over by Italian sailors from the Jews who prayed to God to protect them in their activities on the Mediterranean. In the cartographic documents, portolans (nautical charts), the Black Sea appears with the same name. It is an extension of the realities of integration in the Mediterranean maritime space of the Black Sea as well, from a commercial and maritime point of view, of course also politically (Abulafia, 2014).

The name was also taken over by the chancellery of the first rulers of Muntenia and Moldavia, as the “great sea” appearing as the extreme limit of the possessions held at the end of the 14th century. Since then it returns to the color connotation. In Greek *mavri thalassa* appeared since 1265 in the treaty with Venice, and *Mare Nigrum* appears from 1338. The present name *Black Sea* (Marea Neagră in Romanian) is identical in all the languages of the six coastal states: Черное море (Russian), Чорне море (Ukrainian), Черно море (Bulgarian), სვო ზღვა (georgian) and Kara Deniz (Turkish), respectively.

Starting with the IXth century BC, the colonization of the Black Sea and the Mediterranean began to take place regularly. In the VIIth century BC in all coastal areas of the known ancient world there were Greek colonies. The expansion of the Mycenaean Greeks to the Black Sea was imposed for both geostrategic and geoeconomic reasons. The first and second half of the second millennium BC meant the flourishing of the Aegean Sea, while the Black Sea was considered a geostrategic part of the former (Boşneagu, 2021). The main Greek colonies on the Romanian coast are Histria, Tomis (Constanța) and Callatis (Mangalia).

In Roman times, the development of navigation and trade on the Danube required the development of the river fleet (Classis Flavia Moesia), the maritime fleet (Classis Flavia Pontica) the emergence of the maritime prefecture in Tomis (Orae Maritime Prefecture), the development shipowners' associations, called colleges (e.g. Colegium Nautarium from Dierna-Orșova), the emergence of naval education (Nauti Universitae Danubi from Axiopolis-Cernavoda) (Boşneagu, 2021).

The position of the Black Sea, a turntable between East and West, at the intersection of civilizations, the importance of coastal states, attracted the attention of researchers in various fields to constantly focus on this sea, planning multidisciplinary and multiannual scientific research activities, with the participation of representatives of countries and institutions located at great distances from the Black Sea and whose interest in this area was low in the recent past (Boşneagu, 2021), (Fig. 1).



Fig. 1 Relations of scientific cooperation in the Black Sea at present
(cf. Boşneagu, 2021)

There are very valuable bibliographical references about the *history and geopolitics* of the Black Sea and with express references to the related Romanian space (e.g. Brătianu, 1988; Marin, 2005; Cristea and Papacostea, 2006; Papacostea and Ciocâltan, 2007; Fati, 2016). For example, Gheorghe I. Brătianu highlights the presence of Phoenician and Greek navigators on the shores of the Black Sea, Greek colonies and their trade, Milesian hegemony in the context of

Athenian supremacy, the stages of Roman conquest with the Pontic voyage, Byzantium in the Black Sea basin, the appearance of the Slavs on the Black Sea coast and the Danube, the Byzantine epos, the commercial expansion of Italian maritime cities in the Middle Ages, the Black Sea temporarily closed to Western trade, the expansion of Genoa in the Black Sea, the Black Sea, the stake of the Straits, the internal crisis of the Ottoman Empire and the balance of Christian powers around the Black Sea, the Turks' efforts for control over the Straits, the Genoese colonies in Crimea, the Ottoman monopoly in the Black Sea (Brătianu, 1988).

More recently, *The Black Sea*, by British journalist Neal Ascherson, appeared on this area, which is so interesting from a naturalistic, ethnic, geopolitical, cultural and religious point of view (Ascherson, 1995). With prompt laudatory reviews of the author in hard-to-ignore dailies such as "Financial Times", "New Statesman and Society", "The Spectator" and "The Sunday Telegraph". But the anticipated joy of reading a new bibliographic reference dedicated to this sea, accentuated by its provision to the general public through the language of the widest current circulation at the moment, has failed in disappointment, dissatisfaction and irritation, due to omissions and errors that, at least as a Romanian, you cannot attribute only to lack of information, professional improbity or chance. A work that, according to the title, should circumscribe the geographical area of the entire basin of this sea, practically ignores Romania and Bulgaria (dedicating instead, among others, a consistent chapter, to Poland (sic), due to the time spent by the poet A. Mickiewicz in Crimea, for the treatment of tuberculosis). Against such an omission, the placement of the port of Burgas in Romania bothers only superficially. But the contrariety pales, for example, toward the enumeration of the main religions spread around the Black Sea during the Ottoman Empire: "Orthodox, Christians, Armenians, Jews" (aren't Orthodox and Armenians (the first ones!) Christians?). Or, what can be concluded about the level of documentation, objectivity or good faith of the author when reading the seemingly ingenuous statement: "... when Hungary lost Transylvania in favor of Romania" (sic) !!! What is the use of the spread of this flagrant historical untruth, contradicted even by official Austro-Hungarian documents, quoted in foreign reference historiographical works (e.g. Lehrer, 1989).

N. Ascherson could have completed his selective and subjective bibliography at least with the works of G. Brătianu and M. Lehrer quoted above. The book reveals amateurism, precariousness and lack of *fair play*, to refer to the author's ambiance. The errors were, moreover, explicitly and vehemently claimed by some high-circulation dailies in Istanbul, as a result of the ridiculous "performance" relating to Turkey. It should be added that the attempt of the signatory of these considerations to find answers to his own perplexities, during a face-to-face meeting with the author, aboard the ship *Venizelos* on the occasion of the

International Conference "Religion, Science, Environment: Black Sea in Crisis", September 20-28, 1997, failed due to its skillful avoidance by N.A. (Bologa, 1997, 1998). *Ab imo pectore*.

The five stages of the successive mastery of the Pontic basin were evoked chronologically, by Charles King, holder of the Romanian studies department at Georgetown University, in his exhaustive study, based on his travel and bibliographic experience on the historical evolution of the Black Sea region and its hinterlands: the ancient Greco-Roman Pontus Euxinus – 700 BC - 500 AD, Italian Mare Maggiore – 500-1500, Turkish Kara Deniz – 1500-1700, Russian Chornomore – 1700-1860 and modern Black Sea – 1860-1990 (King, 2004a, b). Unfortunately, this bibliographic contribution also shows errors, despite the much more in-depth documentation of the subject, including the exhaustive Romanian bibliography, thanks to the very good knowledge of the Romanian language by the author. For example, the exaggerated negative considerations of Dobrogea as "a fertile ground for both robbers and various separatist movements" and "stagnant economies, whose services remain inadequate" - without specifying the reference period, an area that on the contrary has made considerable progress in recent decades and which is an European example of multiethnic understanding (Bologa, 2018); or, worse, the clear statement ... „Romania was assigned, through the treaties signed after the war, the former Hungarian province (sic!) Transylvania, the former Russian province Bessarabia (sic!), the former Austrian province of Bucovina (sic!) and a part of Bulgarian Dobrogea” (sic!), hilarious if not sad, incorrect and frustrating appreciation that could easily induce an objective but insufficiently informed reader the perception of conjunctural, unjustified acquisition of these provinces, although Romanian, as possessions or gifts, contrary to historical and statistical records (Lehrer, 1989); finally, regarding the statement “The Romanian coast was full of refineries, ...”, in fact there was and is only one such significant industrial objective, Petromidia, at Cap Midia, still partially in operation.

Currently, the maritime area of Romania has approximately 20,000 km² (https://ro.wikipedia.org/wiki/Marea_Neagra_spatiul_maritim_al_României) consisting of (Fig. 2):

- inland waters – 753 km²,
- territorial sea – 4,487 km²,
- contiguous area – 4,460 km², and
- exclusive economic zone – 10,300 km².



Fig. 2 The maritime space of Romania
(in blue, the territorial waters and the exclusive economic zone of Romania in the
Black Sea)
(Source: https://ro.wikipedia.org/wiki/Marea_Neagră_spațiul_maritim_al_României)

The Serpent Island (Călinescu, 1931; Pădureanu, 2004a) is an island in the Black Sea, 45 km from the shores of Romania and Ukraine, near Musura Bay (Fig. 3).



Fig. 3 The Serpent Island in the Black Sea
(Source: https://www.dw.com/ro/Insula_Serpilor-decizie-favorabila-României)

The Paris Peace Treaty between Romania and the Allied and Associated Powers of 1947 left Serpent Island to Romania, but it was illegally transferred by the USSR after the end of World War II and annexed during 1948. It is currently part of the Ismail district of the Odessa region of Ukraine. With an area of only 17 ha, Serpent Island is not very important from a territorial point of view, instead it is important from a strategic-military and economic point of view. The International Court of Justice in The Hague ruled in 2009 that Romania has 9,700 km² of the continental shelf near the island, although the territorial claims of both states in disagreement (Romania and Ukraine) were significantly higher (Manea, 2004). It is noted to be the first and only extension of sovereign jurisdiction and sovereign rights of Romania after the Great Union of 1918 (https://ro.wikipedia.org/wiki/Insula_Șerpilor-decizie-favorabila-României).

THE BLACK SEA SEA

In the most succinct and inspired definition, the Russian oceanographer Nikolai M. Knipovich considered the Black Sea (Fig. 4) an *unicum hydrobiologicum* (Knipovich, 1933).



Fig. 4 The Black Sea

(Source: <https://ro.wikipedia.org/wiki/Marea-Neagra>)

A map of the Black Sea from 1590 shows *Pontus euxinus*, *Aequor Iafonis pulfatum remige primum*, with the explanation PONTUS EUXINUS, Sed, Dictus ab antiquis Axenus ille fuit, slightly elongated from east to west, highlighting the Danube, with several arms at sea, the Dniester and other tributaries (Fig. 5).



Fig. 5 A map of the Black Sea from 1590
(Collection Alexandru Ș. Bologa)

Another map entitled *Tabula Geographica qua pars Russiae Magnae Pontus Euxinus seu Mare Nigrum et Tartaria Minor cum finitimis Bulgariae, Romaniae et Natoliae* from 1731, shows **PONTUS EUXINUS hodie MARE NIGRUM**, in which *Romania* appears located in the south of Bulgaria (Fig. 6).

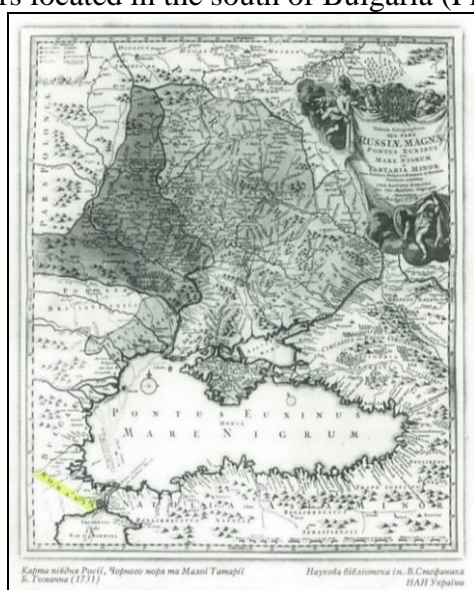


Fig. 6 Map of the Black Sea from 1731
(Collection Alexandru Ș. Bologa)

The Romanian naval Commander Alexandru Cătuneanu coordinated all the measurements that led to the first map of the Romanian Black Sea coast (Fig. 7), being awarded the gold medal at the Universal Exhibition in Paris, in 1900. The hydrographic document had been printed at the specialized French Ministry of the Navy and was then engraved on a copper plate by a well-known French engraver, Ettiene Delaune. In June 1904, 1,000 printed copies arrived in Romania, accompanied by the engraved plaque. This map achieved in the XIXth century, was used to navigate until 1952 (Ionescu, 2016).

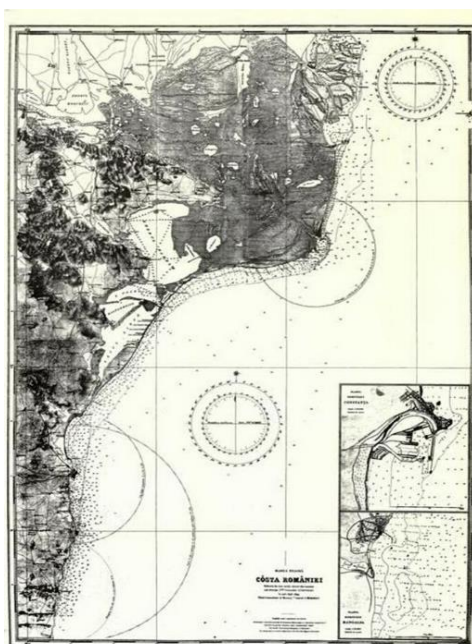


Fig. 7 The Alexandru Cătuneanu map from 1927
(Source: Direcția Hidrografică Maritimă Constanța)

Anthropogenic activities with severe impact have been added to the physical, chemical and biological peculiarities of this marine area, over which originate in a river basin over five times larger than the surface of the sea itself; the territories of the Danube and coastal states that make up this area include a population of over 165 million people in 17 countries (81 million in the Danube basin alone).

Therefore, the Black Sea has been exposed to considerable natural and environmental fluctuations and more recently, in the last decades of the XXth century, to a pronounced anthropogenic stress, with severe impact; it is mainly caused by the following activities:

- transport (Danube, Danube - Black Sea canal, Black Sea, Bystroe navigation canal, river and sea ports, free zones);

- agriculture (natural and chemical fertilizers, herbicides, pesticides / insecticides),
- industry (cement, superphosphates, petrochemicals, nuclear energy, etc.),
- fishing (and overfishing),
- tourism (leisure, water sports, medical treatment).

As a result, the Black Sea has evolved ecologically in recent decades from an initially diversified ecosystem that supported highly productive fishing, in a pronounced eutrophic environment, dominated by the ctenophore *Mnemiopsis leydi*, with limiting living conditions for many plants and animals.

That is why the most serious contemporary issues led the experts of the Global Environment Facility (GEF) to consider the Black Sea in 1982 as "the most seriously degraded sea on the planet."

However, mainly as a result of the reduction in the intensive use of fertilizers in agriculture and various environmental protection measures in riparian countries and coastal states, as well as other welcome interventions (e.g. revision of fishing regulations and quotas, creation of protected areas and other initiatives) there is currently some improvement in the ecological status of the Black Sea and its water quality (expressed, for example, by the considerable reduction in algal blooms, both in intensity and frequency, after 1990).

Therefore, according to contemporary experts, "the state of the Black Sea environment continues to be worrying, due to the continuous degradation of its ecosystem and the inadequate use of its natural resources" (Strategic Action Plan, 1996); actually, „the state of the the Black Sea environment continues to be a matter of concern due to the ongoing degradation of its ecosystem and the unsuitable use of its natural resources” (Strategic Action Plan, 1996).

The Black Sea ecosystem, especially its northwestern sector, continues to face severe environmental damage consisting mainly of coastal erosion, eutrophication, and long-term ecological changes, including the decline of biological diversity and living resources (Bologa *et al.*, 1995).

However, mainly as a result of the reduction in the intensive use of fertilizers in agriculture and various environmental protection measures in riparian and coastal countries, as well as other welcome interventions (e.g. revision of fishing regulations and quotas, creation of protected areas and other initiatives) there is currently some improvement in the ecological status of the Black Sea and its water quality (expressed, for example, by the considerable reduction in algal blooms, both in intensity and frequency, after 1990).

The Romanian Black Sea coast (Fig. 8) stretches for 245 km¹ from the natural border with Ukraine (the Chilia arm of the Danube) to the north, to the border with

¹ Compared to the approximately double total of 455 km, during Great Romania, with the coast afferent to Bessarabia - Cetatea Albă and Izmail counties from the Dniester estuary to the Chilia

Bulgaria to the south. The northern part, 165 km long, is an alluvial formation of low sandy beaches, supported by sand dunes and the Danube Delta. After Cape Midia the shore becomes rocky with cliffs descending steeply to the sea. The coastal area extends inland to the eastern bank of the Danube and is administered by the counties of Tulcea in the north and Constanța in the south.



Fig. 8 Map of Great Romania including the entire sea coast
(Source: Șiaicariu and Constantinescu, 1920)

As is the case of most coastal areas, the Romanian one is also an area with many competing human activities and economic interests (World Bank, 1992).

The Black Sea has been and is still being approached from the point of view of its oceanographic investigation.

The scientific investigation of the Black Sea

General characterization

The Black Sea general physical and chemical characteristics consists of the following:

- a large continental shelf of 144,000 km² (25%),
- high freshwater input with increased levels of nutrients and photoabsorbent detritus (e.g. 400 km³/year, 70 % on the north-western shelf, due to the Danube, Dnieper, Dniester, Bug, and Kuban rivers),

arm (currently Ukraine) of about 100 km and Caliacra county (currently Bulgaria) about 110 km (Fig. 8).

- the existence of cyclonic current systems (i.e., defining or characterizing the eastern and western halistatic zones having more stable salinity depths),
- a weak horizontal water mass exchange with the Mediterranean through the Bosphorus strait (about 100 m deep),
- a marked increase in water density with depth between 0-200 m, (i.e., practically no vertical mixing between the deep and shallow layer),
- the highest anoxic volume (90%) due to the highest H₂S content in the entire World Ocean,
- large spatial and temporal variabilities of physical and chemical properties (e.g., especially in the northwest corner),
- separation of the water column in an upper oxygenated, biotic layer and a deeper anoxic, abiotic one containing hydrogen sulphide (H₂S), separated at a depth of about 150-200 m,
- salinities about half of those known in the World Ocean from 18 to 19‰ at 2,000 m depth,
- high levels of nutrients (nitrogen and phosphates) and photoabsorbent detritus,
- a pronounced degree of eutrophication,
- slightly different ionic ratios of seawater from the rest of the marine and oceanic areas (e.g. more calcium (Ca²⁺), manganese (Mg²⁺), bicarbonate (HCO³⁻) and sulphate (SO²⁻)).

Water balance, currents, and vertical distribution

The major components of the water balance are river discharge, precipitation and vaporation, and water exchange via the Bosphorus and the Kerch Straits. The volume of water flowing into the Black Sea through the Bosphorus has been estimated as being between 123 km³/year (Șerpoianu, 1973) and 312 km³/year (Ünlüata *et al.*, 1990). Estimates for the Bosphorus outflow range from 227 km³/year (Reshetnikov, 1992) to 612 km³/year (Ünlüata *et al.*, 1990).

The geostrophic circulation, defined as currents formed due to balance between the Coriolis force and pressure force in the surface layer of the basin, is presented by the main Black Sea stream (MBS). In the east, central and west regions, the MBS generates extensive cyclone gyres and a multitude of smaller cyclone and anticyclone gyres. At the external part of the MBS, a ring of anticyclonic gyres is formed due to its interaction with the continental slope, which generates a quasi homogenous convergence zone (FAO, 1996).

Despite the existence of a permanent strong pycnocline, with an average varying between 150-200 m depending on the cyclonic and anticyclonic regions, studies show that the water column has intensive vertical dynamics, especially in winter; the strong north and northeast winds elevate the main cyclonic gyre domes (20-30 m from the surface in some areas), which breaks apart the pycnocline and leads to increased convective mixing (FAO, 1996).

Eutrophication

The Black Sea receives a large volume of freshwater containing considerable amounts of inorganic nutrients. Owing to a strong thermohaline stratification and a to long residence time of water mass, the Black Sea ecosystem is highly sensitive to increased production of organic matter (Bologa *et al.*, 1998). The last 30 to 40 years represent a period of intensification of the anthropogenic pressure on the coastal environment and high eutrophication, with negative effects on the whole ecosystem.

Important nutrient and organic input from rivers and industrial and domestic drainage resulted in the increase of the magnitude and frequency of algal blooms, and a pronounced decrease of biodiversity.

The main considerations for which experts consider the Black Sea so endangered can be summarized as follows:

- progressive degradation of the coastal environment by coastal *erosion*¹,
- continuous degradation of *seawater quality* due to increasing *eutrophication* (e.g. Danube: 340,000 t total inorganic nitrogen / year and 60,000 t total phosphorus / year which means 2.5 and 3.8 times more, respectively, compared to 1970-1990; for the Romanian coastal area 4 to 8 times more nitrogen and 13 to 21 times more phosphorus, compared to 1960-1970) (data from 2000);
- extension of *hypoxia and/or anoxia*;
- possible increasing *hydrogen sulphide* (H₂S) concentrations in the eutrophic layers;
- continuous accumulation of atmospheric and land-based *pollutants* (e.g., heavy metals, radionuclides, oil, herbicides, pesticides, and detergents);
- decreasing capacity of coastal areas *for self-purification* from chemical and microbiological contaminants; and
- the rapid extinction of some species, the dramatic decline in *biodiversity* and the drastic reduction of exploitable living marine resources.

Black Sea fisheries

Overfishing is the main culprit for the growing shortage of fish in the seas and oceans. In Europe, the picture is considered very bleak: almost nine out of ten commercial stocks in the Northeast Atlantic, the Baltic Sea and the Mediterranean

¹ Along the Romanian coast, extensive works are being carried out to widen the beaches, reduced in area as a result of the effects of the phenomenon of coastal erosion in recent decades, by specialized Dutch companies.

Sea are overfished. About a third of these stocks are overfished so much that the stock risks losing its ability to reproduce.

In the last decade alone, total landings in the European Union have fallen by a third, and aquaculture in Europe has not been able to compensate for this. Global fish consumption per person has more than doubled since 1973, with Europeans consuming an average of 21 kg of fishery products per year, slightly above the global average of 17 kg, but below the consumption level of about 25 kg, recorded in USA, China and Canada. There is a wide variation within the EU, from 4 kg per person in Romania to 57 kg in Portugal.

In the Black Sea, anchovy stocks declined in the late 1980s due to higher water temperatures due to climate change, nutrient enrichment (eutrophication) caused mainly by the Danube, the invasion of *Mnemiopsis leidyi* (jellyfish from Northeast Atlantic) and overfishing.

As already emphasized, during the last decades the Black Sea ecosystem has been subjected to dramatic changes due to increased pollution of the basin and to overexploitation of some commercial fish species. The abundance of the most commercial carnivores, bonito (*Sarda sarda*), bluefish (*Pomatomis saltator*), and mackrel (*Scomber scombrus*) has sharply decreased (FAO, 1996). The last species have been almost extinct in the Black Sea since 1968. This has been the period of rapid intensification of fishing, particularly of sprat (*Sprattus sprattus phalericus*), horse mackrel (*Trachurus mediterraneus ponticus*), and anchovy (*Engraulis enchrassicholus ponticus*), whose catches have been extended from 3.1, 4.9 and 128.3 thousand tons in 1970 up to 105.2 (1989), 147.7 (1985), 485.5 (1984) thousand tons, respectively (FAO, 1996). Specialists claim that the rapid decline of anchovy stocks could be related both to the deteriorated environmental conditions and the overexploitation during some years. In the early '80s, the ctenophore *Mnemiopsis leidyi* invaded the Black Sea with a biomass resulting in a several fold reduction of the fodder (nutritive) zooplankton biomass, copepods in particular. Taking into account that *M. leidyi* is feeding on eggs and larvae of spawning fish, it is reasonable to assert that the sharp reduction in sprat, anchovy, and horse mackrel could be mainly related to the complex impact of the earlier mentioned factors: pollution / eutrophication, structural alteration in the ecosystem, and intensification of fishing. The intensification of the fishery after 1976, particularly the late forbiddance of bottom trawl-hauls which ruined the benthic biocenosis and spoiled the connections between bottom and pelagic waters, influenced negatively the state of the Black Sea ecosystem (FAO, 1996).

Many fish species in the Black Sea undertake seasonal migrations for nourishing, wintering and reproduction. The pollution of the sea and the overfishing, mainly by the former USSR and Turkey, led to a severe reduction of concentration and biomass of the corresponding species.

The Black Sea is inhabited by 168 fish species, of which 144 are typically marine and 24 are diadromous or partially anadromous. The marine species fished intensively are sturgeons, shad, anchovy, sprat, horse mackerel, whiting, gobies, turbot, spiny dogfish, Mugilidae, bonito, bluefish, and mackerel. Up to 1970, bonito, bluefish, and mackerel were economically important. Since 1968 these species have not been found in the Black Sea, but still exist in the Bosphorus region (FAO, 1996).

After 1979, fish catches in the Black Sea sharply increased, reaching 795.5 thousand tons in 1988, dropping sharply again to 216.5 thousand tons in 1991. In 1992, catches increased slightly. The decreasing catch after 1988 is mainly due to summer spawning of anchovy and horse mackerel in connection with the mass development of *M. leidy*, whose biomass was very high in 1989 (FAO, 1994). The sudden decrease in anchovy and horse mackerel landings since 1988 has been reported in the fisheries of all Black Sea coastal states (Kideys, 1994).

Biodiversity

The poorer flora and fauna of the Black Sea was compensated in the past by their pronounced biological productivity. Relatively few alien species previously entered this particular environment. By the end of the fifth decade of the twentieth century, the Black Sea ecosystem underwent major changes in benthos, plankton and living resources in general, which led to a severe ecological disequilibrium with medium and long term effects.

Black Sea biodiversity studies have shown that since 1950-1960 there have been significant changes in the ecosystem as a whole regarding populations, species composition and biocenoses (Zaitsev and Mamaev, 1997). These changes put an end to centuries of relatively stable ecological balances and marked the beginning of a new era in Black Sea biodiversity, affecting plants, animals, benthic and pelagic inhabitants, mass and rare species, and commercially exploited organisms.

The different taxa in the Black Sea have not been studied to the same extent in each of the coastal states (Zaitsev and Mamaev, 1997). However, the reliable data that exist are already sufficient for scientists to draw conclusions about the present state of the Black Sea biota, including the main reasons for the changes that have occurred, the regions of the sea that have been subject to varying degrees of anthropogenic transformation, endangered species, populations and communities, and major gaps in the knowledge of biological diversity. The major biological long-term changes during the last decades could be summarized as follows (Bologa, 1992; Bologa *et al.*, 1995):

- dramatic changes in the structure and functioning of coastal (benthic) and pelagic (offshore) ecosystems,

- changes in both the quantitative and qualitative status of phyto- and zooplankton communities,
- intensification of phyto- and zooplankton blooms, with an encouraging downward trend after 1990,
- massive reduction of both plant and animal biomass,
- the steady decline of biodiversity and living resources (starting from a less varied flora and fauna compared to the Mediterranean Sea),
- frequent simplification of food chains (often eliminating species of economic value to man),
- occasional mortality of organisms up to 100-200 t / km² / year off the coast of Ukraine and Romania (e.g. edible fish and molluscs),
- decrease of bioproductivity (e.g. benthos, sturgeons, flatfish).

The obvious decrease of the ecological health of the Black Sea induced profound alterations, especially in the structure of littoral ecosystems and generated a major decrease of biodiversity.

A *Black Sea Red Data Book*, created by the Black Sea Environmental Programme (BSEP) with contributions from research institutes from Varna / Bulgaria, Constanța / Romania, Istanbul / Turkey and Odessa, Simferopol and Melitopol / Ukraine, is available on the Internet (<http://www.grid.unep.ch/bsein/redbook/index.htm>): index for all species (n = 160), Plantae (n = 43), Spongia (n = 1), Coelenterata (n = 1), Polychaeta (n = 2), Insecta (n = 4), Halacaridae (n = 1), Crustacea (n = 29), Mollusca (n = 5), Echinodermata (n = 1), Acrania (n = 1), Pisces (n = 41), Aves (n = 25), Mammalia (n = 6).

The seriously threatened biodiversity reflects an accentuated impoverishment, and some invasive species, easily adaptable to the particular environment of the Black Sea, have constituted an obvious danger regarding some local living resources.

Invasive species

The Convention on Biological Diversity defines an allogeneic species as „a species, subspecies or lower taxon, introduced outside its natural spread in the past or present, including any part, gametes, seeds, eggs or means of spreading these species, which may survive and can reproduce later”, while an invasive alien species is „an allogeneic species whose introduction and/or spread threatens biological diversity”.

According to the Romanian Ministry of Environment / National Agency for Environmental Protection, the main natural transport routes of invasive species are alluvial areas, and among the anthropogenic roads and railways; for the marine environment, a preferred way for the spread of invasive species, including in the Black Sea, is to discharge ballast water from seagoing vessels.

In Romania the current situation was characterized by:

- a low level of public awareness and consequently an opposition from society civil interventions to government interventions;
- an extremely low degree of accessibility of scientific information, especially in connection with species identification, risk analysis, etc.;
- the absence of a priority approach to actions on the control of invasive species;
- the unhindered introduction of invasive species - often by mail - as measures of inadequate inspection and quarantine;
- inadequate monitoring capacity;
- lack of effective emergency measures;
- outdated or inadequate legislation;
- poor coordination between government agencies, local authorities and local communities.

These species are causing significant damage to ecosystems, plant and animal species and humans, and are expected to worsen in the future due to climate change, growing international trade and tourism.

The most common examples of invasive species that have significantly contributed to the deterioration of the ecological balance in the Pontic basin in recent decades are the ctenophore *Mnemiopsis leidyi* and the gastropod *Rapana venosa*, species originating from the coastal waters of the western Atlantic Ocean and the Sea of Japan, respectively.

Policy guidelines

“Most of the Black Sea is a commons shared but not owned, and when it comes to managing the commons it is always easier to blame someone and expect ‘them’ to solve the problem.” (Mee, 1994). Thus, the present environmental issues of the Black Sea are obviously extremely complex, and how to deal with these problems is, of course, very difficult. Strong efforts and some recent achievements have been accomplished in this respect at national, regional and international levels. All coastal states devote constant interest to marine research and development activities through their specialized oceanological institutions, universities, and foundations mainly by performing national marine research projects and programmes.

Regional research and management programmes have been successfully carried out since 1990 (and exemplified here until 2010). These programmes included CoMSBlack, NATO TU-Black Sea, NATO/CCMS, NATO TU-Waves, EEC/EROS 20/21, IAEA/RER 1/2/ 003, EEC/QUALIPOL, Black Sea Mussel Watch Pilot Study, GEF Black Sea Environmental Programme (BSEP), several PHARE programmes (Bologa, 1999). New infrastructure such as the IOC Black Sea Regional Centre and the IOI Black Sea Operational Centre have promoted other initiatives; for example, Pilot Project 1 „Black Sea GOOS”, Pilot Project 2

„Black Sea Sediment Fluxes” and a Black Sea devoted leadership seminar (Mamaia, Romania, September 1999), respectively.

Several international agreements, conventions, and declarations refer to the Black Sea (Bologa, 2000). The Bucharest Convention (April 1992) and its three protocols established common legal tools for controlling marine pollution. It also provided the basis for the Black Sea Commission to set up headquarters in Istanbul, Turkey. To provide an appropriate common policy framework, the governments also decided to formulate and adopt an environmental policy declaration for the Black Sea (Odessa, April 1993). This document provides a clear indication on the principles, approaches, goals, and common priorities for regional action: „rehabilitation, protection and preservation of the Black Sea can be ensured only through bilateral and multilateral cooperation, including cooperation with relevant international organizations.”

More concretely, as a result of BSEP (established in 1993), a Strategic Action Plan for the Rehabilitation of the Black Sea, based on National Black Sea Strategic Action Plans and indicating how to implement the main plan, was agreed on by all coastal states in 1996. The 88-point plan came after 3 years of expert analysis and was viewed as a turning point in the collective clean-up of the sea. It sets out short- and long-term goals, from monitoring and treatment of polluted water to public awareness raising schemes.

The recent changes in the Black Sea determined its consideration in various international events. Thus, for example, the Black Sea was one of the case studies during the 1997 Stockholm Water Symposium, „With Rivers to the Sea”. Another Symposium, „Religion, Science and the Environment: The Black Sea in Crises”, took place on board *Elephterios Venizelos*, during her circumnavigation of the Black Sea in September 1997 (Hobson and Mee, 1998), attended also by the former President of Romania, Emil Constantinescu. The international conference called “Oceanography in the Eastern Mediterranean and Black Sea” (Athens, Greece, February 1999) stressed the similarities and differences of two interconnected basins.

Final considerations

As shown, the Black Sea was characterized in the most succinct and inspired way by the Russian oceanographer M.N. Knipovich as "unicum hidrobiologicum", due to its main physical, chemical and biological characteristics compared to those of other seas and oceans. This characterization is valid and concerns, among others, in particular the configuration and arrangement of the continental shelf, the stratification of the water column in an oxygenated layer (biotic) and another anoxic one in proportion of 87% (abiotic), separated at a depth of about 150-200 m, the practical absence of the vertical mixture between the superficial and the deep layer, the most pronounced

hydrogen sulphide (H₂S) content of deep waters in the world, the very accentuated fresh water input with high contents of mineral salts (nutrients) and photoabsorbent compounds (detritus) mainly due to the Danube - the second largest river in Europe, the Dniester, the Dnieper, the Bug and the Kuban, the weak exchange of water masses with the Mediterranean Sea through the Bosphorus Strait (about 100 m deep), spatial variations of physical and chemical properties (especially in the north-western corner), the salinity reduced by about half that of the World Ocean from 18-19 ‰ at sea surface to about 22.5 ‰ at a depth of 2,000 m, the composition slightly different from the ionic ratios (*rhopia*) compared to those in the World Ocean. Some similarities appear only with the Adriatic Sea and the Baltic Sea. The poorer flora and fauna were previously compensated by their high biological productivity. A relatively small number of allogenic (exotic) species have invaded this particular environment in recent decades.

Consequently, the Black Sea has faced and continues to be affected by a serious disequilibrium (Hobson and Mee, 1998; Beşiktepe *et al.*, 1999; Bologa, 2001, 2011a), due to contamination / pollution both on land and in the air, to which pollution of the marine environment itself (e.g. noise, ballast water, PVC) is added, which can be suggested in the sequence of eutrophication → flowering (phyto- and zooplankton) → hypoxia and anoxia → mortality (plant and animal) → diminished biodiversity and living resources.

After 1990, the anthropogenic stress began to subside and considerable efforts were made to rehabilitate this still ecologically extremely endangered sea and the state of its biota.

The elaboration and application of a quality monitoring of the marine environment was a precondition for Romania's accession to the European Union (Bologa, 2003-2004). Improving the quality of Romanian coastal waters was pursued by treating wastewater in treatment plants in Constanța Nord, Constanța Sud, Eforie Sud and Mangalia (Bologa and Costache, 2005). The current environmental problems regarding the Black Sea in an international context were analyzed and interpreted as much as possible: pollution, the Romanian water quality monitoring system, eutrophication, biodiversity, wastewater treatment (e.g. Bologa, 2011a).

The question of ecological compatibility of the Bystroe deep navigation canal with the Danube Delta Biosphere Reserve and the adjacent Black Sea ecosystem was also raised (Bologa, 2006).

Selected bibliographical references

Numerous references to Dobrogea, including as a natural epicentre of Romanian marine research, were included in the anniversary *volume Dobrogea 1878-2008 - Horizons opened by the European mandate* (Ciorbea, 2008).

The bibliography on the Black Sea includes different references, under different aspects and approaches, older or newer, Romanian (e.g. Călinescu, 1931; Antipa, 1933, 1941, 2010a, b; Anastasiu, 1940; Băcescu, 1965a, b, 1967, 1969, 1971, 1976, Chiriac *et al.*, 1966; Gomoiu, 1959, 1976; Scarlat, 1982, 1988; Brătianu, 1988; Constantinescu, 1996; Petranu, 1997; Pădurean, 2004a; Vespremeanu, 2004; Bologa, 2018; Făgăraș, 2008; xxx, 2011; Moldoveanu *et al.*, 2015 Vespremeanu and Golumbeanu, 2018) and foreign (e.g., xxx, 1957; Zinova, 1967; Laking, 1974; Benson and Rehbock, 1993; Mamaev *et al.*, 1996; Hobson and Mee, 1998; Zaitsev and Öztürk, 2001; King, 2004a, b; Oguz, 2008; Finkl and Makowski, 2018).

The *general bibliography* of this monograph is presented at the end of the work.

A *selective bibliography* on the mention of Romanian marine research in the press, offered by Dr. Luminița Stelian from the County Library "Ioan N. Roman" in Constanța, with gratitude from the author, is mentioned in part in the text and in addition to the general bibliography.

The *Bibliography of Dobrogea*, especially for years 1969-1995, is also worth mentioning, for several other articles on this subject (<https://digitalizare.biblioteca.ct.ro/2020/09/02/bibliografia-dobrogei/>).

In Romanian fiction, in the opinion of the writer, literary critic and translator Octav Șuluțiu, a "maximum of picturesque possibilities of the Black Sea" belongs to the writer Radu Tudoran in the novel *Un port la răsărit* (*A port to the east*), in which he describes the Bessarabian coast from the Dniester estuary to the mouth of the Danube (Șuluțiu, 1942).

Thus, Romania, as a maritime state, has further promoted and supports marine research, proving a tradition of over 100 years in the field of marine sciences (Bologa, 1999; Bologa *et al.*, 1995; Bologa and Bavaru, 2018).

FOUNDERS OF ROMANIAN MARINE RESEARCH (Resume)

Among the Romanian scientists of national and international notoriety, the Black Sea and the Serpent Island were especially approached, with professionalism, erudition and passion, by Ioan Borcea, Grigore Antipa, Raoul Călinescu, Maria S. Celan, Gheorghe Brătianu, Nicolae N. Constantinescu etc., who profoundly enriched the knowledge of geography, biology and history of this unique naturalist and water body, as well as other authors outside Pontus Euxinus.

Emil Racovitza (1878-1947)

Emil Racovitza (b. November 15, 1868, Iași - d. November 17, 1947, Cluj) (Fig. 9) was a Romanian biologist, explorer, speleologist and scholar, considered the founder of bio-speleology (the study of underground fauna - caves and

groundwaters). He was elected academician in 1920. President of the Romanian Academy between 1926 and 1929 (Motaș, 1948; Murariu, 2011; http://wikipedia.org/wiki/Emil_Racoviță)



Fig. 9 Emil Racovitza

Grigore Antipa (1867-1944)

Grigore Antipa (b. November 27, 1867 (b. November 27, 1867, Botoșani - d. March 9, 1944, Bucharest) (Fig. 10) was a biologist, zoologist, ichthyologist, ecologist, oceanologist, doctor of biological sciences, professor, full member of the Romanian Academy.



Fig. 10 Grigore Antipa

The Black Sea Monograph. vol. I Oceanography, bionomy and general biology of the Black Sea, published in 1941 (Fig. 11), is one of the most vivid

testimonies, in addition to the entire prodigious and original activity and scientific work of the scientist Grigore Antipa.

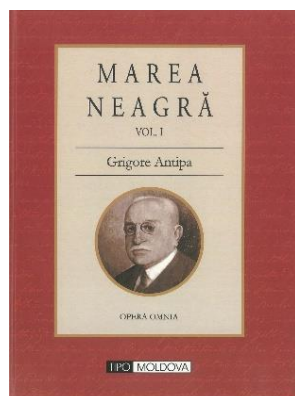


Fig. 11 Cover of the monograph *The Black Sea* by Grigore Antipa, 1941, anastatic edition (2010)

Ioan Borcea (1879-1936)

Ioan Borcea (b. Buhoci, county Bacău, January 13, 1879 - d. Agigea, county Constanța, July 30, 1936) (Fig. 12), was a Romanian zoologist, corresponding member of the Romanian



Fig. 12 Ioan Borcea

Academy, specialist in Black Sea fauna, who dedicated his life to the knowledge of marine ecosystems, being also co-founder of Romanian biological oceanography, founder of the Marine Zoological Station at Agigea, corresponding member of the Romanian Academy and full member of the Academy of Sciences (currently Romanian Academy of Scientists) and dignitary of the Dimitrie

Cantemir Lodge in Iași, which he represented at the solemn meeting in Iassy of the United Romanian Freemasonry.

His major achievement, which has survived to the present day, is represented by the founding of the Marine Zoological Station, at Agigea (Constanța), in 1926 (Fig. 13) (Bologa 1996, 2004a, b, 2014; Bologa *et al.* 2013). He was the director of this Station in his last 10 years of life, until his untimely death, in full creative force. Thus, he is one of the creators of the Romanian biological oceanography. His achievements were briefly recorded in the archives of the "Alexandru Ioan Cuza" University in Iassy.



Fig. 13 Professor Ioan Borcea's creation - the Marine Zoological Station with the annex building (Agigea, 1926)

Maria S. Celan (1898-1989)

Maria S. Celan (Fig. 14) is certainly the most renowned marine algologist in Romania. Doctor of Natural Sciences from the famous Sorbonne University in France. She marked the history of Romanian marine algology through her prodigious didactic and scientific activity carried out uninterruptedly for five decades (Bologa, 2020).



Fig. 14 Maria S. Celan (1898-1989)

Ileana Cautiș (1921-2020)

Ileana Cautiș (Fig. 15) was a doctor of fish engineering and distinguished principal scientific researcher, author for over two decades of investigating the ichthyofauna of the Romanian Black Sea coast and the northwestern African coast of the Atlantic Ocean (Vasilu and Manea, 1987).



Fig. 15 Ileana Cautiș

MARINE RESEARCH STRUCTURES ALONG THE ROMANIAN LITTORAL PRIOR TO THE ESTABLISHMENT OF THE NATIONAL MARINE RESEARCH INSTITUTE AT CONSTANȚA

Between 1960 and 1970, on the current total length of the Romanian coast of 245 km, there were five marine research units with different tutelage, each carrying out research activities, having their own material means and funding; this is it:

- Marine Zoological Station „Professor Ioan Borcea” (founder Ioan Borcea), affiliated to the Ministry of Education (1926-1970), (Bologa, 2014; Bologa *et al.*, 2013),

- Bio-Oceanographic Institute / Fisheries Research Station „Dr. Grigore Antipa ” (founder Grigore Antipa), affiliated to the State Ministry of Agriculture and Fisheries (1932-1970),

- Marine biology sector Constanța of “Traian Săvulescu” Institute of Biology (founder Academician Mihai C. Băcescu), affiliated to the Romanian Academy (1954-1970),

- Oceanographic Research Stations Constanța and Sulina (founder Dr. Eng. C. Bondar), affiliated to the State Water Committee (1960-1970),

- Marine Sedimentology Laboratory (founder Academician G. Murgeanu), affiliated to the Geological Institute of Romania (1964-1970).

THE NATIONAL MARINE RESEARCH AND DEVELOPMENT INSTITUTE "GRIGORE ANTIPA"

About the Romanian Marine Research Institute

As a result of the joint initiative of Academicians Mihai C. Băcescu and Eugen A. Pora, in 1970 the mentioned structures merged into the Romanian Marine Research Institute, known under the acronym RMRI (Fig. 16). The goal of unifying the scientific and auxiliary staff, the material and documentary bases was achieved. At the same time, the continuation of the previous tradition was ensured due to the illustrious predecessors in oceanography Emil Racovitza, Ioan Borcea and Grigore Antipa (Bologa, 1995a, b).



Fig. 16 Headquarters of the Romanian Marine Research Institute, Blvd. Mamaia No. 300, Constanța (1970 and present)

The birth certificate was the **Decision of the Council of Ministers No. 75/1970**, and DCM No. 256/1970 regarding the establishment of the Romanian Marine Research Institute, about where and in what way this institute was to function.

The leadership of the I.R.C.M. was provided by the directors Dr. Eng. Virgil Iordănescu (1970-1975), Dr. Eng. G. Șerpoianu (1975-1976), Rear Admiral Eng. Constantin C. Tomescu (1975-1983), Eng. Marcel Stanciu (1983-1989) and by the deputy scientific directors Dr. Hilarius V. Skolka, Dr. Eng. Virgil Iordănescu and Dr. Eng. Gheorghe Șerpoianu (Fig. 17).



Fig. 17 The leaders of the Romanian Marine Research Institute (1970-1999) and of the National Institute for Marine Research and Development „Grigore Antipa” (1999-2020)

Initially, in addition to the headquarters, the institute also owned two cars, classic equipment and laboratory installations, a pilot equipment for the production of depolluting products for oil (with a capacity of 100 tons / year and various tools for experimental fishing.

The first functional laboratories were (IRCM, nedatat):

- marine geology,
- hydrology and marine pollution,
- marine ecology,
- ichthyology,
- fishing technique,
- marine technology.

Rear Admiral Constantin C. Tomescu (Fig. 18) was appointed director of the Romanian Marine Research Institute by the address R.C.P. / Central Committee / Personnel Section, Bucharest, No. 102, of February 20, 1976 and led the institute in the period 1975-1983 (Bologa and Ciorbea, 2020).



Fig. 18 Rear Admiral Eng. Constantin C. Tomescu
(1922-2009)
(Photo collection Commander Dr. Marian Moșneagu)

Commander Jacques-Yves Cousteau in Constanța

According to the notes of RA Constantin Tomescu, under the auspices of the International Commission for the Scientific Exploration of the Mediterranean Sea (Bologa, 2011b, 2015), the oceanographic vessel *Calypso* performed a cruise in the Mediterranean Sea (July-November 1977), according to a programme that allowed also entry into the Black Sea, whose waters influence the Mediterranean basin (Tomescu, nedatat); the aim was to carry out measurements of marine pollution with certain toxic products: heavy metals - cadmium, copper, mercury, lead etc. - dangerous to life and in the marine environment, radioactivity produced by radionuclides discharged into the sea, etc.

In the Black Sea, they were interested in studying - among others - the Danube basin, the Danube Delta, Sulina and St. George armes, and the East-Constanța sector.

Calypso was present off the Romanian coast between October 6 and 9, 1977, during which Commander Jacques-Yves Cousteau visited the Romanian Marine Research Institute, taking note of the concerns of Romanian researchers and the results obtained, as well as the Dolphinarium from Constanța.

Hopes for new naval equipment ...

From the period of the directorate of RA Eng. Constantin Tomescu dates the address RMRI No. 684 / 25.02.1978, to the Ministry of Agriculture and Food Industry / Deputy Minister Cabinet, regarding the steps taken to equip the institute with ships for conducting research in the Black Sea and the ocean.

Visit of the delegates of the Romanian Marine Research Institute in the USA

Through the RMRI address No. 2140 / 29 1980 to the Ministry of Education and the Bucharest - Otopeni Customs, the departure of the delegation composed of RA Eng. C. Tomescu, Ph.D. G. Müller and Ph.D. M.-T. Gomoiu, on a mission in the U.S.A., was attested.

Creation of the National Salvation Front at the Romanian Marine Research Institute in Constanța on December 25, 1989

Following the events of December 1989 and the creation of the National Salvation Front (NSF) at RMRI in Constanța the author prepared a file with the main testimonies regarding this moment in its history, which he offered to the Constanța County Service of National Archives on May 13, 2021; the documents are arranged chronologically between January 3-29, 1990.

The candidate's applications for the positions of director and scientific deputy director were submitted to the elected president of the NSF, Dr. Alexandru Ș. Bologa, on January 17, 1990 and on January 19, 1990, respectively.

Regrettable NSF proved to be one of the major post-revolutionary disappointments (Fig. 19).

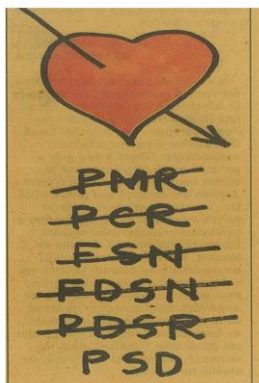


Fig. 19 NSF → ...

The National Institute for Marine Research and Development "Grigore Antipa" and its Semicentennial (2020)

By the **Government Decision No. 686/23.08.999** RMRI was reorganized into the National Institute for Marine Research and Development "Grigore Antipa" (NIMRD) (Fig. 20).



Fig. 20 The National Institute for Marine Research and Development "Grigore Antipa" Constanța

One example of international scientific events organized by NIMRD (Fig. 21 and 22) is given below:



NATO ADVANCED RESEARCH WORKSHOP

**ENVIRONMENTAL DEGRADATION OF THE BLACK SEA
CHALLENGES AND REMEDIES**

Constanța, Romania, 29-31 October 2007



Fig. 21 The participants in the international scientific symposium "Environmental degradation of the Black Sea" organized in collaboration with NATO, NIMRD, Constanța

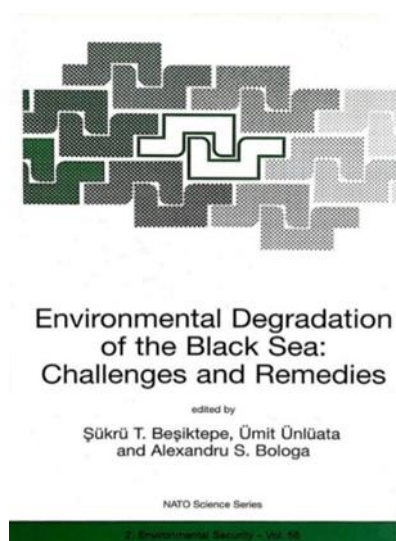


Fig. 22 Volume published following the 1997 NATO Symposium

On October 29, 2020, the **fiftieth anniversary** of the National Marine Research and Development Institute "Grigore Antipa" took place in Constanța. concluded with the awarding of the Anniversary diploma.

OVER 100 YEARS OF ROMANIAN MARINE RESEARCH

Romanian marine research, initially linked naturally to the Black Sea and later extended to other marine and oceanic areas, began over 100 years ago (Bologa, 1993a, 2011c; Bologa and Charlier, 2011), with physical oceanography, fact motivated by two practical aspects: maintaining the navigability of the Danube mouths (at Sulina) and the design of the seaport Constanța; these needs imposed the study of the influence exerted on the shore by the suspended material transported by the Danube, of the sea currents and of the structure and characteristics of the Romanian coast.

Marine biological research, or biological oceanography, also began in the late 19th century (Bologa, 2004b). This beginning coincided with the organization and development of first Romanian expeditions organized by Dr. Grigore Antipa, a brilliant student of E. Haeckel, the creator of ecology, aboard the RRN cruiser "ELISABETA", in the Black Sea (1883, 1884, 1885) (Băcescu, 1954; Marinescu, 1994). As well as with the participation of the most remarkable Romanian biologist, Emil Racovitza aboard the ship "BELGICA" in Antarctica (1897-1898) (Motaş, 1948; Marinescu, 1987, 1993, 1994, 1997, 1999; Balaban, 1998).

The cruises in the Black Sea proved to be particularly valuable through the observations and measurements made, as well as through the numerous samples collected, for their further processing by various other specialists; this performance has not been matched to this day!

Dr. G. Antipa is also the founder of the Bio-Oceanographic Institute, in Constanța, in 1932, which became the Fish Research Station in 1954 and which bore his name, until 1970.

Antipa, Romania's second national delegate to the International Commission for the Scientific Exploration of the Mediterranean Sea (CIESM), was nominated Rapporteur for the Black Sea in 1927, and consequently this scientific body has extended its field of oceanographic research - by the addition of the Black Sea basin - to the wide sphere of such preoccupations; in 1928 he became rapporteur for the entire eastern Mediterranean, the Marmara Sea and the Aegean Sea (Bologa and Marinescu, 2002; Bologa, 2015).

Another illustrious predecessor of Romanian marine research is the biologist Ioan Borcea (1879-1936), trained at the school of P. Bujor, himself a professor of zoology at the University "Alexandru Ioan Cuza" in Iassy (Bologa *et al.*, 2013). The actual research activity took place in his foundation, the Marine Zoological Station (MZS), which would bear his name, founded, with intense efforts, at Agigea, in 1926, owning the *Racovitza* research vessel (Fig. 23). Thanks to the truly generous, dynamic and multilateral personality and the international recognition of I. Borcea, the reputation of the first Romanian marine research establishment far exceeded the country's borders due to the remarkable results on the Black Sea fauna, usually published in *Annals of the University of Iassy*.



Fig. 23 Research vessel
Professor Emil Racovitza

I. Borcea combined in an exemplary way the didactic activity with the preoccupation of scientific research and the organizational ability.

Following the devotion and efforts of Professor Dr. Gheorghe Mustață, after 1990 the MZS was returned to the "Alexandru I. Cuza" University of Iassy.

All three illustrious forerunners of the Romanian school of biological oceanography stood out not only as remarkable scientists, but also as people of culture and devoted patriots, fully engaged and creative in the economic, social and political life of Romania.

Time passed unperturbed and Romanian marine research continued to develop and diversify in the fields of physical, chemical, biological, fisheries oceanography and marine engineering.

The Institute of Hydrotechnical Research, the Oceanographic Research Station in Constanța and a smaller station in Sulina were successively created.

A Marine Sedimentology laboratory was created in Bucharest - Constanța in 1964.

In 1970 the former marine research institutions from the Romanian littoral merged into the Romanian Marine Research Institute (RMRI), transformed in 1990 into the National Institute for Marine Research and Development "Grigore Antipa" (NIMRD) in Constanța, owner, initially besides other smaller research vessels (see above), of the R/V *Steaua de mare 1* (Fig. 24) (Bologa, 1990), dealing with marine research and monitoring.



Fig. 24 The research vessel *Steaua de mare 1*

From the already mentioned Marine Sedimentology Laboratory, which became the Laboratory of Marine Geology and Sedimentology and later on the Romanian Centre of Marine Geology and Geoecology, in 1999 the National Research and Development Institute for Marine Geology and Geo-ecology (GEOECOMAR) was born in Bucharest and Constanța, possessor of the R/V *Mare Nigrum* (Fig. 25).



Fig. 25 The research vessel *Mare Nigrum*

After 1990, the non-governmental organizations from Constanța, *Mare Nostrum* and *Oceanic Club*, were added to the indigenous marine research effort.

ROMANIA AND THE INTERNATIONAL COMMISSION FOR THE SCIENTIFIC EXPLORATION OF THE MEDITERRANEAN SEA

The beginnings of Romanian oceanography and the scientific interest went beyond the limited regional framework of the territorial waters of the Black Sea. The best example in this sense is the invitation of Romania, together with the other co-founding states, to the creation of the Mediterranean Commission (CIESM, 1970), later called the International Commission for the Scientific Exploration of the Mediterranean Sea (CIESM), already since 1910, by its brilliant personality of Romanian biology, Emil Racovitza (Bologa, 1993a, b; Bologa and Marinescu, 2002). Thanks to Grigore Antipa, who was officially appointed rapporteur for the Black Sea in 1927, CIESM expanded its field of oceanographic research by adding the Black Sea basin to the broad scope of its concerns. In 1928 he also became rapporteur for the entire eastern Mediterranean, the Marmara Sea and the Aegean Sea. Since the official election and accession of Romania as a member state (1925), two congresses and general assemblies of this oldest, prolific and long-lived European R-D-I organization have taken place in Romania.

Subsequently, in a long confidential letter from December 1923, E. Racovitza, the most appreciated Romanian biologist, expressed to the Minister of Foreign Affairs I.G. Duca his deep concern about the development of the Mediterranean oceanographic "policy". In this context, Racovitza strongly suggested confidence in France in all respects. A first report on CIESM in Romania was presented by Racovitza to Minister I.G. Duca on January 9, 1924 (Raport, 1924). The following Member States were mentioned then: Egypt, France, Greece, Italy, Morocco, Spain and Tunisia. The document explained the organization of CIESM, the obligations of the member states and the need for Romania's participation. The reasons for this participation were, according to Racovitza, the following: scientific and didactic,

economic, political, national defense and national dignity. Racovitza also offered a detailed programme proposal on Romania's participation in CIESM in 1924, 1925 and 1926. As for the National delegate, Racovitza stated very clearly from the beginning that this representative should not only have "diplomatic competence", but should be a recognized specialist in oceanography, as are everyone else.

Romania's official accession to the Commission took place in 1925. This event was mentioned in the letter of April 1, 1925 to the Romanian Plenipotentiary minister in Paris, by which the Minister of Foreign Affairs of the Romanian Government conferred full powers on C. Diamandi with regard to Romania's admission to CIESM (Scrisoare, 1924). Emil Racovitza was officially informed about his nomination to CIESM on May 29, 1925. A later letter confirmed his appointment to this international scientific body (Scrisoare, 1925). E. Le Danois, Secretary General of CIESM, mentioned: *Je me fais ici l'interprète de tous les membres de la Commission de la Méditerranée en souhaitant la bienvenue à nos collègues roumaines et en adressant des remerciements particuliers à M. le Professeur Racovitza qui depuis de long années a multiplié ces efforts pour permettre l'entrée de son pays dans notre Commission. Le choix de Racovitza comme délégué, c'est un sur garant de l'activité que nos amis roumainins apporteront dans leur collaboration à nos recherches* (CIESM, 1926).

In 1933, G. Antipa sent on behalf of the Government of Romania an official invitation to the CIESM delegates in order to organize the next Congress and General Assembly in Bucharest in 1935. On this occasion, fishing communities could be visited on the lower Danube and some meetings could take place directly on board the fluvial vessel. The President of the Commission greatly appreciated the organization of the Congress and dedicated it with special consideration to Vice-President Antipa (CIESM, 1934). Thus, the XXth Congress and the 17th meeting of the Central Bureau took place in Bucharest (October 15-20, 1935). Member State delegates - Egypt, France, Italy, Monaco, Spain, Tunisia and Yugoslavia - met and scientists Theodor Bușnitza and Zaharia Popovici also attended the event. The President of the Commission, P. Ravel de Thion, mentioned in his message: *In quest'atmosfera di ricordi gloriosi per la civiltà mediterranea, l'Assamblea di Bucurast, capitale della Nazione che sul Mar Nero rappresenta la romanità, assumerà singolarissima importanza e sono sicuro di interpretare i sentimenti di tutti i Coleghi affermando che essa rivestirà anche carattere di festeggiamento in onore del prof. Antipa ...*

The head of the French delegation said: *C'est au nom de l'unanimité des membres de la Commission que nous prions le Gouvernement Roumain de croire à notre gratitude emue pour l'accueil qui nous est fait et pour la libérale hospitalité don't nous bénéficions. M. le Président Antipa a dit que la Roumanie était fière d'avoir été choisi comme siège de notre session; nous avons eu le plaisir, en nous*

réunissant ici a rendre a la Roumanie un hommage pour le grand rôle qu'elle joue dans notre Commission.

It is also worth noting that the XXXth Congress and General Assembly took place again in Romania, in Bucharest and Constanța, under the leadership of Academicians Mihai C. Băcescu and Eugen Pora, in 1966.

The remarkable results of the Romanian marine research, obtained in an institutionalized way in different scientific and higher education establishments, over time, have thus had echo and recognition abroad, e.g. from CIESM (Fig. 26).



Fig. 26 Headquarters of the International Commission for the Scientific Exploration of the Mediterranean Sea, Monte Carlo, Monaco

Romania's national delegates (and also vice-presidents) at CIESM and members or holding leadership positions in the various scientific committees of this body were: Emil Racovitza (1925), Grigore Antipa (1926-1944), Traian Săvulescu (1959), Theodor Bușnitza (1961), Vasile Chiriac / Mihai C. Băcescu substitute (1966), Mihai C. Băcescu (1967-1993), Alexandru Ș. Bologa (1994-2011) and Tania Zaharia (2011-2020).

BYSTROE SHIPPING CANAL IN RELATION WITH THE DANUBE DELTA BIOSPHERE RESERVE AND THE ADJACENT BLACK SEA ECOSYSTEM

The Danube and its Watershed

The Danube, the second largest European river after the Volga, has its source in the Black Forest Mountains of Germany and flows into the Black Sea through three branches - Chilia, Sulina, and Saint George. It is 2,840 km long, has 817,000 km² of watershed, crosses 10 countries (Germany, Austria, Slovak Republic, Croatia, Serbia and Montenegro, Hungary, Romania, Moldova, Bulgaria, and Ukraine) from 17 tributary countries, and bathes four capitals - Vienna, Bratislava, Budapest, and Belgrade. The water discharge distribution of the main branches is Chilia (58 %), Sulina (19 %), and Saint George (23 %). The significance of the Danube River, its hydrographic basin, and related matters are common knowledge and the details have been the topic of several recent

publications (e.g. Le Marquand, 1977; Bologa, 2000, 2001, 2003; Bloesch, 2002; Meinier, 2002a,b; Kroiss *et al.*, 2003; Moisi, 2003; Cinca, 2004).

The Danube Delta Biosphere Reserve

During the last 16,000 years the Danube River has built the Danube Delta at its three Black Sea mouths. Hence, the Delta plays a key role as the interface between the river (freshwater) and the sea (brackish water).

At 5,800 km², the Danube Delta is 2.5 percent of the total Romanian territory. It is the 22nd largest delta in the world, the third largest delta in Europe after the Volga and Kuban, and includes 30 types of ecosystems and represents the greatest reed bed expanses worldwide at 1,560 km².

The Danube Delta is important as a natural physical and chemical filter for Danube water and as a natural control of erosion and floods. It supports more than half of the European population of the common pelican *Pelecanus onocrotalus* (8,000 individuals) and a large share of the world's population of the Dalmatian pelican *Pelecanus philippensis* (sin. *P. crispus*) (200 individuals). It is home to 60 percent of the world's population of two endangered species, the pigmy cormorant *Phalacrocorax pygmeus* (6,000 individuals) and 50 percent of the entire population of red-breasted goose *Branta ruftcollis* (40,000 individuals). The Delta is a potentially significant economic resource for natural products (e.g., reeds, timber, and fish) and tourism.

The Bystroe shipping canal: Danube - Black Sea

The first information on the Ukrainian Bystroe Shipping Canal Project, linking the Danube and the Black Sea (Fig. 27), appeared in April 2003 (Pădurean, 2004b). In 2004, despite strong Romanian and international criticism (*Marea Noastră*, 2004) Ukraine's Ministry of Transportation contracted the German company Josef Moebius Baugesellschaft GmbH of Hamburg, to start building the deep-water Bystroe shipping canal after Ukraine's request had been rejected by several Dutch companies (Bologa, 2006).

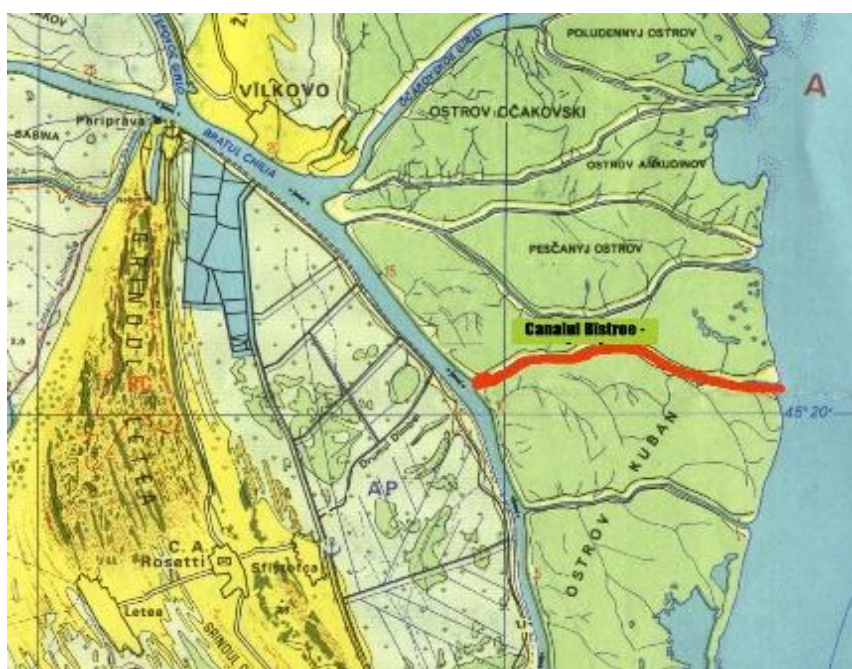


Fig. 27 Location of the Bystroe Danube - Black Sea shipping canal
(Sursa: <https://ultima-ora.ro/portile-deltei/>)

The Bystroe canal, connected with the Chilia branch of the Danube - a natural border between Ukraine and Romania - is to cross the protected Ukrainian Danube Delta Reserve, the most recent reserve and among the most ecologically precious regions of Europe. The construction of the Bystroe canal aims to ensure navigation and trade from the Black Sea to the Danube harbors of Izmail, Reni and Ust-Dunaisk. Approximately 4.2 million tons per year of merchandise, mainly iron ore, oil and wheat, are to be shipped through the canal. The present navigation fees and the dependence on Romanian transit approvals are frustrating for Ukraine. The 170-km long canal is expected to cost US\$ 200 million. The navigation route originates in the Chilia branch, passes through the Bystroe passage, through the Danube plain for many kilometers, and ends, protected by dams, 3 km into the Black Sea where it is 120 metres wide and 8 meters deep.

Ecological consequences and the need for an environmental impact assessment

The main negative ecological impacts foreseen after the opening and exploitation of the Bystroe canal consist of increased Danube water flow and velocity in the Chilia branch, the drying up of vast deltaic territories, destruction of rare and threatened flora and fauna, especially ichthyofauna and avifauna species, and the loss of about 100 million tons of fish per year (Ziua, 2004).

Reports of expert organizations

Reactions have followed the development in the endangered areas. Critical reports on the construction of the Bystroe shipping canal, alternative proposals for a waterway through the Ukrainian part of the Danube Delta (Ocheakovskyi Rukav branch and Prorva canal, sluiced canal from Solomonov branch to Zhebranskaya Bay of the Black Sea), and the need for an impartial EIA have been issued by UNESCO's Man and Biosphere Programme and the Ramsar Convention Secretariat (Kvet and Santhé, 2003) the Convention on the Conservation of European Wildlife and Natural Habitats (Léthier, 2004) and a call was issued for an immediate halt to plans for building this canal by the WWF International Danube-Carpathian Programme (Hajdu and Baltzer, 2004).

Reactions and warnings of civil society

Civil society associations promoting respect for international law have asked the President of Ukraine to stop the building of the Bystroe canal. They warned of several major impacts on the Danube Delta, and were supported by notable organizations such as World Wildlife Fund International, Wetlands International, Bird Life International, and the International Association for Danube Research, among others. Their concerns relate to the following aspects:

With almost 20,000 signatures, 140 organizations and institutions from Romania, Ukraine and numerous other countries have reminded Ukraine that by building this canal, Ukraine is breaking various international assignments and agreements to which it has subscribed:

- Ramsar Convention on Wet Lands of International Importance especially as Waterfowl Habitat (1991);
- Paris Convention on the Protection of the World's Cultural and Natural Heritage (1975);
- Bern Convention on the European Wildlife and Natural Habitats Protection (1979);
- Rio de Janeiro Convention on Biological Diversity (1992);
- Helsinki Convention on the Protection and Use of Transborder Waters and International Lakes (1992);
- Sofia Convention on the Co-operation, Protection and Durable Use of the Danube River (Danube Convention, 1994); and
- Agreement between the Romanian Government and the Ukrainian Government on Co-operation in Management of Boundary Waters (Galați, 1997).

It is alleged that Ukraine violated other conventions during the process of Bystroe canal construction, including the following:

- Bonn Convention on Conservation of Migratory Species;
- African-Eurasian Migratory Waterfowl Agreement;

- Espoo Convention on Environmental Impact Assessment in a Transboundary Context; and
- Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Issues.

Some conclusions

The Danube Delta is one of Europe's largest natural wetlands, with large parts under national and international protection (e.g., UNESCO Biosphere Reserve, at least 11 bilateral and international agreements / conventions), and it is shared between Romania and Ukraine. The Man and Biosphere (MAB) Programme of UNESCO recognized the universal value of the Danube Delta Biosphere Reserve in August 1990 through its inclusion in the international network of biosphere reserves. Since September 1990 when Romania became Party to the Ramsar Convention, the Danube Delta Biosphere Reserve has been an internationally recognized wetland zone, mostly in its capacity as habitat for aquatic birds. The importance of the Biosphere Reserve was also recognized in December 1990 when it became Party of the Cultural and Natural World Patrimony. The Ukrainian side of the Danube Delta was declared a biosphere reserve under the UNESCO/MAB Programme in 1998. In 1999, UNESCO recognized the Transboundary Biosphere Reserve Danube Delta of Romania / Ukraine.

The unilateral decision of Ukraine to make use of the Bystroe shipping canal represents a major impact on the Danube Delta ecosystem, mainly on the Danube Delta Biosphere Reserve area. Navigation in general, and the newly constructed first segment of the Bystroe shipping canal in particular, are threatening the unique plant and animal life and hence biodiversity in the Danube Delta through direct or indirect impacts (i.e., hydrological and physical alterations).

A bilateral solution to the Bystroe shipping canal should consist of negotiating better economic conditions and regulations for Ukrainian (and other) ships, in order to concentrate shipping impacts and stress in the already built Sulina channel, inaugurated in 1861 for navigation, and to conserve the other channels of the Danube Delta. The transboundary aspect of the Bystroe shipping canal and its related ecological problems should be considered by the International Commission for the Protection of the Danube River. The Commission should have taken the lead responsibility for solving it, as an international body recognized by both Romania and Ukraine.

STORIES FROM ABROAD

Sur la surveillance de la radioactivité marine le long de la côte roumaine,
Constantin Dovlete (France)

Some pages from the history of joint marine expeditionary research, Tatyana S. Osadchaya (Russian Federation)

A scientific vizit to Constanța / Romania in 2007 with YUNUS-S - Bayram Öztürk (Turkey)

Trieste - Costanza dalla stessa latitudine con lo stesso atteggiamento: sempre oceanografo - Mihai I. Burcă (Italy)

REFERENCES

- [1] Abulafia D., 2014, *Marea cea Mare. O istorie umană a Mediteranei*, Ed. Humanitas, București, 808 pp.
- [2] Anastasiu O.A., Ottescu N.I., 1940, *Este Marea Neagră săracă în pești?*, Tipogr. „Ion C. Văcărescu”, București, 86 pp.
- [3] Antipa G., 1933, La vie dans la mer Noire, Conférence fait le 7 Janvier 1933 au Grand Amphitéâtre de l’Institut Océanographique de Paris, *Ann. Inst. Océanogr.*, 13, 2, 54-90, Ed. Blondel la Rougery, 90 pp.
- [4] Antipa G., 1941, *Marea Neagră*. vol. I *Oceanografia, biomomia și biologia generală a Mării Negre (cu 6 hărți din care 4 colorate și 52 figuri în text)*, Academia Română, Publ. Fond. Vasile Adamachi, X, LV, M.O. și Imprim. Stat., Imprim. Naț., București, 313 pp.
- [5] Antipa G., 2010a, *Marea Neagră*, vol. I *Oceanografia, bionomia și biologia generală a Mării Negre (cu 6 hărți din care 4 colorate și 62 figuri în text)*, M.O., și Imprim. Stat., Imprimeria Națională, 1941, Cuvânt înainte dr. Alexandru Ș. Bologa, ediție nouă anastatică, B. Ștefanachi, Tipo Moldova, Iași, 313 pp.
- [6] Antipa G., 2010b, *Marea Neagră*, vol. I *Anexă Hărți*, ediție nouă anastatică, B. Ștefanachi, Tipo Moldova, Iași, 5 hărți.
- [7] Ascherson N., 1995, *Black Sea*, Hill and Wang, New York, 306 pp.
- [8] Balaban A.T., 1998, Introduction à l’anniversaire du centenaire de l’expédition Belgica, *Noesis*, 23, 12-15.
- [9] Băcescu M.C., 1954, Grigore Antipa (10 decembrie 1867-9 martie 1944), *Bul. Inst. Cerc. Pisc.*, 2, 5-26.
- [10] Băcescu M.C. (red. resp.) 1965a, 1967, 1969, 1971, 1976, *Ecologie marină*, vol. I, II, III, IV, V., Ed. Acad. R.S. România, 344 pp, 293 pp, 326 pp, 357 pp, 349 pp.
- [11] Băcescu M.C., 1965b, *Bibliographie roumaine de la mer Noire*, Com. nat. R.P. Roumanie pour l’UNESCO, Bucarest, 122 pp.
- [12] Benson K.R., Rehbock P.F., *Oceanographic History. The Pacific and Beyond*, 1993, Univ. Washington Press Seattle and London, 556 pp.
- [13] Beşiktepe A., Ünlüata Ü., Bologa A.S. (Eds.), 1999, *Environmental Degradation of the Black Sea: Challenges and Remedies*, NATO Science Series, 2. Env.-Sec.-56, Kluwer Acad. Publ., Dordrecht, The Netherland, 393 pp.
- [14] Bloesch J., 2002, Integral Water Protection Along the Danube - Trite or Concept, *Archiv für Hydrobiologie, Supplementband* 141, 1-2 (*Large Rivers*, 13, 1-2), 123-128.
- [15] Bologa A.Ș., 1990, The Romanian Marine Research Institute at its 20th anniversary: tradition, status, perspectives, *Cercet. Mar. - Rech. mar.*, 23, 7-13.

- [16] Bologa A.Ș., 1992, Review of the state of environment and biological changes in the Romanian sector, in *Problems of the Black Sea*, plenary reports, Int. Conf. Sevastopol, Ukraine, 10-15 November, 91-96.
- [17] Bologa A.Ș., 1993a, 100 de ani de oceanologie românească, *Cuget liber*, 25 noiembrie.
- [18] Bologa A.Ș., 1993b, Romania and the International Commission for the Scientific Exploration of the Mediterranean Sea, *Noesis*, 19, București, 129-138.
- [19] Bologa A.Ș., 1995a, 25 years from the founding of the Romanian Marine Research Institute, *Jubilee Symposium*, Constanța, September 15, 1-11.
- [20] Bologa A.Ș., 1995b, I.R.C.M. - 25 de ani de cercetări oceanologice la Constanța, *Cuget liber*, 12 septembrie, 2.
- [21] Bologa A.S., 1996, Marine biological research around the Black Sea, *Noesis*, 22, 53-64.
- [22] Bologa A.Ș., 1999, Romanian contributions to ongoing Black Sea research and management programmes, in *Environmental Degradation of the Black Sea: Challenges and Remedies*, Ș. Beşiktepe, Ü. Ünlüata, A.Ș. Bologa (Eds.), NATO Science Series, 2. Environm. Sec.-56, Kluwer Acad. Publ., Dordrecht / Boston / London, 367-376.
- [23] Bologa A.Ș., 2000, Regional research and management developments in the Black Sea, *Ocean Yearbook* 14, 515-519.
- [24] Bologa A.Ș., 2001, Recent changes in the Black Sea ecosystem, *Ocean Yearbook*, 15, The University of Chicago Press, Chicago and London, 463-474.
- [25] Bologa A.Ș., 2003, The Danube Drainage Basin - The State of the Black Sea Ecosystem: Need for Continuing Co-operation and Partnership, *13th Stockholm Water Symposium*, Abstracts vol., 11-14 August, 149-152.
- [26] Bologa A.Ș., Apas M., Cociașu E., Cuingioglu E., Pătrașcu V., Pecheanu I., Piesvu V., Popa L., 1998, Present level of contaminants in the Romanian Black Sea sector, Internat. Symp. Mar. Poll., *Extended Synopses*, IAEA-SM-354/26, 47-48.
- [27] Bologa A.Ș., 2003-2004, A Black Sea integrated environmental quality monitoring - a prerequisite for regional co-operation and EU accession, in Reuniune de lucru "Problemele ambientale ale Dunării Inferioare, inclusiv ale Deltei Dunării, și idei noi privind siste-mul integrat de observare și precizare pentru Dunăre, Delta Dunării, Marea Neagră", Bucuresti, 19-22 ianuarie 2004 // ICS-UNIDO EGM on ICZM of Mediterranean and Black Sea, Trieste / Italy, 13-15 December 2004, *Geo-Eco-Marina*, 9-10, 8-11.
- [28] Bologa A.Ș., 2004a, 125 de ani de la nașterea profesorului Ioan Borcea (1879-2004), *România liberă*, 4315, 28 mai.
- [29] Bologa A.S., 2004b, Development of marine biological institutions around the sea, in *Ocean Bridging the Millennia - A Spectrum of Historical Accounts*, UNESCO, China Ocean Press, 209-222.

- [30] Bologa A.Ș., 2006, Is the opening of the Bystroe Shipping Channel compatible with the Danube Delta Biosphere Reserve and the adjacent Black Sea ecosystem?, *Ocean Yearbook*, 20, 393-409.
- [31] Bologa A.Ș., 2011a, Present environmental problems of the Black Sea. în *The Black Sea: Dynamics, Ecology and Conservation*, A.L. Ryann and N.J. Perkins (Eds.), Nova Science Publ., Inc., New York, USA, 265-274 / revizuit în *ARS Biol. Sci. Ser.*, 1, 1, 18-30 (2012).
- [32] Bologa A.Ș., 2011b, România și Comisia Internațională pentru Explorarea Științifică a Mării Mediterane (CIESM) - scurt istoric. *Noema*, X, 333-338.
- [33] Bologa A.Ș., 2011c, Romanian marine centennial, *J. Coastal Res.*, 27, 2, 364-367.
- [34] Bologa A.Ș., 2014, Date arhivistice privind prima Stațiune de cercetări marine românești de la Agigea, *Noema*, XIII, 265-280 / Archival data on the first Romanian Marine Research Station at Agigea, Constanța (1926), *Noesis*, XXXVIII-XXXIX, 87-102. Bologa A.Ș., 2015, Cercetarea marină românească și cooperarea cu Comisia Internațională pentru Explorarea Științifică a Mării Mediterane (C.I.E.S.M.), *Rev. Pol. Șt. Sciento-metr.*, 4, 4, 325-328.
- [35] Bologa A.Ș., 2018, *Dobrogea at 140 Years after its Union with the Romanian State - An Example of Contemporary West-pontic Multiethnic Understanding*, Ed. Ex Ponto, Constanța, 332 pp.
- [36] Bologa A.Ș., 2020, *Maria S. Celan - conferențiar doctor biolog - O viață de sacrificiu dedicată științei românești și universale*, Ed. Ex Ponto, Constanța, 102 pp.
- [37] Bologa A.Ș., Bologa A.F., Charlier C.H., 2013, Ioan Borcea and the first Romanian Marine Zoological Station at Agigea (1926), *Noesis*, 29, 161-174 / in *Places, People Tools: Oceanography in teh Mediterranean and Beyond*, C. Groeben (Ed.), Proceed. VIIIth Int. Congr. Hist. Oceanogr., Gianini, Ed. Spa, Napoli, Italy, 169-184.
- [38] Bologa A.Ș., Bodeanu N., Petran A., Țigănuș V., Zaitsev Yu.P., 1995, Major modifications of the Black Sea benthic and planktonic biota in the last three decades, in *Les mers tributaires de Méditerranée*, F. Briand (éd.), Bulletin de l'Institut océanogr., numéro spécial 15, CIESM Science Series No. 1, Monaco, 85-110.
- [39] Bologa A.Ș., Apas M., Cociașu E., Cuingioglu E., Pătrașcu V., Pecheanu I., Piescu V., Popa L., 1998, Present level of contaminants in the Romanian Black Sea sector, Internat. Symp. Mar. Poll., *Extended Synopses*, IAEA-SM-354/26, 47-48.
- [40] Bologa A.Ș., Marinescu A., 2002, Romanian developmental contributions of E. Racovitza and G. Antipa to the scientific exploration of the Mediterranean Sea, in *Oceanographic History. The Pacific and Beyond*, K.R. Benson & P.F. Rehbock (Eds.), Univ. Washington Press, USA, 275-279.
- [41] Bologa A.Ș., Costache V.P., 2005, Improvement of Romanian coastal water quality by urban sewage treatment, *J. Coastal Res.*, 21, 5, 977-981.

- [42] Bologa A.Ș., Charlier R.H., 2011, Romanian marine centennial, *J. Coastal Res.*, 27, 364-367.
- [43] Bologa A.Ș., Bologa A.F., Charlier R.H., 2013, Ioan Borcea and the first Romanian Marine Zoological Station at Agigea (1926), *Noesis*, 29, 161-174 / revised in *Places, People, Tools: Oceanography in the Mediterranean and Beyond*, C. Groeben (Ed.), Proceed. VIIIth Int. Congr. Hist. Oceanogr., Gianini Ed. Spa, Napoli, Italy, 169-184.
- [44] Bologa A.Ș., Bavaru A., 2018, Historical development of marine sciences in Romania, *Ann. Ser. Biol. Sci.*, 7, 1, 5-25 / republ. Quasiquicentennial development of marine sciences in Romania and its maritime Dobrogea, in *Dobrogea at 140 Years after its Union with the Romanian State - An Example of Contemporary Westpontic Multiethnic Understanding*, A.Ș. Bologa (Ed.), Ed. Ex Ponto, Constanța, 332 pp, 191-205.
- [45] Bologa A.Ș., Ciorbea V., 2020, Institutul Român de Cercetări Marine sub directoratul contra-amiralului Constantin C. Tomescu (1975-1982), *An. Muzeului Marinei Române*, Constanța, XXIII, 293-309.
- [46] Boșneagu R., 2021, O scurtă istorie a bazinului Mării Negre cu implicații în transportul maritim, *Simp. șt. an. C.R.I.F.S.T. Constanța*, 29 mai.
- [47] Brătianu G., 1988, *Marea Neagră: De la origini până la cucerirea otomană*, Ed. Meridiane, Biblioteca de artă, Arte și civilizații, București, vol 1 și 2, 352 pp resp. 387 pp.
- [48] Călinescu R., 1931, *Insula Șerpilor - Schiță monografică (cu 8 figuri, 7 planșe și 1 hartă)*, Inst. Arte Graf. și Ed. „Glasul Bucovinei”, Cernăuți, 62 pp.
- [49] Chiriac V., Băcescu M.C., Bodeanu N., Boisnard D., Bondar C., Cautiș I., Gomoiu M.T., Gomboșiu V., Petran A., Pora E.A., Rădulescu I., Skolka H., Semenescu M., Șerpoianu G., Teodorescu-Leonte R., 1966, *Contributions roumaines a l'étude de la mer Noire*, C.E.E. / Cons. Min., R.S.R., Bucarest, 112 pp.
- [50] CIESM, 1926, *Rapport et Proces-verbaux des Réunions*, I (Nouvelle série), Paris, mai.
- [51] CIESM, 1934, *Rapport et Proces-verbaux des Réunions*, 8, Paris, mars.
- [52] CIESM, 1970, *Conférence de Madrid, 27 octobre 1969, Cinquantenaire de la C.I.E.S.M.*, 140 pp.
- [53] Ciorbea V. (coord.), 2008, *Dobrogea 1878-2008 - Orizonturi deschise de mandatul european*, Ed. Ex Ponto, Constanța, 798 pp.
- [54] Cinca S., 2004, Dunărea vie - un parteneriat cu natura, *România liberă*, Opinii, Aldine, 27 februarie.
- [55] Constantinescu N.N., 1966, History of economic cooperation in the Black Sea area during the 20th century, *St. Econ. Coop. Black Sea Area 20th century*, Workshop, Bucharest, Romania, May 20-22, Expert Publ. House, 162 pp.

- [56] Cristea O., Papacostea Ș., (ed.), 2006, *Marea Neagră: puteri maritime - puteri terestre: sec. XIII - sec. XVIII*, Ed. Inst. Cultural Român, Seria Biblioteca de istorie, Marea Neagră / 3, 366 pp.
- [57] Direcția Hidrografică Maritimă Constanța.
- [58] FAO, 1996, Environmental Management of Fish Resources in the Black Sea and their Rational Exploitation, Rome, Circ. letter No. 909, Prelim. version, 198 pp.
- [59] Fati S., 2016, *Ocolul Mării Negre în 90 de zile - Șapte țări, opt granițe și o lovitură de stat în prime time*, Ed. Humanitas, București, 459 pp.
- [60] Făgăraș M. (coord.), 2008, Studii comparative privind biodiversitatea habitatelor copstiere, impactul antropic și posibilitățile de conservare și restaurare a habitatelor de impor-tanță europeană dintre Capul Midia și Capul Kaliakra, Proiect UE Program PHARE CBC 2005 România-Bulgaria, *Conf. Constanța*, Mamaia, 26-28 sep., Ed. Ex Ponto, Constanța, 161 pp.
- [61] Finkl C.W., Makowski C., 2018, *Diversity in Coastal Marine Scieces - Historical Perspectives and Contemporary Research of Geology, Physics, Chemistry, Biology, and Remote Sensing*, a Festschrift in honor of Ass. Professor Dr. Alexandru Ș. Bologa, Springer Int. Publ. AG, Coastal Research Library, 701 pp.
- [62] Gomoiu M.-T., 1959, *Text explicativ la colecția de material didactiv privind flora și fauna Mării Negre*, București, 30 pp.
- [63] Gomoiu, M.-T., 1976, *Ghid pentru cunoașterea florei și faunei marine de la litoralul românesc al Mării Negre*, 1976, Agigea, 108 pp.
- [64] Hajdu B., Baltzer M., 2004, WWF Press Release: Ukraine Breaches International Agreements and Puts Europe's Second Largest Wetland Under Threat, 10 May.
- [65] Hobson S., Mee L.D. (Eds.), 1998, *The Black Sea in Crisis, Religion, Science and the Environment*, World Scientific, Singapore, New Jersey, London, Hong Kong, 262 pp.
- [66] Ionescu S., 2016, Destinul celui care a pus Marea Neagră pe hartă. După un triumf mondial la Paris, comandorul Cătuneanu a sfârșit tragic, *Adevărul*, 7 decembrie.
- [67] Institutul Român de Cercetări Marine, nedatat, Organizarea și desfășurarea cercetărilor marine în România, 8 pp. dact.
- [68] Kideys A.E., 1994, Recent dramatic changes in the Black Sea ecosystem: The reason for the sharp decline in Turkish anchovy fisheries, *J. Mar. Systems*, 5, 171-181.
- [69] King C., 2004a, *The Black Sea, A History*, Oxford Univ. Pressm 276 pp.
- [70] King C., 2004b, *Marea Neagră - O istorie*, D. Branea și C. Chevereșan (trad.), Ed. Brumar, Timișoara, 403 pp.
- [71] Knipovich V.N., 1933, *Ghidrologhiceskie issledovania v Cernom more (Cercetări hidrologice în Marea Neagră)*, Tr. Azovskgo-Cernomorskoi naucino promâslovoi ekspediții (Actele expediției științifice industriale din Marea Azov și Marea Neagră), Moskva, 10, 1-272.
- [72] Kroiss H., Zessner M., Lampert C., 2003, Nutrient management in the Danube

- basin and its impact in the Black Sea, Proceed. of IOI-BSOC Leadership Seminar, Mamaia, Romania, 27-29 September 2002, *J. Coastal Res.*, 19, 4, 898-906.
- [73] Kvet J., Salathé T., 2003, UNESCO (Man and Biosphere Programme) and Ramsar Convention, Mission Report, Danube Biosphere Reserve / Kyliiske Mouth Ramsar Site, Ukraine, 27-31 October.
- [74] Laking, P.N., 1974. *The Black Sea: Its Geology, Chemistry, Biology. A Bibliography*. Woods Hole Oceanogr. Institut., Woods Hole, Massachusetts, 368 pp.
- [75] Le Marquand D.G., 1977, *International Rivers: The Politics of Cooperation* (Vancouver, Canada: Wastewater Research Centre, Univ. British Columbia.
- [76] Lehrer M.G., 1989, *Ardealul pământ românesc (Problema Ardealului văzută de un american)*, Ed. Științ. Enciclop., ed. îngrijită de I. Pătroiu, 430 pp.
- [77] Lethier H., 2004, Council of Europe, Convention on the Conservation of European Wildlife and Natural Habitats, Standing Committee 24th Meeting, Strasbourg, 29 November-3 December, Possible New File, Shipping Canal in the Bystroe Estuary (Danube Delta, Ukraine), Report of the on-the-spot appraisal, 22-24 July, 17 pp.
- [78] Mamaev V.O., Aubrey D.G., Eremeev V.N. (Eds.), 1996, *Black Sea Bibliography 1974-1994*, GEF Black Sea Env. Progr., CoMSBlack / Woods Hole Oceanogr. Inst., Black Sea Environm. Series 1, UN Publ., New York, 364 pp.
- [79] Manea C., 2004, Diferendul româno-ucrainian privind împărțirea zonelor maritime din Marea Neagră trece într-o nouă frază - cea a justiției internaționale, *Marea Neagră*, 14, 4, 15.
- [80] *Marea Noastră*, 2004, Bâstroe - un canal al dezastrului ecologic, LNR, Redacția, 14, 3 (52), iulie-septembrie, 6-8.
- [81] Marin G. (coord.), 2005, *Marea Neagră: Spațiu de confluență a intereselor geostrategice*, Ed. Centr. Tehnico-Editorial al Armatei, București.
- [82] Marinescu A., 1987, The first Romanian scientific exploration of the Black Sea waters (1983), in *Ocean Sciences: Their History and Relation to Man*, Proc. 4th Int. Congr.
- [83] Marinescu A., 1993, Documents des archives roumaines sur l'expédition „Belgica”, *Noesis*, 18, 47-60.
- [84] Marinescu A., 1994, Grigore Antipa, savant à d'exceptionnels mérites d'organisateur, *Noesis*, 20, 139-146.
- [85] Marinescu A., 1997, Jules Guiart et Emil Racovitza, *Noesis*, 35-44.
- [86] Marinescu A., 1999, *Emil Racoviță și expediția "Belgica"*, Ed. All, București, 326 pp, 16 planșe.
- [87] Mee L., 1994, *Saving the Black Sea*, Editorial, Off. letter GEF-BSEP, 1, September 1.
- [88] Meinier B., 2002a, Prospects for Institutional Change in the Black Sea Catchment to Address Water Quality Problems,” Report No. 304 (Simon Fraser University, Canada, 93 pp.
- [89] Meinier, B., 2002b, The Quest for Integration: Prospects for Institutional Changes

- in the Black Sea Basin, *Cercet. mar. - Rech. mar.*, 34, 321-329.
- [90] Moisi P., 2003, Danube Environmental Forum (DEF) - A successful example of a River Basin Non-Governmental Organization, *13th Stockholm Water Symposium*, Abstracts vol., 11-14 August, Stockholm, Sweden, 145-148.
- [91] Moldoveanu M., Vasiliu F., Dima L., 1995, Some considerations regarding the status of the dolphins along the Romanian littoral of the Black Sea, 1st Meeting Black Sea Marine Mammals, Istanbul/Turkey, December 12-15.
- [92] Motaș C., 1948, Le professeur Emil Racovitza, *An. Acad. Rom., Mem. Sect. Șt.*, III, XXIII, 4, 95-96.
- [93] Murariu D., 2011, Grigore Antipa și Emil Racoviță - colegi, prieteni și proeminente personalități ale științei românești și mondiale, *Stud. comun./DIS*, IV, 63-79.
- [94] Murariu, D., 2016, *Les pinnipedes antarctiques. Recherches d'Emile Racovitza*, Oguz T. (Ed.), 2008, *State of the Environment of the Black Sea (2001-2006/7), Commission on the Protection of the Black Sea Against Pollution*, Istanbul, Turkey, 448 pp.
- [95] Papacostea Ș., Ciocâltan V., 2007, *Marea Neagră - Răspântie a drumurilor intercontinentale (1204-1453)*, Ed. Ovidius Univ. Press, 360 pp.
- [96] Pădurean D.I., 2004a, *Insula Șerpilor*, Ed. Muntenia, 557 pp.
- [97] Pădurean D.I., 2004b, Canalul Bâstroe - scandalul anului, *România liberă*, Dobrogea, 23 octombrie, 19.
- [98] Petranu A., (Ed.), 1997, *Black Sea Biological Diversity Romania*, GEF Black Sea Env. Progr., Black Sea Environment Series 4, UN Publ., New York, 314 pp.
- [99] Raport, 1924, E. Racoviță către I.G. Duca, 9 ianuarie, Arhivele de Stat, București, România.
- [100] Reshetnikov V.I., *Vodniy balans Chernogo morya i ego izmenenie pod vliyaniem khozyaist-vennoy deyatelnosti*, Diss., 150 pp.
- [101] Scarlat C., *Țărnul nevăzut al Mării Negre*, 1982, R. Vulpe (introd.), Ed. Militară, București, 135 pp.
- [102] Scarlat C., 1988, *Itinerare subacvatice la Istru și Pontul Euxin*, Ed. SPORT - TURISM, București, 179 pp.
- [103] Scrisoare, 1924, G. Antipa lui E. Racoviță, 12 iunie, Arhivele de Stat, București, România.
- [104] Scrisoare, 1925, C. Diamandi lui I.G. Duca, 13 martie, Arhivele de Stat, București, România.
- [105] *Strategic Action Plan for the Rehabilitation and Protection of the Black Sea*, Istanbul, Turkey, 31 October 1996.
- [106] Șerpoianu G., 1973, Le bilan hydrologique de la mer Noire, *Cerc. mar. - Rech. mar.*, 5-6, 145-153.
- [107] Șiaicariu V., Constantinescu D.S., 1920, *Atlasul istoric și geografic al neamului românesc*, 5.pdef.www.dacoromania.ro

- [108] Șuluțiu O., 1942, Radu Tudoran, Un port la răsărit, *Rev. Fund. Reg.*, 10 octombrie.
- [109] Tomescu C.C., nedatat, Notă despre vizita Comandantului Jacques-Yves Coasteau și a navei oceanografice *Calypso* la Constanța (6-9 octombrie 1977).
- [110] Ünlüata Ü., Oguz T., Latif M.A., Ozsoy E., 1990, On the physical oceanography of the Turkish Straits, in *Physical Oceanography of the Straits*, J.L. Platt (Ed.), NATO ASI Series, Kluwer Acad. Publ., The Netherlands, 25-60.
- [111] Vasiliu G., Manea G., 1987, *Istoria ihtiologiei românești*, Bul. Cerc. Pisc, Supl. I, Galați, 332 pp.
- [112] Vespremeanu E., 2004, *Geografia Mării Negre*, Ed. Univ. București, 236 pp.
- [113] Vespremeanu E., Golumbeanu M., 2018, *The Black Sea. Physical, Environmental and Historical Perspectives*, Springer Geography, IX, 150 pp.
- [114] Zaitsev Y.P., Mamaev V., 1997, *Marine Biological Diversity in the Black Sea. A Study of Change and Decline*, Black Sea Env. Progr., U.N. Publ., Black Sea Env. Series 3, 208 pp.
- [115] Zaitsev Y.P., Öztürk B. (Eds.), 2001, *Exotic Species in the Aegean, Marmara and Caspian Seas*, Turkish Marine Research Foundation Istanbul, Publ. No: 8, 265 pp.
- [116] Zinova A.D., 1967, *Opređeliteli zelenîkh, burîkh i krasnîkh vodoroslei iujnîkh morei SSSR*, Ed. Nauk, Moskva - Leningrad, 398 pp.
- [117] *Ziua*, 2004, Autocratul Kucima vrea sa câștige alegerile călcând peste pelicani, Eveniment, august, 4.
- [118] World Bank, 1992, *Romania - Environmental Strategy Paper*, Report No. 10613-RO, July 31, 122 pp.
- [119] xxx, 1957, *A Short Guide. The Black Sea Coast of the Soviet Union*, J. Gibbons (transl.), Y. Kopylov (illustr.), Foreign Languages Publ. House, Moscow, USSR, 183 pp. xxx, 2011, *International Symposium, Protection and Sustainable Management of the Black Sea Ecosystem, Third Millennium Imperative*, Vth ed., Book of Abstracts, Constanța, 29-30 Sept., Constanța, Romania, 125 pp.
- [120] https://ro.wikipedia.org/wiki/Marea_Neagră_spațiul_maritim_al_României
- [121] https://ro.wikipedia.org/wiki/Insula_Șerpilor-decizie-favorabila-României
- [122] <https://ro.wikipedia.org/wiki/Marea-Neagra>
- [123] <http://www.grid.unep.ch/bsein/redbook/index.htm>
- [124] <http://digitalizare.biblioteca.ct.ro/2020/09/02/bibliografia-dobrogei>
- [125] https://ro.wikipedia.org/wiki/Emil_Racoviță
- [126] <https://ultima-ora.ro/portile-deltei/>