

REPORT ON THE STATE OF THE MARINE AND COASTAL ENVIRONMENT IN 2013

**DIRECTOR,
Eng. Simion NICOLAEV, PhD**

**SCIENTIFIC DIRECTOR,
Eng. Tania ZAHARIA, PhD**

**The following researchers brought their input to this material:
*L. Alexandrov, L. Boicenco, V. Coatu, D. Diaconeasa, C. Dumitrache,
M. Golumbeanu, L. Lazar, V. Malciu, O. Marin, R. Mateescu,
V. Maximov, D. Micu, E. Mihailov, M. Nenciu, S. Nicolaev, V. Nita, A. Oros,
V. Patrascu, A. Spinu, E. Stoica, C. Tabarcea, F. Timofte,
D. Tiganus, T. Zaharia***

Copyright © 2014 NIMRD. All rights reserved.

Copying this document and the use or transmission of its contents are not permitted without the written consent of NIMRD.

*For any further information on the
STATE OF THE MARINE AND COASTAL
ENVIRONMENT IN 2013,
please contact NIMRD Constanta
E-mail: office@alpha.rmri.ro*



CONTENTS

- 1. Marine protected areas** (*V. Nita, M. Nenciu, T. Zaharia, A. Spinu*)
 - 1.2. Marine habitats (*V. Nita, D. Micu, T. Zaharia*)
- 2. State of marine ecosystems and marine living resources.**
 - 2.1. State of Black Sea waters
 - 2.1.1. Physical indicators
 - Sea state (*E. Mihailov*)
 - Temperature (*E. Mihailov*)
 - Water masses (*E. Mihailov*)
 - Upwelling phenomena (*E. Mihailov*)
 - 2.1.2. Physical-chemical indicators
 - Transparency (*L. Lazar*)
 - Salinity (*L. Lazar*)
 - pH (*L. Lazar*)
 - Dissolved oxygen (*L. Lazar*)
 - 2.1.3. Eutrophication indicators
 - Nutrients
 - Phosphates (*L. Lazar*)
 - Nitrates (*L. Lazar*)
 - Silicates (*L. Lazar*)
 - Chlorophyll *a* (*L. Boicenco*)
 - 2.1.4. Contamination indicators
 - Heavy metals (*A. Oros*)
 - Total Petroleum Hydrocarbons (*D. Tiganus*)
 - Polycyclic Aromatic Hydrocarbons (*D. Tiganus*)
 - Organochlorine pesticides (*V. Coatu*)
 - Marine environment radioactivity (*V. Patrascu*)
 - Microbiological load (*E. Stoica*)
 - 2.2. State of the ecosystem and marine living resources.
 - 2.2.1. State of the littoral and coastal zone
 - Coastal processes (*A. Spinu, D. Diaconeasa*)
 - Sea level (*V. Malciu*)
 - 2.2.2. State of the marine ecosystem
 - Phytoplankton (*L. Boicenco*).
 - Algal blooms (*L. Boicenco*)
 - Zooplankton (*F. Timofte, C. Tabarcea*)
 - Phytobenthos (*O. Marin*)
 - Zoobenthos (*C. Dumitrache*)
- 3. State of marine fish stocks**
 - 3.1. Marine living resources indicators (*V. Maximov*)



3.2. Measures for solving critical issues

(S. Nicolaev, V. Maximov)

4. Integrated Coastal Zone Management *(M. Golumbeanu, S. Nicolaev)*

5. Maritime Spatial Planning *(L. Alexandrov, M. Golumbeanu, G. Radu, A. Spinu).*

6. Anthropogenic pressures *(R. Mateescu)*

SUMMARY

The **Report on the State of the Marine And Coastal Environment in 2013** is a complex work, summing-up the result of a large team of experts from NIRDEP - NIMRD "Grigore Antipa" Constanta. It is an overview of the current status of the Romanian Black Sea ecosystem, structured on chapters and substantiated by the most novel scientific data available.

The state and evolution trends of the marine and coastal environment in the **Vama Veche - 2 Mai Marine Littoral Aquatory (ROSCI0269**, under NIMRD's custody) continued to be monitored in 2013, from the physical, chemical and biological point of view. No extraordinary events, likely to modify/alter marine habitats, were recorded within the Vama Veche - 2 Mai Marine Littoral Aquatory area. The monitoring of the marine environment did not point-out any alarming parameters concerning species and habitats in the reserve. No particular issues were reported in the relationship with tourists in the beach area of the reserve, nor with local authorities, who were supportive with the custodian.

The **monitoring of marine habitats** in 2013 was made by NIMRD within the project "Services for monitoring the conservation state of Community interest marine species and coastal and marine habitats in Romania" (financed through the Environment Sectoral Operational Program), in compliance with the European Commission's requirements for reporting based on Article 17 of the Habitats Directive.

The evolution of the main **hydrological indicators** at the Romanian coast and on the Romanian coastal shelf was determined, in 2013, based on the observations and measurements of parameters such as: sea state; seawater temperature, from the network comprising 35 stations located in the Sulina - Vama Veche area.

The **sea state** is a result of waves higher than 1 m. From this perspective, in 2013, the sea state was smooth in June (8.89%) and December (8.60%), with wind waves, and moderate during the other months (except for July and October, with a maximum of 33.33% and 40.22%, respectively). The maximum sea state on the Beaufort scale was 5-7 (maximum wave height 3.1 m) and was recorded in October 2013.

Seawater temperature in Constanta in 2013 was 1.13°C higher as compared to the reference period (1959 - 2012).

Three typical **water masses** were identified in the Western Black Sea in 2013: the upper quasi-homogeneous layer (UQL), cold intermediate layer (CIL) and the seasonal thermocline. During the warm season (August), the cold intermediate layer reaches depths beyond 30 m.

In spring-summer, an **upwelling** process was recorded in the coastal area with a duration of 24 days, caused by prevalent western and south-western winds. The surface seawater temperature dropped by 6.7°C in 24 hours. Satellite images also caught intensive algal blooms phenomena in mid June, in the north-western corner of the Black Sea.



The **physical-chemical indicators** investigated in 2013, with the aim of monitoring the quality of transitional, coastal and marine waters of the Romanian Black Sea coast, were obtained as a follow-up of analyzing 144 waters samples from the surface and the water column (0-50 m). The main physical-chemical and state indicators which characterize and regulate the eutrophication level were analyzed, namely: transparency, salinity, pH, dissolved oxygen, inorganic nutrients.

The **seawater transparency** values in 2013 emphasized the high variability range of marine waters, which, in the north, are still under the influence of river input. The salinity of surface waters framed within the specific variability range of the Romanian Black Sea waters, being mainly influenced by freshwater river input, lower in the summer of 2013, and water mass mixing phenomena, more intense in spring.

During the studied period, the surface layer waters of the Romanian coast were well **oxygenated** in all three water bodies. In the water column, there were values below the allowed limit (80%), both for the ecological state and the human activity impact area in Order 161/2006. No anoxia phenomena were recorded. The **pH** of Romanian Black Sea waters recorded normal values.

Phosphate concentrations in Romanian Black Sea waters recorded, during 2013, values close to the reference period of the 1960s. **Nitrate** concentrations continued to drop, recording the lowest mean historical value during 1976-2012. **Silicates** recorded low values, with higher concentrations in the Danube influence area and in the water column. In coastal waters, the influence of the Constanta South Waste Water Treatment Plant is felt in what concerns nutrients, which generally recorded concentrations exceeding the natural variability range of Romanian Black Sea waters. Overall, the trend at the Romanian coast is of decreasing river and nutrient input.

The distribution of **heavy metals** in marine waters, sediments and mollusks along the Romanian coast pointed-out some differences between various sectors of the coast, generally higher concentrations being recorded in coastal zone subjected to anthropogenic pressures (harbors, waste water discharges), as well as in the marine zone under the direct influence of the Danube.

In 2013, the mean values of **Total Petroleum Hydrocarbons (TPH)** in the analyzed environmental components (water and sediments) were within the variation limits of the period 2010-2012, timeframe with a decreasing contamination trend compared to 2006-2009.

The **Polycyclic Aromatic Hydrocarbon (PAHs)** pollution level in water in 2013 is significantly lower compared to the period 2006-2007 and continues the decreasing trend of PAH concentrations of recent years (2008-2012). The low values of the total toxicity equivalent of benzo[a]pyrene -Total B(a)P_{eqv} ($\mu\text{g l}^{-1}$) - and the benzo[a]pyrene concentrations determined, not overtaking the maximum allowable limit of 0.05 ($\mu\text{g l}^{-1}$) set by the EC Regulation no. 208/2005, point-out a low likely and potentially carcinogenic Polycyclic Aromatic Hydrocarbon contamination in all water samples. The quality assessment of Romanian Black Sea sediments for 2013 revealed that 31% of sediments are chronically polluted - contaminant concentrations are at levels at which there is an unacceptable risk for likely chronic long term effects in marine species - red - and 19% moderately polluted - green. The indices calculated in order to



identify pollution sources show oil pollution in two stations in the northern part of the Romanian coast and pyrolytic pollution in the Constanta South 5 m station (influence area of the waste water treatment plant).

Concerning **organochlorine pesticides**, in 2013, Romanian littoral waters were dominated by HCB and lindane, while in sediments higher concentrations were measured for several compounds in the Gura Buhaz and Costinesti areas. The bioaccumulation of organochlorine pesticides was more severe in the species *Mitylus* and *Rapana*. Frequent overtakings of the threshold values proposed for defining the Good Environmental Status of water were recorded both in the northern and southern sectors, while in sediments - especially in the northern area.

The results of the **radioactivity** of the marine environment components were achieved within the project BS ERA NET 041 "Radiation background of Black Sea coastal environment (RACE)" and were included for the first time in the Report on the State of the Marine and Coastal Environment. The activity level of tritium in seawater is, on average, below 10 UT, being largely influenced by river and rainfall input. Marine processes act as homogenizing and reducing factors, diminishing the impact of radioactivity off the Danube mouths, from north to south and from shore towards the offing. The constant values of the marine environment are close to the natural radioactivity background and do not pose any threat to the environment and human health. The activity of tritium in seawater measured for 2012 and 2013 ranged between 3-28 UT, pointing-out the freshwater input. These values are almost half of those measured 17 years ago and are comparable with values recorded in rainfall. The southern part of the coast, even to the Bulgarian-Turkish border, is relatively more homogeneous both at surface, and in the water mass (depth 20 m), a mean value of 6.5 UT being measured. The organically bound tritium (in fish) recorded a level comparable with that of the water. The mean C-14 activity measured in seawater was 0.25 Bq/gC, within the normal environmental background limits. The K-40 natural radionuclide is present in marine living resources with values ranging between 45-270 Bq/kg fw, its content depending on the specificities of each organism. The Cs-137 fission product recorded values between 0.2-1.3 Bq/kg fw in marine living resources, well below the threshold for food consumption. In sediments, Cs-137 occurred at a level ranging between 1-5 Bq/kg dry weight. Relatively higher values were recorded in wet sediments, which may reach dry land under the action of waves and winds. The dose rate of ionizing radiations measured in the coastal zone recorded values ranging between 33-198 nSv/h (within the range of the local natural radiation background), being lower in the beach area. There is an increasing trend northwards, and values up to 200nSv/h can be encountered on areas covering maximum 1-2 sqm on the Chituc Levee, the main input being the natural radionuclides (Ra-226) carried by the richer river sediments.

The **microbiological load**, a state indicator of contaminants in the marine environment, was good in the southern part of the Romanian Black Sea during 2013; the concentrations of enteric bacteria [total coliforms (TC), faecal coliforms (FC), faecal streptococci (FS)] were generally found varying below the limits of the National Regulations and EC Bathing Water Directive and the values indicating the level of faecal pollution of bathing seawater.

Coastal processes were also monitored. For the northern shoreline, accumulation areas covered ~ 91 ha, while erosion areas ~ 120 ha. Shoreline advancement on distances > 10 m was recorded on $\sim 24\%$ of the total length, shoreline retreat by > 10 m on $\sim 30\%$, the remaining shoreline (46%) being in dynamic balance, as the shoreline retreated or advanced by less than ± 10 m. Concerning the southern part of the Romanian Black Sea coast, during 30 September - 2 October 2013, the hydro-meteorological conditions amplified and wind blew with a speed beyond 10 m/s, with maximum speeds up to 30 m/s, especially from the N, E and NW. Under such severe circumstances, the cliffs were affected in the southern part of the Romanian coast, as land slides, collapses and torrent formation occurred.

Sea level, as one of the coastal zone state indicators, was characterized in 2013 by the occurrence of high levels, above the 1933-2012 multiannual mean. The 2013 mean was the third highest annual value recorded during 1933-2013.

Overall, 2013 was characterized by a poor development of the **phytoplankton** community, the annual mean of the phytoplankton amounts in the surface horizon ($39.67 \cdot 10^3$ cells \cdot l $^{-1}$ and 0.37 g \cdot m $^{-3}$) being smaller than the mean values recorded in 2012 ($82.84 \cdot 10^3$ cells \cdot l $^{-1}$ and 0.40 g \cdot m $^{-3}$).

In 2013, five species recorded values higher than one million cells per liter, more than in 2012 (three species), but fewer compared to 2010 (8 species). Among these, the species *Skeletonema costatum* recorded the maximum density in the shallow waters of Mamaia ($4 \cdot 10^6$ cells \cdot l $^{-1}$) in February.

In 2013, the total **zooplankton** was dominated by the fodder component, which recorded mean densities and biomasses higher than the past years. From the qualitative point of view, in summer, the dominant group were copepods, followed by cladocerans. The copepods *Acartia clausi*, *Oithona davisae*, *Oithona similis* and *Centropages ponticus*, the cladocerans *Penilia avirostris*, *Pseudevadne tergestina* and *Evadne spinifera*, the appendicular *Oikopleura dioica* and the chaetognathe *Parasagitta setosa* were constantly present in the analyzed samples. Among alien species, the ctenophores *Mnemiopsis leidyi*, *Beroe ovata* and the copepod *Oithona davisae* were documented.

Based on the qualitative analysis, in summer 2013, 23 **phytobenthos** taxa were identified. Phanerogam plant associations are considered ecological niches highly important for the marine ecosystem. At the Romanian coast the following marine phanerogams are encountered: the *Zostera noltei* monospecific plant association (north - Navodari, south - Mangalia), the *Zostera noltei* - *Stuckenia pectinata* plant association (in Navodari), as well as areas covered by *Zannichelia palustris* (species documented during the 2013 summer season in the extreme south, in Vama Veche). The fresh biomass for *Zostera noltei* in Mangalia, on the meadow covering the seabed between 1-3 m, was similar to the previous year, being an indicator of the fact that the regeneration of the species is continuous. The *Cystoseira barbata* meadows continue the regeneration process documented in recent years (tall specimens, high fresh biomasses, especially in the deeper horizons 2-3 m. However, the species remains very sensitive to anthropogenic activities. As a follow-up of the quantitative analysis of the samples collected from the Romanian coast in 2013, the clear prevalence of perennial sensitive species, indicators of a higher ecological quality areas, with a higher species diversity, in



the southern part of the littoral was recorded, while opportunistic species were dominant in the north. During the 2013 summer season, the photophilic associations *Cladophora vagabunda* - *C. sericea*, *Ulva* ssp. - *Ceramium* ssp. were frequent. These were the species forming the algal deposits washed-out on shore during the summer season.

Zoobenthos, as eutrophication status indicator, still showed a constant evolution, in terms of species diversity. The qualitative assessment in all monitored areas (Sulina- Vama Veche) has led to the record of 56 macrozoobenthic species, the faunistic array keeping the characteristics of previous years. In 2013, a higher diversity was recorded in the coastal waters of the central and southern part of the coast, where 26 and 35 macrozoobenthos species, respectively, were identified, compared to 2012. The multiannual evolution in the number of species present in the Romanian water sectors showed a slight, but continuous tendency towards qualitative balancing. Along the entire Romanian Black Sea coast (Sulina - Mangalia), the quantitative distribution of macrozoobenthos was heterogeneous, with the highest densities and biomasses being concentrated in the Casino Mamaia area, with means of 10,000 ind/m² and 392 g/m² in shallow waters, on sandy substrate.

In 2013, in the Romanian marine sector, the **fishing industry** practiced by fishermen was done in two ways: active fishing gear with coastal trawler vessels, made at depths of 20 m, and fixed fishing gear, practiced along the coastline in 20 fishing points, located between Sulina and Vama Veche, in shallow waters (3-11 m pound nets), but also at 20-60 m depths/gillnets and long lines. The population structure indicates, as in previous years, the presence in the catches of a greater number of species (over 20), in which the mainstream belonged to small species (sprat, anchovy, whiting, goby), as well as to the larger ones (turbot and Danube shad). As in previous years, the low share of some species, such as: dogfish, horse mackerel, mullet, bluefish, but also the occurrence as isolated specimens of blue mackerel and bonito were reported. The fishing effort continues the trend of reduction reported since 2000. After a decreasing trend during 2002-2010, when it dropped from more than 2,000 t, in 2002, to 1,390-1,940 t, during 2003-2006, and below 500 t during 2007 - 2009, reaching a minimum value in 2010/258 t, in the past years the total catch has had an increasing trend, namely 568 t, in 2011, 835 t, in 2012, and 1,711 t, in 2013 (more than 100% higher than the previous year).

The **Integrated Coastal Zone Management (ICZM)** is one of the significant components of the Marine Strategy. International cooperation within an EU context in the frame of sharing knowledge and experiences is a great help in the development of the Romanian ICZM program and the preparation of an adaptive coastal response to anticipated impacts of climate changes. The 17th ICZM Advisory Group Meeting (11-12 September 2013) was organised according to the Work Programme of the Black Sea Commission. Consequently, were presented the National Reports of the Black Sea riparian countries, as well as the progress of the PEGASO Black Sea CASEs, *Black Sea CASEs progress - Romania CASE; Ukraine CASE; Georgia CASE*. Therefore, has been developed **a core set of indicators** that are instrumental in measuring the implementation of ICZM policies and programmes. PEGASO partner Black Sea Commission Permanent Secretariat called ICZM National Focal Points (NFP) to



contribute into its testing by compiling coastal sustainability indicators for coastal zones of the Black Sea. Romania selected Constanta County as part of the Dobrogea Region.

In 2013, the **Maritime Spatial Planning Activities (MSP)** were carried-out within certain NIMRD projects, in strong relation with the information support and competent authorities in the field. NIMRD, as national institute with pluri-disciplinary marine research activities, has contributed in supporting the ICZM and MSP authorities, the elaboration of MSP specific national regulations, the harmonization and implementation of European directives under national/local conditions, the elaboration of plans and inventory of typical coastal zone, cross-border and marine activities, collaborations with other institutions, expanding the collection of maritime space data, the development and design of GIS networks. Along all these activities, NIMRD continued producing thematic and integrated maps of the coastal and maritime space, covering coastal waters, transitional and marine waters, coastal and marine habitats, marine protected areas, natural resources surveys and uses, pressures, maritime activities, tourism, resource extraction, shipping and transportation routes.

The environmental problems identified as being caused by the **anthropogenic pressures** in 2013 were the following: coastal erosion/sediment dynamics, water/air pollution, population increase in residential areas close to the shoreline, uncontrolled development of tourism and leisure activities beyond the carrying capacity of the environment, changing the height regime of beach constructions, passing constructions with non-permanent use in the category of permanent constructions on the beaches, maritime shipping, natural resource extraction, overexploitation of fish stocks, loss of coastal and marine habitats, preservation of the endangered species list. In 2013, environmental monitoring revealed slightly increased pollution concentrations in the marine area under the influence of the Danube, as well as in the southern sector, in areas subjected to human pressures (harbors, waste water discharge areas). Thus, it can be summed-up that the main anthropogenic pressures identified in the Romanian coastal zone are a result of the sharp development of various socio-economic activities in the built-up space of the coastal zone: constructions/holiday homes in tourist areas, expansion and modernization of existing tourist marinas etc.

In order to reduce and control the problems at the Romanian coast, we suggest the optimization of coastal management activities and conducting related studies on the risks and hazards in existing conditions or reconsidering emergency situations management: accidental oil spills, earthquakes, flood management, coastal ecosystem response to toxic waste spill, the impact of insecticides, biotechnological hazard impact on the community, chemical hazard on the community in times of drought, desertification, land degradation, climate change, risk assessment of landslides/slope of the cliff, intense storms, marine waterspouts etc.

KEY WORDS: *Black Sea, Romanian coastal area, eutrophication, contamination, biodiversity, endangered species, habitats, protected areas, marine living resources, sustainable development, maritime spatial planning, anthropogenic pressures*