

Development of marine biological institutions around the Black Sea

An overview

by Alexandru S. BOLOGA

Abstract

Biological research on the Black Sea had already begun by the end of the 18th century. In time, specialized research stations were created in all the countries around the Black Sea. Some of them were the nuclei of specialized research institutions, such as the one in Sevastopol (Ukraine), founded in 1963. Others had only a limited existence; nevertheless, they all contributed to a greater understanding of marine biota and their conditions of life. This paper reviews the main biology institutions created in Russia, the Ukraine, Romania, Bulgaria, Turkey and Georgia, presented in their chronological order and listed here in counter-clockwise order.

Key words

Black Sea, Marmara Sea, marine biology, marine research institutions

Introduction

The specialized literature includes numerous contributions on the development of marine biological research institutions and of oceanographic surveys. However, the history of scientific establishments around the Black Sea, which were devoted to providing a better knowledge of its unique hydrobiological environment, has received little attention. A more extensive treatment of this topic can be found in Bologa (1997). Figure 1 on next page is a map, showing the countries in which the institutions, discussed in this article, are found.

The Black Sea

The first recorded name of the Black Sea is 'Pontos Axeinos' (in Greek) derived from the Iranian word 'akseana' (meaning inhospitable). Later, as Greek colonies sprang up on the shores, the name 'Pontos Euxeinos' (friendly or hospitable sea) came into use.

Fig. 1. The Black Sea area



Herodotus, Polybius and especially Strabo refer in their papers to the Black Sea's western shore, the mouths of the Danube, and Serpent Island. Ptolemy mentioned it in his paper 'Geographica', and Seneca named it 'Pontos Scythicus'. Martial called that sea 'Mare Sarmaticum', Publius Ovidius Naso wrote for the first time about 'Pontos Euxeinus' in his poem 'Halieutikon' (on fish or fishing), and Marsigli wrote about the Danube sturgeons (Pora, 1977).

In the Middle Ages, Genovese sailors called this sea 'Mare Negro' (Black Sea), which name (in various translations) is still used to this day in the coastal states of the area and elsewhere. The sea is referred to, for example, as: 'Marea Neagra' in Romanian, 'Chornoe (pronounced: chor-no-yeh) More' in Russian, 'Chorne More' in Ukrainian, 'Cherno More' in Bulgarian, 'Kara Deniz' in Turkish and 'Shavi Sgva' in Georgian.

By the end of the 18th century, scientific studies of the Black Sea had commenced. The first oceanographic concerns pertained mainly to marine biology.

Russia and the Ukraine



Fig. 2. PALLAS, Peter Simon, 1741-1811
(Source: Russian Academy of Science)

Russian researchers (some were of German origin) commenced rather thorough investigations of the Black Sea in the late 1700s. Such researchers included the naturalists Peter S. Pallas (Fig. 2) (*Zoogeographica Rosso-Asiatica*, 1811), Karl Eduard E. Eichwald

(*Specilegia zoologica*, 1831), G. Ratke (*Beitrag zur Fauna der Krim*, 1837), M. Nordmann (Ichthyofauna, in A. Demidoff's *Voyage en Russie méridionale et Crimée par la Hongrie, la Valachie et la Moldavie*, 1854), V. Czerniavski (*Materialia ad zoographia ponticam comparatum*, 1868). Deserving special mention are K. Kessler's papers on marine fish (begun in 1858) and those in which he outlined (for the first time) the paleozoogeography of the Black and Caspian Seas. These concerns have naturally led to the idea of creating permanent bases for biological research around the Black Sea.

Nikolai Mikluho-Maklai, a well-known ethnographer and traveller, raised this issue during the second conference of Russian naturalists and physicians in 1868. This led Alexander O. Kovalevskiy, Ilya Mechnikov, Ivan Sechenov, and other members of the Novorossiisk county Naturalists' Society (established in 1870 and attached to the Novorossiisk University in Odessa) to create the nucleus of the first biological station in Odessa in 1871 (see History of Odessa Branch of IBSS at www.obibss.narod.ru/history/history.html), which was headed by Vasili N. Ulianin. Later it was transferred to Sevastopol. [Editors' note No. 1, end of article]. The Society not only created the first Pontic (Black Sea) biological station, but also produced a monograph drawn up at that station by S.M. Pereiaslvtseva ('Protozoa and Turbellaria'), which was published in 1892 in the station's *Bulletin*, marking a first in the relevant domain.

In 1878 the station's directorship was assumed by S. M. Pereiaslvtseva (she headed it for the next 10 years) and in 1889 by A. O. Kovalevsky, while Pereiaslvtseva continued working as the station's Chief Zoologist. After

her departure from Sevastopol in 1891, the latter position was taken over by A.A. Ostroumov. The station's main task in the field of marine exploration was to make an inventory of the flora and fauna of the southern Crimean waters. A first synthesis was written, including a list of 380 species and zoogeographical considerations, which is still considered valid by researchers.

Through the efforts of Nikolai Andrusov (Fig. 3), two expeditions, on the vessels *Chernomorets* (1890) and *Donets* and *Zaporozhets* (1891) were organized in order to conduct the first surveys in the deep waters of the Black and Azov Seas (Andrusov, 1891; Vinogradov, 1958). Among the most important results of this expedition was the discovery of large concentrations of hydrogen sulphide in the deeper layers of the Black Sea, which influence its biological diversity. I.B. Spindler, A.A. Ostroumov and V. Karavaeva took part in this expedition, which marked the beginnings of research efforts carried out by that station beyond the Sevastopol sector and even outside the Black Sea.

In 1892 the station was subordinated to the Russian Academy of Science. In 1902, the leadership of the station was taken over by Sergei A. Zernov, who extended the scope of the research from zoology to ecology and ethology. Benthic biocoenosis studies were included in a first monograph on that subject



Fig. 3. ANDRUSOV, Nikolai Ivanovich, 1861-1924
Source: Institute for the History of Science and Technology, Russian Academy of Science

for the Black Sea (1913). Nine types of biocenoses were established, in accordance with bottom nature and depths. Zoological research carried out in the station covered four fields: fauna (Ulianin, Pereiaslvtseva), anatomy-morphology (Kovalevsky), ecology (Zernov) and biological oceanography (Zernov, Vodianitsky).

The station's researchers made important discoveries on the circulation through the Bosphorus, the Black Sea hydrological budget, the origins of the Pontic flora and fauna, and zoogeographical topics. New monographs were published on the basis of collected samples, such as on Molluscs by Milaskevich in 1916, Nematodes by Filipiev in 1918 and Polychaetes by Jakubova in 1930 (as summarized by M.C. Bacescu in a public lecture on the marine biological stations around the Black Sea, at the Institut Océanographique, Paris, circa 1970).

The following Russian and Ukrainian marine research institutions developed over time: Odessa Zoological Station; the Karadag Biological Station; the V.M. Arnoldi Novorossiisk Biological Station; the A.O. Kovalevsky Institute of Biology of the Southern Seas, Sevastopol. The Biological Station (standing since 1871) at Sevastopol, became the nucleus of the new Institute of Biology of the Southern Seas (IBSS). The establishment of the Institute (belonging to the Ukrainian Academy of Science) was also the result of the merging, in 1963, of all the important biological stations of Odessa and Karadag. Its endowment and expansion into new research fields have enabled the Institute to continue its constant development.

Important monographs have been published. Examples are: the *Catalogue of Southern Seas Algae* (in Russian), by A.D. Zinova, in 1969, *Catalogue of Invertebrates from the Black Sea and the Sea of Azov* (edited by F.D. Morduhai-Boltovskoy, with contributions by Romanian specialists), fish catalogues and papers concerning the biology of various animal groups from the Black Sea. Some of these papers contain comparisons with animal groups from the Adriatic Sea or Indian Ocean.

IBSS now includes 17 departments, four of which are within the Odessa branch and 13 in Sevastopol. The Karadag Biological Station (a former branch of IBSS) is now part of the Karadag Natural Reserve. The main fields of activity are oceanography, hydrobiology, ecology, radioecology and mariculture.

Two research vessels, *Akademik Kovalevsky* and *Professor Vodianitsky*, are used for geophysical, hydrographical and biological research in various zones of the world. The IBSS library includes more than 15 000 volumes, various periodicals, microfilms and other audio-visual materials. Some universities from the Russian Federation and the Ukraine successfully continue the tradition of student practice at this Institute. IBSS also has an aquarium that is very attractive to both specialists and the general public.

Other marine biological institutions in the ex-Soviet Black Sea area include: the Odessa Branch of the A.O. Kovalevsky Institute of Biology of the Southern Seas, the Odessa University, the P.P. Shirshov Institute of Oceanology (Moscow) with its Southern Branch in Gelendzhik, the Institute for Fishery Oceanography (Kerch) and Kiev University.

In 1992, the present Ukrainian Scientific Centre for the Ecology of the Sea (UkrSCES) resulted from the development of the previous Odessa Branch of the State Institute of Oceanography, which in itself was a network of institutes of the former Soviet Union's Hydrometeorological Service (now the Russian Hydrometeorological Service, headquartered in Moscow). Since then, the Centre has been reoriented towards the ecological aspects of the marine environment. [Editors' Note No 2.]

The evolution of marine biological research in Russia and the Ukraine can be very briefly summarized as follows: (i) flora and fauna inventory and zoogeographical period (end of 18th century until the end of 19th), (ii) the ecological period (from then until 1917) and (iii) the modern period of complex research.

Romania

The participation of Emil Racovitza, as a biologist and oceanographer, in the Antarctic expedition on board the vessel *Belgica* (1897), marks the beginning of Romanian marine biology (Bologa, 1993; Bologa and Marinescu, 2002). [3] The first investigations on marine benthic algology (macro- and microphytes) belong to that initial period; they were included in *Plantas Romaniae hucusque cognitae, enumerat Augustus Kanitz: Algae auctore Julius Schaarschmidt* (1879-1881), followed by contributions by Paul Bujor (1900), Emanoil C. Teodorescu (1907), and Maria Celan (whose publications spanned the period 1930-1980).



Fig. 4. ANTIPA, Grigore

(Source: Grigore Antipa, *Hommage à son oeuvre*, Imprim. Nat., Bucharest [1938], 727 pp [In French])

Other events were the first Romanian expeditions to the Black Sea, organized by Grigore Antipa (Fig. 4) in 1893, 1894 and 1895 on-board the cruiser *Elisabeta*, with a view to collecting biological and especially ichthyological samples. From the beginning of the 20th century, G. Antipa wrote on important studies on the Black Sea fish (clupeids and sturgeons) and on fisheries. Antipa was invited by Albert I, Prince of Monaco, to participate in the first meeting for the creation of the International Commission for the Scientific Exploration of the Mediterranean Sea (CIESM) in 1910 but did not attend the meeting. Nevertheless Romania could be considered as among CIESM's

founding states (Bologa, 1993; Bologa and Marinescu, 2002) and E. Racovitza was elected in 1925 as first national representative to that Commission.

The mechanisms of bioproductivity in the northwest region of the Black Sea were explained by G. Antipa in his monograph, *The Black Sea. Oceanography, Bionomics and General Biology of the Black Sea* (1941), which is considered useful to this day.

International scientific cooperation (especially with the former USSR and Bulgaria) in marine biology started in 1953 and concerned studies on the benthic communities, microphyto- and zoobenthos, as well as fish feeding and migration.

A first Romanian bibliography on marine biological research was produced by Mihai C. Bacescu under the aegis of the UNESCO National Commission (1965). This was enlarged by Mihai Semenescu (editor) of the former State Water Council (1966). An updating by Alexandru S. Bologa and Teodor M. Cristescu within the framework of the Cooperative Marine Science Program for the Black Sea (CoMS-Black) followed in 1994 (cf. Mamaev et al., 1996).

The following Romanian marine research institutions are worth mentioning in the framework of their historical development: the 'Prof. Ioan Borcea' Marine Zoological Station, Agigea; the Bio-oceanographic Institute, later on named 'Dr Grigore Antipa' Marine Research Station, Constantza; the Oceanology Laboratory of the 'Traian Savulescu' Institute of Biology, Bucharest; and the Romanian Marine Research Institute, Constantza.

Most of the Romanian marine research institutions have finally merged into a national specialized institute, namely the Romanian Marine Research Institute (RMRI), founded through the efforts of M.C. Bacescu and Eugen A. Pora in 1970 (Serpoianu, 1976; Bologa, 1990). The merging within RMRI of the human, material and informational resources available along the Romanian seashore was intended to increase the efficiency of the research activity in this field. During its first ten years, RMRI, as an interdisciplinary unit, belonged to the National Council for Science and Technology. After 1980, the Institute was successively subordinated to the Ministry of Education (1981), the Ministry of Agriculture and Food Industry (1982) and the Central Office for Fisheries and Fish Processing. After the Romanian Revolution of December 1989, RMRI was affiliated to the Ministry of Environment, created in 1990 and later on re-named the Ministry of Waters, Forests and Environmental Protection.

Immediately after its foundation, RMRI was organized into specialized laboratories: hydrology and pollution, ecology, ichthyology, fishing techniques, geology and technology. The research teams, the administration and ancillary unit previously existing in separate places (Constantza, Agigea) were housed in one building in 1980.

The creation of RMRI was beneficial and had an important contribution to the progress and diversification of the Romanian marine research through the: (i) continuation and intensified study of physical, chemical, biological, and fishery oceanography; (ii) investigations into new oceanographic fields

(e.g. marine pollution, geology, technology); (iii) specialization in various fields of scientific and practical interest in Romania and/or abroad; (iv) enrichment of the specialized library; (v) organization of surveys beyond the Black Sea region; (vi) continuous development of international cooperation through international organizations, conventions and research contracts; and (vii) response to requirements from economic sectors involved in the knowledge, exploitation and protection of the marine environment (minerals, oil and gas deposits, the Danube-Black Sea Canal, harbour facilities, industrial units, fishery in the Black Sea and in several areas of the world ocean, and others).

In operation now for 28 years, RMRI's facilities have included a main building with laboratories, services and annexes, a 570 HP research vessel *Steaua de Mare 1* ('starfish 1') for research and experimental fishing, a 150 HP research vessel *Palamida* for coastal research, the multi-purpose 150 HP motor-boat *Exploratorul*, two land experimental stations for aquaculture (Ovidiu, Istria), a nuclear unit, a computer office, a specialized library and a prototype workshop.

The main research area has always been the Black Sea, especially its Romanian sector, in the following main research domains: (i) seashore morphodynamics and sedimentology; (ii) marine hydrology, physics, chemistry and biochemistry; (iii) marine biology and microbiology; (iv) marine ecology and radioecology; (v) applied ecology and aquaculture; (vi) applied pollution studies; (vii) management of marine fishery resources; (viii) marine engineering and technology;

and (ix) ecological protection and improvement of littoral lakes.

RMRI is the coordinator of most marine research activities in Romania and also the national focal point in relation with numerous foreign partners in matters concerning marine sciences (CIESM, FAO, GEF). At the national level, the research projects are carried out within the framework of the National Programme for Ecology and Environment Protection through its sub-programme, Marine Environment.

Regarding the present degradation of the ecological state of the Black Sea, issues of primary concern are beach erosion, the increase of the eutrophication and of the planktonic biomasses as well as the decrease of biodiversity and biological resources (Bologa et al., 1993). RMRI is also engaged in regional research and management programmes for the Black Sea (e.g. CoMS-Black, GEF, Phare, NATO, EROS 2000/21), and bilateral scientific and technical cooperation with the specialized institutions around and beyond the Black Sea (e.g. France, Greece, China, IAEA). It also participates in various conventions concerning that semi-enclosed marine basin (i.e. the Black Sea), which in recent years has been seriously threatened from the ecological point of view (Bologa, 1991-92).

Other services include access to the library (Bologa and Suman, 1993), scuba activities and educational support (e.g. university courses, training, granting of MSc, PhD and other degrees). RMRI has a yearly scientific publication, *Cercetari marine - Recherches marines*, and its specialists are also authors or co-authors of other scientific pub-

lications such as *Biologie des eaux saumâtres de la mer Noire*, vol. 1-2, RMRI, Constantza (1977), *Treatise on Algology*, vol. 1-4, Ed. Acad., Bucuresti (Bucharest) (1976-1981), *Marine Primary Productivity*, Ed. St. Enciclop., Bucuresti (Bucharest) (1987).

Other major Romanian institutes studying the Black Sea are the Institute of Biology (Bucharest), the Romanian Centre for Marine Geology and Geoecology (Bucharest and Constantza), the Danube Delta Research and Design Institute (Tulcea), the University of Bucharest, the University of Iassy, and Ovidius University in Constantza.

Bulgaria

For historical reasons, in Bulgaria the creation of marine biological stations was more difficult and occurred later than in Russia, the Ukraine and Romania. The Marine Biological Station (MBS) with its aquarium was founded in 1932 in Varna. The most important early faunistic studies were published by G. Chichkoff (1912), who prepared a list of 249 animal species, including vertebrates that he had identified. Together with Russian and Romanian researchers, A. Paspalev (1933), who had visited the Bulgarian coast, published data on the distribution of some representative species of the Black Sea fauna. From 1932 to the end of 1954, nineteen volumes, produced by the MBS, were published. Most of the publications are devoted to the species composition of the flora and fauna as a basis for community-level research and to clarify the trophic resources for fish in the Black Sea. The faunistic data that had been collected

were summarized in the *Catalogue of Bulgarian Black Sea Fauna* by A. Valkanov and T. Marinov (1955), which was followed by two further editions in 1964 and 1982.

In 1954 the Scientific and Research Institute of Fisheries was founded, based at the Marine Biological Station. Later the name was changed successively to the Research Institute of Fisheries and Oceanography, Institute of Fisheries, and Institute of Fisheries and Aquaculture (as it is called today), belonging to the National Centre for Agricultural Sciences. Through perennial biological investigations, evaluations of seasonal phytoplankton, zooplankton, zoobenthos, qualitative and quantitative composition and distribution have been carried out and fish resources monitored. The results obtained have been published in 22 volumes (*Proceedings of the Institute of Fisheries*).

Biological and ecological investigations were reinforced in 1989 with the founding of the Marine Biology and Ecology Department within the Institute of Oceanology of the Bulgarian Academy of Sciences. The research covers: (i) marine flora and fauna monitoring in parallel with the development and implementation of marine biodiversity studies, (ii) conservation and restoration measures (artificial reefs, protected areas and marine reserves), (iii) development of a system of chemical and biological indicators for assessment of marine environmental quality, (iv) eutrophication and pollution impact assessment and (v) sustainable exploitation of Black Sea living resources.

The scientific staff are involved in many national and international projects such as

the: (i) National Action Plan for Biodiversity Conservation; (ii) Bulgarian-Swiss Biodiversity Conservation Programme, and (iii) environmental management of fish resources in the Black Sea and their rational exploitation. The results obtained are presented in more than 100 publications in the volumes of *Compt. Rend. Acad. Bulg. Sciences*; CIESM, NATO ASI Series; UN Publications, Black Sea Environmental Series, FAO etc.

The main goals of the current EC FFP Project 'Centres of Excellence' are restructuring the research and expert activities and are targeted toward long-range sustainable development of the Black Sea region in the context of integrated environmental, economic and social problems through: (i) increased regional and international cooperation and networking; (ii) providing user-friendly information media and a 'Tool-box' of measures ('strategy') for sustainable development and management of the Black Sea region; and (iii) improving the quality of the marine environment and quality of life in harmony with the EC standards and environmental policies as a contribution to the call for confirming the international role of Community Convention on Biodiversity, the EU Council Directive on Water Policy, and implementation of the Black Sea Strategic Action Plan.

Turkey

While the northern half of the Black Sea has an abundance of data available on marine biology, the same cannot be said about the southern part, where the data are much more scarce. On occasion, the Rus-

sians and Romanians have collected quantitative and qualitative data on the biocenoses of the Turkish sector, as the creation of their institutions with a biology profile is more recent.

In Turkey, the marine biological activities started in 1933 at the Fishery School in Istanbul. This school ceased its activities in 1940, but its initial investigations there were taken over by the General Directorate of Fisheries (Trade Ministry).

The Institute of Hydrobiology of the University of Istanbul was created in 1952 and carried out biological research in the Black and Marmara Seas until 1980. Initially it also created a branch at Trabzon – the School of Marine Sciences and Technology.

Specialized research including marine biology began in 1985 after the creation of the Institute of Marine Sciences at Erdemli (1975), as part of the Middle East Technical University (METU). One of its main divisions deals with Marine Biology and Fishery. For example, an international project evaluates the impact of rapid ecological changes in the biological productivity of the Black Sea by utilizing satellite data from SeaWIFS and the CZCS.

The Trabzon Fisheries Research Institute (1987) within the jurisdiction of the Ministry of Agriculture and Rural Affairs should be mentioned; its main aims are to carry out scientific studies in inland and marine environments, to determine the potential of aquatic resources, size of fish stocks and fishing fleets, to develop aquaculture and to provide technical and practical information to the fishing community, including fish farmers.

Contributions to the study of the Black Sea biology in Turkey, in cooperation with various other organizations, are made primarily by the Istanbul Technical University, the Marmara University, the Bogazici University and the Environmental Research Centre. The Institute of Hydrobiology of the Aegean University (1965) and the Institute of Marine Sciences and Technology of the Dokuz Eylül University in Izmir (1976) have also carried out some biological investigations in the Black Sea.

Georgia

Marine research in Georgia got its start during the mid-sixties (former Soviet period); its primary objective was the preparation of an adequate professional staff of the Faculty of Biology at Ivane Javakhishvili Tbilisi State University, in the zoology branch. As well, studies on both marine and freshwater life have been traditionally carried out at the Georgian Branch of the Southern Research Institute of Sea Fisheries and Oceanography (Georgian Branch of YugNIRO) since its establishment. The major aims of the scientific activity of the latter branch have been the: (i) reproduction of fish stocks (sturgeon, salmon, and carp species); (ii) development of biotechnologies for marine and fresh-water aquaculture objectives, such as breeding and rearing fish; (iii) development of state-of-the-art technologies; and (iv) investigations into the etiology and development of methods for the prevention of diseases affecting marine fish and mammals.

In addition, the research branch had a demonstration complex, which was one of the major places of interest in the country. Beginning in 1975, one programme showed how dolphins amazed and amused the general public with their abilities. For fifteen years they routinely performed simple and complex feats. Unfortunately, the dolphinarium is now inactive.

The Marine Ecology and Fishery Research Institute (MEFRI), established in Batumi (1931), was famous for its aquarium and dolphinarium (which were closed in



Fig. 5. Black Sea Regional Activity Centre for Biodiversity Conservation in Batumi, Georgia
(Source: <http://mefri.iatp.org.ge/>)

1988). The Institute is comprised of the following research groups: (i) aquatic resources and stock assessment, (ii) ichthyology and aquaculture, (iii) hydrobiology and applied ecology, and (iv) marine ecotoxicology and environmental monitoring. MEFRI has been designated as the Regional Activity Centre for Biodiversity Conservation under the Black Sea Environment Programme (see Fig. 5).

For the last few years in Georgia, the institutional structure for environmental pro-

tection has undergone some significant reorganization. The Ministry of Environmental Protection and Natural Resources is the State Body responsible for the environment and the sustainable use and regulation of natural resources. The ministry leads the coordination in this sphere in terms of international relations, cooperation, and also for the activity of the State, scientific and public organizations.

Most importantly, the latest marine research-related programmes, including biology issues have been identified as follows: (i) Restoration of Sturgeon Populations at the Black Sea Coast of Georgia (Biodiversity Conservation Department of the Ministry of Environment); (ii) TACIS Black Sea Biodiversity Project (Batumi Black Sea Biodiversity Regional Centre); and the (iii) National Black Sea Strategic Action Plan (Ministry of Environment and Centre for Environmental Research). [Editors' note No. 4].

Results of international and regional activities

Various marine biology-related research activities, programmes and databases are being carried out in the Black Sea at bilateral, multinational and regional levels, usually with the participation of almost all the riparian countries. Examples are as follows (Bologa, 1999):

I. Completed

- (i) Cooperative Marine Science Program for the Black Sea (CoMSBlack);
- (ii) Ecosystem Modelling as a Management Tool for the Black Sea: A

Regional Program of Multi-Institutional Cooperation (NATO-TU-Black Sea);

- (iii) Investigation between the River Danube and the Northwestern Black Sea (EC/EROS 2000);
- (iv) Biogeochemical Interactions between the Danube River and the Northwestern Black Sea (EC/EROS 21);
- (v) Black Sea Mussel Watch Pilot Study (IOC/Plymouth Marine Laboratory, U.K.);
- (vi) CIESM Bibliographic Data Base (1984-1998), version 3.0 (1998);
- (vii) Black Sea Environmental Program (GEF/UNEP, UNDP, World Bank) and
- (viii) NATO TU-Black Sea Project Database Inventory, version 2.0 (1998).

II. Ongoing

[see editors' note No 5]

- (i) Black Sea Ecosystem Processes and Forecasting / Operational Database Management System (NATO SfP-971818)

Recent literature and other information sources

Among the most relevant recent scientific publications regarding the biodiversity of the Black Sea is *Marine Biological Diversity in the Black Sea. A Study of Change and Decline* (Zaitsev and Mamaev, 1997). The present status quo of the Black Sea biological diversity is best reviewed in the Romanian, Bulgarian, Ukrainian and Georgian National

Reports published in the Black Sea Environmental Series, No. 4, 5, 7 and 8, edited by Adriana Petranu (1997), Asen Konsulov (1998), Yuvenali P. Zaitsev and Boris G. Alexandrov (1998), Akaki M. Komakhidze and Nikolay Mazmanidi (1998), respectively. Many relevant references on the Black Sea ecosystem, its organisms and their biology are cited in the *Black Sea Bibliography 1974-1994* (Mamaev et al., 1996).

The *Black Sea Red Data Book*, created within the Black Sea Environment Program (BSEP), by contributions from marine research institutes in Varna (Bulgaria), Odessa, Simferopol and Melitopol (Ukraine), Constantza (Romania) and Istanbul (Turkey), is available on the Internet (<http://www.grid.unep.ch/bsein/redbook/index.htm>) with an index for all species (160), plantae (43), spongia (1), coelenterata (1), polychaeta (2), insecta (4), halacaridae (1), custacea (29), mollusca (5), echinodermata (1), acvania (1), pisces (41), aves (25) and mammalia (6).

Three other major achievements for the Black Sea in the last decade, representing sources of comprehensive information on all organizations working in the Black Sea Region, as well as useful information sources on the Black Sea environment are the: (i) Black Sea Geographic Information System (GIS), (ii) Black Sea Information System, and the (iii) Black Sea Environmental Internet Node (www.grid.unep.ch/bsein/). ■

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Alexandru S. BOLOGA

Romanian Marine Research Institute
Mamaia 300
RO-8700 Constantza 3
P.O. Box 312, Romania
E-mail: abologa@alpha.rmri.ro
Tel: +40 241 543288
Fax: +40 241 831274
Website: <http://www.rmri.ro>

Editors' notes

1. In his paper the author refers to a publication by the Ukrainian scientists from Odessa, and states that the first biological station in the Black Sea region was established in Odessa, in 1871. Other sources (see the following paper by Y. Tokarev in this volume) indicate that this same station was established, the same year, in Sevastopol. The editors are not in the position to provide any judgement on the matter but would like to urge specialists in the history of science from the National Academy of Science of the Ukraine to clarify the matter. However, the editors see a certain logic in establishing a station in

Sevastopol as a field base for visiting biologists away from their home city (Odessa), as was proposed indeed by Nikolai Mikluho-Maklai in 1868 at a conference in Moscow. Also, for marine biological research, the environmental conditions in the coastal Crimea (such as the presence of numerous small bays, rocky shores, steep underwater slopes, but no river inputs and very limited land-based pollution of coastal waters) were more favourable indeed as compared to the conditions in a wide and shallow bay in front of Odessa, a big city neighbouring with marshes.

2. Among the institutions of the Russian Federation dealing with the marine biology matters of the Black Sea, one should add the Azov Research Institute of Fishery (AZNI-IRKH) in Rostov-on-Don, as well as the A.N. Severtsov Institute of Ecology and Evolution (Tobolsk), which belongs to the Russian Academy of Sciences.
3. Regarding Racovitza, see mention in article by R. Charlier (p. 373) and photo of statue on Plate 6 in colour section.
4. Among the latest marine research-related programmes in Georgia one should mention a programme on the Black Sea Harmful Algal Blooms (a contribution to the IOC programme on Harmful Algal Blooms, HAB) executed by the Faculty of Biology at Tbilisi State University. Georgian scientists contributed recently to studies of the Black Sea biodiversity; thus in 1998, the National Report on Biodiversity of the Black Sea was issued, and in 2001 a monograph on the Black Sea fauna was published by N. Mazmanidi, a researcher from the Marine Ecology and Fishery Research Institute (MEFRI).

[Source: I. Khomeriki, Tbilisi University, Georgia.]

5. Regarding the international undertakings in the Black Sea region, the Black Sea Environmental Programme has been completed and a new UNDP/GEF Black Sea project started, entitled 'Control of eutrophication, hazardous substances and related measures for rehabilitating the Black Sea ecosystem: Phase 1'. Another important ongoing regional project is the 'Strategic Partnership for Nutrient Reduction in the Danube River and Black Sea' supported through the World Bank-GEF Nutrient Reduction Investment Fund.

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