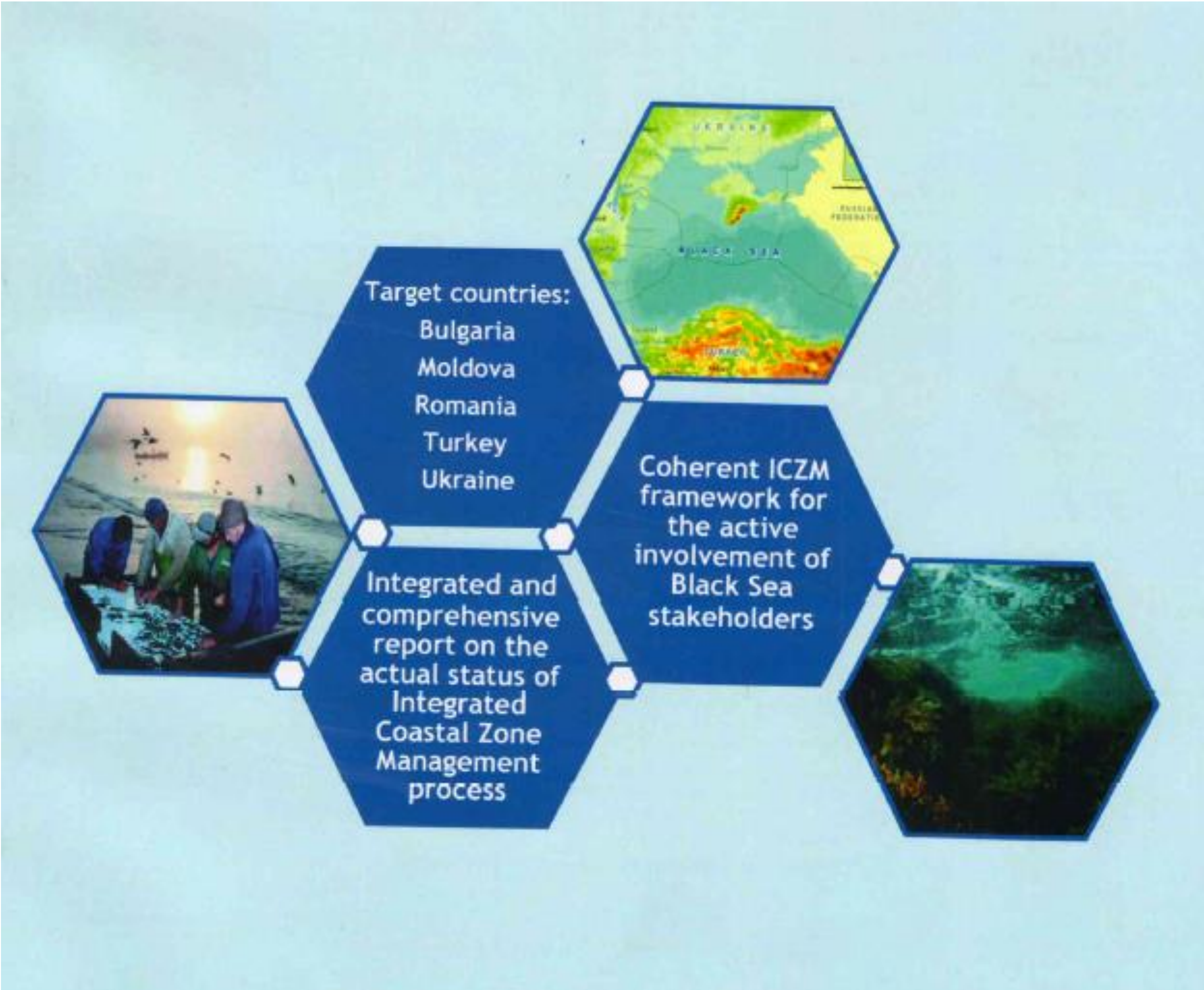
STUDY ON INTEGRATED COASTAL ZONE MANAGEMENT



Common borders. Common solutions

Mariana Golumbeanu and Simion Nicolaev (editors)
Contributing authors:
Valeria Abaza
Laura Alexandrov
Gulfem Bakan
Laura Boicenco
Florica Brasoveanu
Valentina Coatu
Oleg Dyakov
Luminita Lazar
Magda Ioana Nenciu
Razvan Mateescu
Victor Nita
Andra Oros
Alina Daina Spinu
Vasile Stegarescu
Galina Atanasova Stoyanova
Daniela Tiganus
Tania Zaharia

For bibliographic purposes, this document shall be cited as:
Golumbeanu M. & Nicolaev S.(editors),2015,*Study on Integrated Coastal Zone Management, 454p*
Ex Ponto Publiching House, 2015

ISBN: 978-606-598-397-7
CIP: 579.68
65.012

All data and information included in this STUDY ON INTEGRATED COASTAL ZONE MANAGEMENT are owned by the Project "Improvement of the Integrated Coastal Zone Management in the Black Sea Region – ICZM", funded by the Joint Operational Programme Black Sea Basin 2007-2013

IMPROVEMENT OF THE INTEGRATED COASTAL ZONE MANAGEMENT IN THE BLACK SEA REGION – ICZM

March 2015

This publication has been produced with the assistance of the European Union. The content of this publication is the sole responsibility of the authors and can in no way reflect the views of the European Uinion.

Common borders. Common solutions

Contents of the ICZM study

EXECUTIVE SUMMARY

The Black Sea region is experiencing increasing pressures mainly due to population increase, urbanization and growth in agriculture, fisheries, and industry. As it is essential for the national economy, competition for its resources is growing, threatening to destruct the functional integrity of the coastal resource system. The coast is already subject to erosion, water pollution, decline of renewable resources, loss of biological diversity, wetlands losses and destruction of landscape. The need to deal in the future with the impacts of climate change in combination with finding adaptive responses is also an essential issue.

Current solutions within the individual sector frameworks usually "*transfer*" problems to other areas, resources, products or services. Industry and power engineering are able to create a situation wherein the environment becomes unsuitable for any other type of utilisation. As problems become more and more critical, the transference of coastal problems from one place to another and from one sector to another can be long-term. There needs to be a mechanism for solving such problems, elaborated within the prevailing economic and social systems. Such solutions must begin to involve all stakeholders including the general public.

In the framework of the Study promoted by the Project *"Improvement of the Integrated Coastal Zone Management in the Black Sea Region" (ICZM)* and supported by the Joint Operational Programme "Black Sea Basin 2007-2013" to underpin the impact assessment a specific activity was carried out by the National Institute for Marine Research and Development "Grigore Antipa" to provide an updated analysis of the results and progress of ICZM within 5 states from Black Sea region: Bulgaria, Moldova, Romania, Turkey and Ukraine.

In order to provide such an overview, specific objectives were settled out:

- Assessing the Black Sea marine and coastal ecosystem vulnerability and developing endeavors of implementing European Integrated Coastal Zone Management/ICZM practices.
- Collecting/validating data, identifying solutions and elaborating action plans.
- Developing an ICZM step-by-step approach.
- Identifying types of instruments and measures to implement ICZM.
- Assessing the potential polluters in the Black Sea and qualitative monitoring status on the Romanian Black Sea Sector.

Context of ICZM in Europe

The coastal zone is an extremely complex social-ecological system that varies in relation to its environmental, socio-economic, cultural and governance factors. Integrated Coastal Zone Management (ICZM) seeks to develop an integrated model for sustainable development that is based on finding points of convergence among these factors (Diedrich et al., 2010).

In order to promote the unitary concept of ICZM in the European Union, the Recommendation 2002/413/EC on the implementation of integrated coastal zone management in Europe has been developed. This Recommendation introduces a strategic approach based on the integrity and functioning of the ecosystem and on sustainable natural resource management in the

marine and terrestrial components of the coastal area. The practice of the developed coastal nations demonstrates that the most reasonable way in which to realise principles for sustainable coastal development is through integrated coastal zone management (ICZM).

The eight Integrated Coastal Zone Management (ICZM) principles are an important element of the European approach to ICZM. These principles of good practice, outlined in the EC

Recommendation (2002/413/EC) and Strategy (2000/547/EC), were also endorsed by the European Commission in its Communication on ICZM. Since the publication of the Recommendation in 2002 the 8 ICZM principles have quickly become the standard against which progress in ICZM in Europe is measured (McKenna et al., 2008).

EU coastal Member States 2010 were invited by the Commission to provide an update of the progress in implementing ICZM from 2006 up to 2010. An impact assessment was conducted to explore the need and options for future EU action and to assess potential social, economic and environmental consequences of the new initiatives proposed by the European Commission (2011).

Context of ICZM in the Black Sea

At the regional level the Advisory Group on the Development of Common Methodologies for Integrated Coastal Zone (AG ICZM) is subsidiary body of the Black Sea Commission institutional structure, which gives advice to the Black Sea Commission on proper management of the coastal zone and elaboration and implementation of regionally coordinated integrated coastal zone management strategies, methodologies and instruments in the context of sustainable development *(Strategic Action Plan for the Environmental Protection and Rehabilitation of the Black Sea, adopted on 17th April 2009)*. The updated SAP (2009) includes ICZM targets, such as:

- Further recognize and implement integrated coastal zone management principles into policies;

- Develop and disseminate information, training and education materials on ICZM in regional languages, referring to coastal and marine biodiversity conservation,

- Identify and make an inventory of Black Sea landscapes of high natural, historical, cultural and aesthetic value;

- Undertake preliminary regional assessment of coastal erosion, etc.

The Black Sea states showed considerable progress in coastal planning and management leading to more sustainable use of the coastal zone. Extensive construction, erosion, deforestation and destruction of coastal habitats are registered along the coasts of the Black Sea in certain areas. The Black Sea ICZM Strategy was drafted; however, its adoption needs to be accelerated. ICZM spatial planning methodology was developed by the ICZM Activity Centre (Russian Federation), and further tested in Ukraine and Turkey, proving its usefulness and it will be wider promoted in the Black Sea coastal states and elsewhere. Also, new ICZM pilot projects should be initiated, as they offer unique opportunities for enhancing ICZM expertise using and improving the available Black Sea spatial planning methodology and ICZM strategy. Information exchange on best available practices should be more actively pursued in the region. The region should also agree on and use regularly a coherent system of indicators for an integral assessment of the Black Sea coastal zones state and implementation of ICZM (Antonidze, 2010).

The Black Sea Commission plans to initiate consultations in order to develop an ICZM Protocol for the Black Sea region. Marine Spatial Planning is planned to be introduced in close integration with ICZM (Black Sea Outlook, Odessa 2011).

The Methodology used in elaborating this Study based on:

- Reporting guidance Implementation of ICZM Recommendation 2006-2010, DGENV.D.2/15.2.2010;
- DPSIR Methodology (Driving forces - Pressure - State - Impact - Response) to facilitate analyzing the connections between socio-economic trends, ecological phenomena and instrutional framework;
- Harmonization of methods and solutions considered in elaborating the Study with the experience of more proficient countries in the ICZM area of expertise (the Netherlands);

- Whereas Romania is the only Black Sea basin country with a specific ICZM legislation, its success in implementing ICZM will be a driving force for the other riparian countries.

Further essential sources of information were:

- Annual report of the Black Sea Commission Advisory Group on Development of Common Methodology for Integrated Coastal Zone Management (ICZM AG), BSC, 2010, 2013, Publications of the Commission on the Protection of the Black Sea Against Pollution (BSC), Istanbul, Turkey.

- EU co-funded research projects (concluded and on-going) and territorial cooperation projects (especially the projects funded under the Joint Operational Programme "Black Sea Basin 2007-2013").

For the rest of the project partner countries (Ukraine, Moldova, Bulgaria and Turkey) the reports drafted by the ICZM experts appointed by the project partners were used. Additional data were used from the Stock-Taking on ICZM in the Black Sea Region; relevant national documents, national projects, regional projects, national legislations, national documents elaborated under the aegis of the World Bank etc.

More heterogeneity was found in countries which adopted a framework equivalent to an ICZM strategy; with few exceptions a holistic approach is already considered in planning and management tools in place in different countries, as well as strategies considering long term perspectives were developed in the last period.

Chapter 1. Integrated Coastal Zone Management: Concepts and Principles
Coastal Zone Management in the target countries

In respect to overview of the national policies towards ICZM in target countries coastal planning and management aspects seem to be mostly in place in Bulgaria, Romania and Ukraine, whereas less developed in other countries. The framework to carry ICZM forward is almost complete in Bulgaria and Romania, whereas absent in other countries. The improvement by time at the local and national levels is most pronounced in Romania; however, funding is a problem for all the countries to undertake actions on the coast.

Integrated Coastal Zone Management is also recognized in the new Strategic Action Plan for the Rehabilitation and Protection of the Black Sea (adopted in April 2009) as the main instrument to achieve sustainable development in the region through the involvement of all stakeholders.

As well as an inventory of existing measures applied in coastal zones and an analysis of the need for additional actions in order to achieve the objectives set out (for maritime spatial plans and integrated coastal management strategies) were considered, respectively.

Chapter 2. Current legal and institutional frameworks for international and cross-border cooperation in the Black Sea Basin as a prerequisite for the introduction of an integrated approach to CZM.

It considered that good governance, the rule of law, promotion of respect for human rights, migration management, energy, transport, the environment and economic and social development should constitute priority actions. The resolution encourages priority financing for small-scale development projects and stresses the need for a projectbased approach with a view to including local authorities, business communities, NGOs or other civil society organisations.

It encourages the development of synergies between the various EU policies that come into play in the Strategy (especially for the European Member States), particularly the Structural Funds, the Research and Development Framework Programme and the Trans-European Transport Networks in order to ensure the sustainability of the actions financed so that opportunities created by one economic development initiative can be taken up by another, complementary initiative.

Chapter 3. The current state of the coastal zone focused on the current state of the coastal zone based on the following components: General features of the Black Sea region; Delineation of the Black Sea coastal zone; Natural conditions; Anthopogenic pressures and impacts; Protected areas and valuable natural sites/ecological network, Interaction between coastal zone and maritime zone (maritime transport routes; submarine cable and pipeline routes; fishing areas; sea farming sites; nature conservation sites).

The Black Sea is considered to be a huge laboratory naturally hosting oxic, hypoxic and anoxic water masses permanently existing due to strong vertical stratification. While strong vertical stratification supports isopycnal distribution of various biogeochemical species, the wide range of redox conditions supports specific processes rendering the Black Sea a unique place to study the Earth System responses to climate changes and anthropogenic forcing. Since a large part of the basin (i.e. approx. deeper than 100 m) is anoxic, life forms in the Black Sea display limited diversity and almost all pelagic and benthic fauna and flora dwell in the shallower upper oxic water layers.

Over the past 20 years the Black Sea region has faced numerous socio-economics changes. Based on The Blue Growth report the most important economic functions in the Black Sea are shortsea shipping, offshore oil and gas exploration and coastal tourism (ESaTDOR, 2013). Other important sectors are: fishery, land based industry, military uses and infrastructure. Aquaculture is developing in all Black Sea countries, but it has grown rapidly into an important activity in Turkey, Bulgaria and Ukraine (BSC, 2007, Deniz, 2001).

The present current state indicates some gaps in our knowledge due to the absence of sufficiently comprehensive monitoring data. For the success of ecosystem restoration, a holistic approach of the Black Sea Integrated Monitoring and Assessment Programme (BSIMAP) of the key ecosystem indicators, e.g. set by EEA within the DSPIR framework, should be effectively implemented. This approach will further set a basis for the policy-relevant assessment of the state of the Black Sea environment in the EU context. The DSPIR protocol, however, may require some adaptations to the Black Sea conditions in terms of network of coastal stations, sampling frequency, and sampling depths in order to allow detection of temporal trends and inter- comparison of different areas.

The Water Framework Directive (WFD) Directive 2000/60/EC, establishing a framework for Community action in the field of water policy as for management the coastal zone within 1 mile distance from the coastline offshore, while the Marine Strategy Framework Directive (MSFD) Directive 2008/56/EC is the legislative instrument for management of member states territorial marine waters including the EEZ. According to the WFD all member states should reach good ecological status (GES) of their coastal environment by 2015, while MSFD postulate achieving of Good Environmental Status (GEnS) for the European regional Seas by 2020.

The varied coastal geomorphology of the encompassed areas gives to the Black Sea coast a unique specificity among the all enclosed seas, and due to this diversity it should be approached carefully within the ICZM process implementation.

Because coastal erosion at the Black Sea Coast has been prolonged and rapid, regional intervention must be both immediate and well-planned. After analyzing the results regarding the shoreline variability for different Black Sea sectors, due to the variability of geomorphological changes and various erosion causes, the conclusions are that it is necessary to deepen the issues, practically and theoretically, in order to reach a correct understanding of the coastal processes and their impacts under new climate conditions. In general, the effects of hydrological and meteorological factors, especially of storms surges, are not limited only to the natural shore. They are extended to areas governed by anthropogenic factors, where the impacts of winter storms are more visible and consequences become more dramatic on short terms, due to strong wind/waves magnitude, or their durations.

The magnitude of shoreline retreat is proportional with the average seasonal and annual sea-level rise. The continuous shoreline and sea-level monitoring allows the extension of efficient specific shore protection solutions on specific shore sectors. The currently methods emphasize the general characteristic of the shore response, which together with the proper arrangements works will make possible the correction and good management practices at different space and time scales, namely a proper Regional Sediment Management in connection with environmental-friendly coastal construction works.

A comprehensive analysis of the natural drivers in the Black Sea coastal zone has resulted in identifying a series of pressures exerted on the environment by natural factors, as follows:

Climate change/extreme phenomena:

- Sea level rise
- Storm intensification
- Extreme warming of seawater in summer (temperatures above 28-30°C)
- Increasing incidence of extreme phenomena such as marine tornado/waterspout
- Changes in dominant wind frequency, causing the increasing incidence of coastal upwelling processes
- Increasing incidence of heat waves/air humidity above 80%, overcoming of the UV index etc.
- Precipitation/drought intensification
- Salt water penetration in some coastal area
- High salinity variability of water masses from lagoons and coastal waters.

Enhancement of coastal erosion processes:

- Beach erosion
- Shoreline retreat at a forecast sea level rise
- Decrease of sedimentary transport rates
- Beach flooding after storms
- Instability in river outflow mouths and lagoon entrance channels
- Littoral belts erosion and vulnerability
- Cliff erosion and instability
- Property loss/damages to the infrastructure in high coastal hazard areas
- Extension of the interchange zone between shoreline retreat/advancement

Chapter 4. Legal, political and institutional frameworks for ICZM

It is compulsory to point out that there are some differences between countries that have already become members of the European Union (EU) (Bulgaria and Romania) and the other Black Sea countries. The EU has stricter demands with regard to environmental law enforcement and the integrated approach to using natural resources.

The Black Sea countries are strong and active supporters of the global efforts to acknowledge the importance of wetlands and modify human practices so that these areas are retained for future generations. The governments of Black Sea countries are signatory parties to several international treaties relating to environmental and wetland conservation. For this reason, the governments have to ensure that their obligations under these treaties are met through the approval and implementation of national policies on wetlands, including the development and implementation of national wetland conservation strategies. The significant role of the national governments in integrated approach of coastal zone should be realized through cooperation and partnership with other governments, the business sector and local communities.

Chapter 5. Analysis of problems and opportunities in terms of the introduction of ICZM in the Black Sea Region

The analysis of issues in marine and coastal areas and those originating from catchment basins reveals (Black Sea Transboundary Diagnostic Analysis, 2008) that the underlying causes of individual problems in many cases interact with each other, sometimes have common basis, and may frequently lead to effects of combined and cumulative nature. One of the root causes leading to wide range of such issues is poorly regulated development and resource use in coastal zones, and a brief tour around the region immediately reveals the large scale of this. Obviously, the multiplicity of interdependent problems there can only be dealt with and responded in a holistic and integrated manner.

The Black Sea coastal countries, including Romania, Bulgaria, Ukraine, Turkey cooperating within the framework of the Bucharest Convention, agreed therefore to employ common governance methodologies based on "*ecology principle*", that coastal economic development (associated with the coast and the sea itself) to be sustainable should take full account of marine and coastal environment safety and consider also developments upstream in the wider catchment areas that may negatively impact the state of the Black Sea.

In particular, through signing the *Strategic Action Plan for the Environmental Protection and Rehabilitation of the Black Sea, 2009* (BS–SAP, 2009) countries confirmed to adhere to the following governance and management approaches:

- Integrated Coastal Zone Management (ICZM);
- The Environmental Impact Assessment (EIA)
- Integrated River Basin Management (IRBM).

In the context of Ecosystem Approach the harmonization of ICZM and Maritime Spatial Planning (MSP)/Marine Protected Areas (MPA) processes would be the manifestation of the principle of integration of terrestrial and marine domains. The planning at landward and seaward should therefore be conducted in truly coordinated manner if the fulfillment of the 'ecology tenet' is looked for. In that way, MSP - MPA, ICZM - MSP and ICZM - IRBM links has to be established with legacy, planning practices, etc. for sustainability of the governance and environmental protection.

Based on analysis provided by the experts in the project, we can made the following conclusions with regard to the medium - and long - term priorities for ICZM in the Black Sea region:

- Legal framework and strong management instruments are needed in all Black Sea countries to facilitate ICZM implementation on the ground.
- The Black Sea region should agree on and apply a coherent system of indicators for an integral assessment of the state of the coastal zones in the Black Sea, and the progress with implementation of ICZM.
- ICZM Guidelines should be developed to serve as a solution in a medium term.
- ICZM legal instrument, such as protocol to the Black Sea Convention, could be developed and adopted in the medium to long term perspective.

Based on these conclusions, the BS-SAP (2009) contains two broadly defined targets (and related outputs) in the field of ICZM:

(i) to further recognize and implement integrated coastal zone management principles (through development of ICZM Guidelines);
(ii) to disseminate the knowledge of ICZM at various levels of governance (through development of education packages and delivery of practical training).

These targets (and related research and development needs) are in line with the statements of the ICZM Communication of European Commission, concerning the generating information and knowledge about the Coastal Zone, in which the European Community pledges to:

(i) promote the research that meets coastal zone management needs;
(ii) put special emphasis on definition of indicators for the coastal zone;
(iii) support education and training in ICZM.

It should also be recognized, that the coastal management tasks and governance objectives cannot be achieved without the application of sound science and its integration with coastal decision - making. Therefore, in the spirit of the Shared ICZM Governance Platform with Mediterranean, the strategic research agenda for coastal sciences is proposed to follow the two decades of best practice applied in this partner region as well as in the Black Sea area.

Based on the experience of almost 20 years of ICZM work within the framework of the Bucharest Convention and BS-SAP, as well as on the extensive collaboration with EU initiatives towards the Black Sea and other regional seas, the following key governance, policy and management oriented research areas are proposed for inclusion in the field of science and research:

- Scientific background to support the development of ICZM legal instrument, such as the ICZM Protocol for the Black Sea.
- Develop monitoring and research capacity in the Black Sea region to comprehensively study the state of the coast, with special focus on sensitive coastal resources and ecosystems (beaches, dunes, wetlands, estuaries, lagoons, bays, river mouths, etc.).
- Compile data in agreed formats for regular calculations of statistical, spatial and progress indicators for ICZM, including indicators defined for MSP and IRBM needs, and harmonized with coastal sustainability indicator schemes applied in other European regional seas.
- Adapt, develop and implement comprehensive set of training and education packages (based on experience from other regional seas) oriented towards the scientists, decision makers and practitioners involved at various levels in coastal research and management.
- Further promote and implement the strategic research agenda for coastal sciences & engineering in support of ICZM in the Black Sea region, building on networking experiences of international scientific fora, such as biannual Medcoast and Black Sea Outlook conference series.

- Extend the research and application of the Shared ICZM Governance Platform developed under the FP7 PEGASO Project.
- Establish on an operational basis the observation system of the Black Sea catchment, following the key recommendations of FP7 EnviroGRIDS.
- Establish National centers for Oceanographic and Environmental Data.

Chapter 6. What has to be done to improve opportunities for introducing ICZM in the Black Sea Region

Within the legislation of the European Union (EU) frameworks for the implementation of ICZM have been established. The EU is one of the parties of the Barcelona Convention, so that through common policies, legislation, strategies, programs and projects of the EU and international organizations a framework for the development and implementation of ICZM initiatives at the national level is created (Protocol on ICZM in September 2010).

Although not all the Black Sea states are EU State Members, most of them are trying to accomplish requirements of the European Union (EU) frameworks for the implementation of ICZM. The zones of the marine environment and coastal areas are topic to a wide range of EU policies and regulations.

It is important to approach intergovernmental collaboration and coordination and to facilitate synchronization in development policies and plans for the coastal zone to achieve established goals and objectives which should be derived from the coastal zone management strategy. Planned institutional set-up is consequently based on the identification of the coordinating bodies (or entities) needed, the tasks/activities that need to be carried out by these forms as already identified in the existing coastal zone management legislation.

The appropriate functioning of this institutional set-up is based on:

1. Training and application of policies and plans in the various sectors of the economy is the concern of the existing government sector agencies (regional and local level), as placed down in existing laws and regulations.

2. Incorporated management of the coastal zone by developing a platform for guidance, steering and matching to achieve cross-sectorial planning and management.

3. Integration of anticipatory or corrective measures that are needed and that are derived from cross-sectorial planning concerns also has to be implemented by the sector organizations.

In order to improve the current conditions in marine area, some suggestions must be taken into account:

- National/Regional Committees/Centers for the Coastal Zone in the Black Sea Region should be either considered as a decision making authority, or an executive one. The NC is a specific structure (with identified powers and obligations) and acts under the coordination of a lead agency.
- A multilateral interest between government agencies to cooperate in a voluntary way, not using an imposed form of collaboration (enforced by legislation) should be achieved.
- Existence of two entities in the marine field: a central authority represented by the National/Regional Committees/Centers for the Coastal Zone and regional and local stakeholders, which are empowered with the effective decision making process should be useful.
- The financing system is very important for ICZM, so a major task for coastal zone management legal framework is to maintain all alternatives opened.
- To create an efficient framework for several bodies - National Committees for the Coastal Zone, Operational Secretariat, Working Groups and Expert Groups – it is useful to define a clear set of procedures and regulations.
- Elimination of the existing inconsistencies that still persist in the coastal zone management legal framework should be carried out with the support of an expert team. The new draft law on ICZM development must avoid overlaps with other regulations, suggesting mutually beneficial solutions.

A major issue during operation of ICZM processes is the handling conflict of interests. In order to be able to handle these conflicts one must be aware of their causes and consequences, establish a transparent methodology to come to a solution (decision) and to have the capability to counteract the negative effects of proposed uses of coastal resources that have on other users, with appropriate measures. Establishing a good communication process among stakeholders is possible only in a positive atmosphere, developed in a long-term relationship. Existence of a mutual respect among group members, in order to pass the issues with responsibility, is essential.

Annex 1 - ICZM step by step approach. The document outlines in 10 steps a point of view that shows how ICZM can be functional for the Black Sea Area. Based on the analysis of some maritime and coastal planning initiatives around the world these 10 steps are described in this report. The guide contains measures with the wanted results as well as the proper tasks for each step.

This kind of planning process does not end in just one plan. The process is ongoing and can be evaluated and adapted all the time. To have a successful implementation of the ICZM process is important to follow 10 basic steps. These steps can be part of a cyclical process. During this process many facts can change including stakeholders that can influence in time the planning process. You can set a number of objectives that will adapt later with the benefits/costs determined by the management measures.

The ten steps can set out the direction for future projects regarding Black Sea Area. This document is in perfect harmony with the Black Sea Area situation following these 10 basic steps. The main goal and the content of each action are described for each part of the guide.

Annex 2 - Types of measures to take and instruments to use. A cross-sector methodology for planning and management is needed. Viable development of the coastal zone is more that "*inaccessible ideal*" and significant efforts have to be assumed and investments made.

Marine and coastal ecosystems provide the valuable natural capital as a basis for the economy and living environment of the Black Sea regions. Data to describe the current use and trends in the use of natural capital included measuring natural and semi natural areas, species and habitats of conservation importance, protected areas, natural capital degradation, ecosystem vulnerability, and the cost of natural-capital depreciation.

The first step is to develop a long-term vision on expected coastal management actions and developments to ensure continuity within a longer time perspective. Short and medium term coastal management plans and activities for designated regions or coastal areas are to be developed, merging concrete no-regret actions and nearby targets with long-term activities such as drawing up a strategy and action plan.

Water management and coastal development should be considered as leading or guiding principles in integrated spatial planning of low lying coastal and marine areas.

Secondly is important to develop and facilitate the possibilities to exchange and share knowledge and learning experiences in order to better address the main triggers for ICZM: population growth, unsustainable economic development and anticipated impacts of climate change. Increasing food, health and livelihood security and education will contribute to an early stabilization of the world population.

The Black Sea coastal zone management is an important mechanism for sound economic development and ecological and environmental security. Regional cooperation in flood and drought management is already essential and will become even more critical for dealing with the impacts of climate change effectively in the future.

Annex 3 - Pilot application focused on Romania coastline comprising: Assessment study of the potential polluters in the Black Sea and qualitative monitoring status on the Romanian Black Sea Sector.

The receiving area of the freshwater from rivers and anthropogenic input it is along the entire Romanian coastal zone being directly influenced in the northern part by the Danube and other rivers from the NW Black Sea and in the central and southern areas by the input from the channel Danube-Black Sea and municipal and industrial land-based sources.

The main abiotic components of the receiving area will be detailed taking into account the eutrophication indicators – nutrients and the pollution indicators – contaminants (heavy metals, polynuclear aromatic hydrocarbons (PAH), organochlorinated pesticides and PCBs).

The study of the receiving zone was done on data collected in the national monitoring program of the Black Sea during 2006-2011/2013. Thus, were selected surface samples from stations nearby Danube's mouths (Sulina 10 m, Sulina 20 m and Sfantu Gheorghe 5 m, 20 m and 30m) and stations in the neighbourhood of the main municipal and industrial sources – Gura Buhaz 5m (corresponding to the impact of the area Navodari – Rompetrol Refinery), Constanta Nord 5m (corresponding to the impact of the WWTP Constanta Nord), Constanta Sud 5m and Eforie 5m (corresponding to the impact of the WWTP and Constanta Port), Costinesti 5m (corresponding to the impact of the WWTP Eforie Sud) and Mangalia 5m (corresponding to the impact of the WWTP Mangalia and Mangalia Port). Following the analysis of the monitoring data of the abiotic components of the marine ecosystem in the receiving area of the land based sources of pollution it was observed that:

- The significant input in the western part of the Black Sea become from the Danube whish freshwater discharge influences the Black Sea chemistry along the entire Romanian littoral.
- Permanent or seasonal, in the neighbourhood of the settlements Constanta and Mangalia, were found increased concentrations of nutrients and contaminants in the marine receiving area.
- As regards nutrients, were generally observed mean concentrations higher in the central and southern part of the area, permanent in the neighbourhood of the Constanta Sud and seasonal, Mangalia.
- The impact analysis of discharges of hazardous substances (heavy metals, pesticides and polycyclic aromatic hydrocarbons) identified sediment contaminated with heavy metals in ports (Constanta Sud, Mangalia), in shallow areas affected by discharges of wastewater (Gura Buhaz, Eforie Sud) and marine area in front of the Danube mouths (Sulina, Mila 9 St. Gheorghe).
- Indices calculated to identify pollution sources show petroleum pollution in the area near the port of Constanta South - Agigea and another of pyrolytic nature in Constanta South WWTP, concentrations of contaminants are at levels where there is an unacceptable risk of term biological effects long.
- The differences in spatial distribution of heavy metal concentrations in marine waters revealed for some elements the fluvial contribution in the north part of the coast (lead, nickel, chromium) and terrestrial sources of pollution in the southern sector (lead, chromium) (Mangalia, Constanta Sud).
- Most metals had increased accumulation in sediments from the Danube front area (Sulina - Portita) and Constanta South port aquatorium, while the central sector (Baia Mamaia, Constanta East) and southern extremity (Costinesti - Vama Veche) were generally characterized by lower values.

- During 2006-2012 evaluating the level of contamination with polycyclic aromatic hydrocarbons indicates a bad ecological status (BES-red) for marine sediments from immediately adjacent area of pollution sources (5m) and for those from marine areas (depth of 20 m).
- Recent data (2013) of quality of the polycyclic aromatic hydrocarbons contaminated sediments indicate a good environmental status in sediments from mouths of the Danube and Rompetrol Refinery areas and those neighboring sewage treatment plants, at the depth of 5, 20 m, with a moderate level of pollution of polycyclic aromatic hydrocarbons in which biological effects are reduced unlikely.
- Analysis of the temporal evolution of the concentrations of organochlorine pesticides in marine waters in front of the mouth of the Danube outstanding a significant decline of the total content of organochlorine pesticides and also, of the concentrations of individual compounds, that had significant concentrations in previous years: HCB, lindane, aldrin.
- The distribution of concentrations suggests chronical pollution with organochlorine pollutants, especially organochlorine pesticides on the entire coastal area, the source of this pollution being predominantly diffuse, most likely from air pollution.

The study offers an innovative working instrument to overcome common challenges and differences and bring together the national approaches of the five participating countries: Bulgaria, Moldova, Romania, Turkey and Ukraine to follow EC and other international recommendations on integrated coastal zone management.

Based on this comprehensive study on ICZM within project regions, the external experts will be able to build the technical toolkit for ICZM implementation, which will contain one set of indicators agreed by the partners, outline of a common methodology.

Introduction

The economic and environmental situation in the Black Sea region is associated with certain problems, but also with a great variety of possibilities for development. The development of our society, with increasing demands of all economic sectors, urbanization, tourism and others contributed to the increasing pressures on the coastal area and consequently on the marine environment.

Purpose of the Study

The purpose of the study is to offer an integrated and comprehensive report on the actual status of Integrated Coastal Zone Management process in the target countries: Bulgaria, Moldova, Romania, Turkey and Ukraine.

The main difficulty in ICZM approach is the fact that the five different countries have been facing administrative and institutional diversity, lack of methodologies and insufficient technical capacity. Therefore, the study provides a work platform for the active involvement of different stakeholders from Black Sea region in implementing a coherent ICZM framework, which can bring together the national approaches of the five participating countries under harmonized procedures. Further on, a group of external experts will work on creating common indicators and methodologies (technical toolkit) on integrated coastal zone management process.

Institutions and experts involved

- National Institute for Marine Research and Development "Grigore Antipa" (NIMRD) Constanta, Romania;
- "Ovidius" University of Constanta, Romania.

The experts involved were appointed based on the proposals and criteria elaborated by NIMRD, in collaboration with an ICZM experts' group, representing each partner country in the wider ICZM Project.

Experts from partner countries:

- Mrs. Galina Atanasova Stoyanova - ICZM Expert for Bulgaria;
- Dr. Vasile Stegarescu - ICZM Expert for Moldova, IEG ASM - Institute of Ecology and Geography - Academy of Sciences of Moldova;
- Prof. Dr. Gulfem Bakan - ICZM Expert for Turkey, Ondokuz Mayıs University, Engineering Faculty, Environmental Engineering Department, Samsun, Turkey;
- Mr. Oleg Dyakov, ICZM Expert for Ukraine.

Key-experts:

- Study Director/Technical Coordinator - Dr. Simion Nicolaev;
- GIS format transposal of coastal and marine data expert - Dr. Alina Daiana Spinu;
- Communication and dissemination expert - PhD student Magda Ioana Nenciu;
- Marine pollution sources expert - Dr. Andra Oros;
- Marine biodiversity experts - Dr. Laura Boicenco, Dr. Valeria Abaza;
- Marine geomorphology expert - Dr. Razvan Mateescu;
- Maritime Spatial Planning expert - Dr. Laura Alexandrov;
- Marine Protected Areas and Natura 2000 experts - Dr. Tania Zaharia, Dr. Victor Nita;
- Land-based pollution sources assessment expert - Dr. Luminita Lazar, chemist Daniela Tiganus;
- Marine, maritime and coastal legislation expert - Associate Prof. Dr. Florica Brasoveanu;
- Integrated Coastal Zone Management Expert - Dr. Mariana Golumbeanu.

Methodology used to carry out the Study

The main benchmarks in elaborating this Study were:

- EU/ICZM Strategy,
- DPSIR Methodology (Driving forces - Pressure - State - Impact - Response) to facilitate analyzing the connections between socio-economic trends, ecological phenomena and institutional framework;
- Harmonization of methods and solutions considered in elaborating the Study with the experience of more proficient countries in the ICZM area of expertise (the Netherlands);
- Whereas Romania is the only Black Sea basin country with a specific ICZM legislation, its success in implementing ICZM will be a driving force for the other riparian countries.

The coastal zone is a highly dynamic area, notable changes being reported each season, but mainly from one year to the other.

The process of data identification considered the existence of the current (integrated) monitoring systems in the coastal zone (for Romania): the physical, chemical and biologic monitoring of the marine environment performed by NIMRD and Dobrogea-Littoral Water Basin Administration; Shellfish water quality monitoring system; Ballast water quality monitoring system (NIMRD); Bathing water quality monitoring system (Public Health Directorate).

Further essential sources of information were:

- BSC, 2013. Annual report of the Black Sea Commission Advisory Group on Development of Common Methodology for Integrated Coastal Zone Management (ICZM AG). Publications of the Commission on the Protection of the Black Sea Against Pollution (BSC), Istanbul, Turkey.

- National Report on the Marine and Coastal Zone Status (annual), compiled by NIMRD.

- Summer Season Environmental Status Report, compiled by NIMRD, Dobrogea-Littoral Water Basin Administration, Public Health Directorate.

- EU co-funded research projects (concluded and on-going) and territorial cooperation projects.

For the rest of the project partner countries (Ukraine, Moldova, Bulgaria and Turkey) the reports drafted by the ICZM experts appointed by the project partners were used. Additional data were used from the Annual National Reports of the ICZM Focal Points of the Black Sea Commission; Stock-Taking on ICZM in the Black Sea Region (as a product of the PEGASO FP7 Project); relevant national documents, national projects, regional projects, national legislations, national documents elaborated under the aegis of the World Bank etc.

To overcome the heterogeneity of the available information reported in National Reports, or to complete the analysis in the absence of a national report, the methodological approach adopted in the Study had to resort to complementary information gathering through on-line available information search, institutional web sites, the consultation of scientific literature, technical documents and reports overview, other multi-media tools made available by most important and pertinent ICZM European projects and initiatives, completed and in-progress. Relying on the Reporting guidance - Implementation ICZM Recommendation 2006-2010 and considering the heterogeneity in the reports, the analysis at country level was carried out on the basis of a qualitative evaluation approach. A specific focus was provided in respect to cooperation frameworks in Regional Seas and instruments relevant for Integrated Coastal Zone Management.

Need for ICZM in the Black Sea Region. Why Integrated Coastal Zone Management in the Black Sea Region? What should we improve?

The history of ICZM in the Black Sea region started following the signing of the Convention on the Protection of the Black Sea Against Pollution (Bucharest Convention, 1992). ICZM activities were launched within the Black Sea Environmental Program (BSEP) funded by GEF and jointly managed by UNDP, UNEP, World Bank, and European Union's PHARE and TACIS programs in the period 1993 - 2008. The Black Sea countries have reached a consensus on the necessity of reconstruction of existing management systems in compliance with ICZM principles in the Odessa Declaration (1993), Strategic Action Plan (1996), and in the new Strategic Action Plan for the Protection and Rehabilitation of the Black Sea, which was adopted in April 2009 (Antonidze, 2010).

The Draft Regional Black Sea Strategy on ICZM was developed by the ICZM Advisory Group (AG) of the Black Sea Commission with a technical support from the Europe Aid Project Technical Assistance to the Black Sea; the strategy was approved in 2004. The ICZM AG accepted in 2007 to measure the implementation of ICZM in the Black Sea region using the Progress Indicators Set, elaborated by EUCC-the Coastal Union. The results of the investigation showed good progress in the region during the last years in coastal planning/management and development of legal/policy framework for ICZM at the national level, reflected in more sustainable use of the Black Sea coasts and resources of coastal waters. Based on 15 years of experience, the Black Sea states showed considerable progress in coastal planning and management leading to more sustainable use of the coastal zone (Antonidze, 2010). However, stronger political support is needed for the ICZM process and long-term financial commitment.

A crucial step should be the development or further development of ICZM legislation at the Black Sea national and regional levels. New ICZM pilot projects should be initiated, as they offer unique opportunities for enhancing ICZM expertise using and improving the available Black Sea spatial planning methodology and ICZM strategy. Information exchange on best available practices should be more actively pursued in the region. The region should also agree on and use regularly a coherent system of indicators for an integral assessment of the Black Sea coastal zones state and implementation of ICZM (Antonidze, 2010).

Actually, coastal zones require a complex system of management involving an integrated approach. The systems must allow for the co-ordination of multiple, often contradictory, interests in order to utilise all the resources with a maximum social, economic and ecological benefit for the present and future generations.

Current solutions within the individual sector frameworks usually “transfer” problems to other areas, resources, products or services. Industry and power engineering are able to create a situation wherein the environment becomes unsuitable for any other type of utilisation. As problems become more and more critical, the transference of coastal problems from one place to another and from one sector to another can be long-term. Transfer of coastal erosion from one place to another is no solution, neither is transfer of river water pollution further downstream. These are unacceptable solutions to coastal conflicts. There needs to be a mechanism for solving such problems, elaborated within the prevailing economic and social systems. Such solutions must begin to involve all stakeholders including the general public.

The integrated approach allows for the combination of conflicting interests into a single Spatial Plan for all groups and thus bringing these interests to conformity. It gives better opportunities for future natural resource users and improves their ability to react effectively to unforeseen situations. We must ensure that we do not burden future generations with the problems we are causing today.

The Strategic Action Plan (1996) for the Rehabilitation and Protection of the Black Sea (BS SAP) has been one of the fundamental elements of the regional cooperation in the Black Sea which was first settled in 1992 by the Convention on the Protection of the Black Sea Against Pollution. The Plan was based on the findings of the first Transboundary Diagnostic Analysis (TDA) of the Black Sea (1996) and developed with certain principles to include specific policy actions to combat with the identified threats and problems.

The provisions of the BS SAP 1996 clearly stated for the ICZM issues in the Black Sea area, that in order to ensure proper management of the coastal zone, coordinated integrated coastal zone management strategies shall be developed for the Black Sea region. In order to attain this, the following actions were foreseen to be taken:

a) A Regional Black Sea Strategy for integrated coastal zone management should be developed. It was advised that the Istanbul Commission develop such a strategy by 2005, upon the recommendations of its Advisory Group on the Development of Common Methodologies for Integrated Coastal Zone Management. The regional strategy should elaborate basic principles and methodologies for land- and water-use planning as well as for designing zoning systems. The methodologies and principles recommended in the regional strategy shall be taken into account when developing or reviewing national strategies and planning instruments for integrated coastal zone management.

b) Each Black Sea coastal state should endeavour to adopt and implement, in accordance with its own legal system, by 1999, the legal and other instruments required to facilitate integrated coastal zone management.

c) Inter-sectorial committees for integrated coastal zone management should be established at the national, regional and local levels of public administration, where appropriate, by the end of 1997. These committees should design and implement national plans for integrated coastal zone management through participatory approaches.

d) Erosion and land degradation have important environmental and social impacts. Coastal erosion, due to the changed hydraulic conditions in many of the region's rivers, is a problem which has transboundary implications. Deforestation is another major factor contributing to land degradation. A survey of coastal erosion problems in the region was to be conducted by 2005. It was recommended that the Istanbul Commission, through its Advisory Group on the Development of Common Methodologies for Integrated Coastal Zone Management coordinate the work on this survey. The survey should have addressed the magnitude of the problem, including its economic implications; propose remedial actions, and included suggestions for pilot studies and demonstration projects.

e) Aquaculture and tourism are two areas considered to have scope for economic growth in the Black Sea and to benefit the region in general. In order to avoid environmental damage resulting from these activities, and particularly damage with transboundary implications, their development should be managed along common environmental norms to be established by 2006. It was advised that the Istanbul Commission, with the support of its Advisory Groups, adopt these common norms and liaise, where appropriate, with the Fisheries Commission, once this body has been established, to adopt an industry code of practice.

f) Eco-tourism should be stimulated in the region, amongst other things, through the implementation of concrete pilot projects in Black Sea coastal states. In close cooperation with the tourist industry and the national tourism authorities, environmental codes of conduct and training courses in sustainable tourism were to be developed. The tourism industry, both for the benefit of the industry and for the benefit of the environment, needs to be more adequately planned with a view to incorporating concerns such as those related to water supply, sewage treatment bathing water quality, the use of natural resources and resort development into newly developed projects from the beginning. Moreover, it shall be required that tourist development projects be subjected to environmental impact assessments.

Following to the provisions of the BSSAP 1996, a draft regional ICZM Strategy was prepared and Annex I of it presents proposals at national and regional levels for legislative improvements, the creation of ICZM institutional framework, the development of economic instruments, the development of pilot projects at the local level, ICZM training and education and establishment of ICZM monitoring and reporting system. Clear guidelines of an ICZM approach have also been provided within the Strategy to the Black Sea countries. The ICZM AG - BSC has conducted a survey among the BS States to measure the progress made between 2000 and 2005 in terms of "*aspects of coastal planning and management*", "*availability of a framework as a basis of ICZM development*", "*most aspects of ICZM are in place and functioning*" and "*efficient, adaptive and integrative process embedded at different levels of governance*". During the mentioned time frame, none of the countries have shown constant and really effective political support for the ICZM process. Coastal planning and management aspects seem to be mostly in place in Bulgaria, Romania and Ukraine whereas less developed in other countries. The framework to carry ICZM forward is almost complete in Bulgaria and Romania, whereas absent in other countries. The improvement by time at the local and national levels is most pronounced in Romania; however, funding is a problem for all the countries to undertake actions on the coast.

A number of pilot projects for testing of ICZM methodology on spatial planning for ICZM were implemented in the Black Sea coastal states with financial support of international donors and based on the methodology drafted by the ICZM Activity Center, Russian Federation in 1999-2000 (tested initially in the Russian resort town of Gelendzhik) under the EU funded TACIS project. Within the EuropeAid project ("Technical Assistance to the Black Sea Environmental Program" 2002 - 2004) together with the regional ICZM Strategy, mentioned above, the following documents were also developed:

- Guidelines For Preparation of National Codes of Conduct For Coastal Zones of Black Sea States;
- ICZM Tools and Techniques (Best practices);
- Glossary of ICZM Legal Terms.

Integrated Coastal Zone Management is also recognized in the new Strategic Action Plan for the Rehabilitation and Protection of the Black Sea (adopted in April 2009) as the main instrument to achieve sustainable development in the region through the involvement of all stakeholders.

The updated SAP (2009) includes ICZM targets, such as:

- Further recognize and implement integrated coastal zone management principles into policies;
- Develop and disseminate information, training and education materials on ICZM in regional languages, referring to coastal and marine biodiversity conservation,
- Identify and make an inventory of Black Sea landscapes of high natural, historical, cultural and aesthetic value;
- Undertake preliminary regional assessment of coastal erosion, etc.

The Black Sea states showed considerable progress in coastal planning and management leading to more sustainable use of the coastal zone. However, despite of the existing already legislation in Bulgaria, Romania and Georgia, this kind of management is not always considered in practice. Extensive construction, erosion, deforestation and destruction of coastal habitats are observed along the coasts of the Black Sea in certain areas. The Black Sea ICZM Strategy was drafted; however, its adoption needs to be accelerated. ICZM spatial planning methodology was developed by the ICZM Activity Centre (Russian Federation), and further tested in Ukraine and Turkey, proving its usefulness and it will be wider promoted in the Black Sea coastal states and elsewhere.

The coastal zone is an extremely complex social-ecological system that varies in relation to its environmental, socio-economic, cultural and governance factors. Integrated Coastal Zone Management (ICZM) seeks to develop an integrated model for sustainable development that is based on finding points of convergence among these factors (Diedrich et al., 2010).

The Black Sea coastal zone is experiencing increasing pressures mainly due to population increase, urbanization, growth in agriculture, fisheries, and industry. As it is essential for the national economy, competition for its resources is growing, threatening to destruct the functional integrity of the resource system. The coast is already subject to erosion, water pollution, decline of renewable resources, loss of biological diversity, wetlands losses and destruction of landscape. The need to deal in the future with the impacts of climate change in combination with finding adaptive responses is also an issue.

Integrated Coastal Zone Management (ICZM) is defined as:

European Commission

"*ICZM is a continuous process of administration the general aim of which is to put into practice sustainable development and conservation in coastal zones and to maintain their biodiversity. To this end, ICZM seeks, through more efficient management, to establish and maintain the best use and sustainable levels of development and activity (use) in the coastal zone, and, over time, to improve the physical status of the coastal environment in accordance with certain commonly held and agreed norms*."

World Bank

"*Integrated Coastal Zone Management (ICZM) is a governmental process and consists of the legal and institutional framework necessary to ensure that development and management plans for coastal zones are integrated with environmental (including social) goals and are made with the participation of those affected*."

UNEP

"*Integrated Coastal Area Management (ICAM) is defined as an adaptive process of resource management for sustainable development in coastal areas. Sustainable development requires that the quantity and quality of coastal resources are safeguarded in order that they not only satisfy the present needs but provide a sustained yield of economic and environmental services for future generations*."

HELCOM

"*The concept of Integrated Coastal Zone Management – ICZM – aims to build a platform for different authorities, sectors, interests and communities, to focus on the interaction between various activities and demands for natural resources in coastal zones, with the common objective to achieve an ecologically sustainable development within a specific geographical area*."

The practice of the developed coastal nations demonstrates that the most reasonable way in which to realise principles for sustainable coastal development is through integrated coastal zone management (ICZM).

The eight Integrated Coastal Zone Management (ICZM) principles are an important element of the European approach to ICZM.

These principles of good practice, outlined in the EC Recommendation (2002/413/EC) and Strategy (2000/547/EC), were also endorsed by the European Commission in its Communication on ICZM. Since the publication of the Recommendation in 2002 the 8 ICZM principles have quickly become the standard against which progress in ICZM in Europe is measured (McKenna et al., 2008).

Even though ICZM is an effective tool for advancing towards sustainability in the coastal zone, ensuring equitable use of coastal resources (natural, socio-economic and cultural) and integration among the different administrative and societal sectors, the success of ICZM in supporting sustainability goals in Europe has been limited due to, among others, the challenge associated with translating the basic principles of ICZM into management action (Shipman et al., 2007, Diedrich et al., 2010).

ICZM Principles

Principle 1: A broad overall perspective (thematic and geographic) which will take into account the interdependence and disparity of natural systems and human activities with an impact on coastal areas.

Principle 2: A long-term perspective which will take into account the precautionary principle and the needs of present and future generations.

Principle 3: Adaptive management during a gradual process which will facilitate adjustment as problems and knowledge develop. This implies the need for a sound scientific basis concerning the evolution of the coastal zone.

Principle 4: Local specificity and the great diversity of European coastal zones, which will make it possible to respond to their practical needs with specific solutions and flexible measures.

Principle 5: Working with natural processes and respecting the carrying capacity of ecosystems, which will make human activities more environmentally friendly, socially responsible and economically sound in the long run.

Principle 6: Involving all the parties concerned (economic and social partners, the organisations representing coastal zone residents, non-governmental organisations and the business sector) in the management process, for example by means of agreements and based on shared responsibility.

Principle 7: Support and involvement of relevant administrative bodies at national, regional and local level between which appropriate links should be established or maintained with the aim of improved coordination of the various existing policies. Partnership with and between regional and local authorities should apply when appropriate.

Principle 8: Use of a combination of instruments designed to facilitate coherence between sectorial policy objectives and coherence between planning and management.

ICZM is a process of management, the development of which is carried out at national, regional and local level, involving participation of all the stakeholders and the general public. It is implemented through the establishment of organisational and legal frameworks, instruments and procedures, which are needed for the provision of the optimal combination (integration) of development plans in the coastal zones.

The coastal zone is an extremely complex social-ecological system that varies in relation to its environmental, socio-economic, cultural and governance factors. Integrated Coastal Zone Management (ICZM) seeks to develop an integrated model for sustainable development that is based on finding points of convergence among these factors (Diedrich et al., 2010).

The European Parliament and the Council adopted in 2002 a *Recommendation on Integrated Coastal Zone Management* which defines the principles sound coastal planning and management. These include the need to base planning on sound and shared knowledge, the need to take a long-term and cross-sector perspective, to pro-actively involve stakeholders and the need to take into account both the terrestrial and the marine components of the coastal zone.

The impact assessment is conducted in conjunction with the assessment of possible future action on maritime spatial planning.

Many European coastal zones face problems of deterioration of their natural, socio-economic and cultural resources. The impacts of climate change are expected to further increase the exposure of the coast to flooding and erosion. Yet, coastal planning activities or development decisions still take place in a sectorial way, hardly being linked to each other. This fragmented approach to planning and management leads to inefficient use of resources, conflicting claims on space and missed opportunities for more sustainable coastal development.

To improve this situation, the European Parliament and the Council adopted in 2002 a Recommendation on Integrated Coastal Zone Management which defines the principles sound coastal planning and management. These include the need to base planning on sound and shared knowledge, the need to take a long-term and cross-sector perspective, to pro-actively involve stakeholders and the need to take into account both the terrestrial and the marine components of the coastal zone.

A first overview of ICZM implementation was made in 2006 (Rupprecht, 2006) on the basis of National Member State reports and additional information gathering. The European Commission has launched a review of the EU ICZM Recommendation, with a view to a follow-up proposal by the end of 2011. An impact assessment is conducted to explore the need and options for future EU action and to assess potential social, economic and environmental consequences that new initiatives proposed by the European Commission may have. The impact assessment is conducted in conjunction with the assessment of possible future action on maritime spatial planning.

Following natural boundaries rather than political borders, many resource management problems have been complicated by a lack of coordination between the policies and practices of different jurisdictions. This disconnect magnifies the importance of collaboration among stakeholders on both sides of the divides that have compartmentalized them.

However, effective collaborative resource management is not easily achieved, and when the ecosystem in question spans an international border, complications arise.

The legal, social, and economic differences that can exist between nations add layers of complexity to the challenges that any collaborative effort faces. Despite these obstacles, transboundary ecosystem stewardship is occurring in an international context.

There are four main types of barriers that appeared be much more prominent in transboundary situations. These barriers are:

1) Legal and governmental differences that complicate coordination and implementation; 2) Barriers to communication, movement, and information;

3) Social and cultural differences including language differences that inhibit the development of trust and a common sense of community; and

4) Economic disparities that constrain certain stakeholders' willingness or ability to participate in the process (Council of Europe, 2011).

Cooperation among European countries can be framed at different levels, depending on the scale of undertaken initiatives (regional and sub-regional, national or subnational, local).
Moreover financial resources rely on different funding programmes supported by EU or National-Regional-Local institutions.

One of the most important instruments supporting cooperation among institution in charge of coastal planning and management as well as other stakeholders is the European Territorial Cooperation (ETC) programme of the European Union Cohesion Policy. It was observed an increase in the number of cross border projects focusing on coastal management issues in the current programming period in respect to the previous one.

Regarding transnational cooperation projects several projects aim to implement ICZM principles and substantially contribute to support sustainable coastal zone management trough cross border collaboration, knowledge and information exchange, institutional agreements.

1.1.1. Overview of the national policies towards ICZM in the target countries

In respect to ICZM principle implementation major progress was made in those countries having an ICZM strategy and which are in the implementation phase. Since the implementation started recently there is room for more progress to be achieved in the very next future; thanks to the laid down of foundation required for ICZM, in particular regarding integration of planning and management of the marine and terrestrial components of the coast, positive impacts are foreseen.

More heterogeneity can be found in countries which adopted a framework equivalent to an ICZM strategy; with few exceptions an holistic approach is already considered in planning and management tools in place in different countries, as well as strategies considering long term perspectives were developed in the last period.

Bulgaria

ICZM has not a long history in Bulgaria, as the country is an EU member state since 2007. Nevertheless, some activities related to ICZM can be mentioned mainly voted to preserve the coastline from erosion. The realization of interventions to strengthen the coastline allows to preserve the coastal environment and to promote the coastal development in accordance with the requirements of environmental protection. From a legal point of view, in the years 2005-2010 many new laws on transposition and implementation of environmental acquis have been issued. The themes concern the protection of the environment (protected areas, marine environment, biodiversity etc.) and the spatial planning and development (The Regional Development Act and the Law on Spatial Development).

In the years 2005-2010 several plans and programmes have been adopted both at national and local level: River Basin Management Plans (Varna region), Environmental plans (National Environmental Protection Strategy, Biodiversity Conservation Action Plan, Protected areas Management Plan, and so on), and Sustainable development plan (National Strategy for Sustainable Tourism Development).

The institutional coordination's competencies are scattered among different institutions. The Ministry of Environment and Water and the Ministry of Regional Development and Public Works are responsible for decision-making in the area of integrated coastal zone management and sustainable development. The Ministry of Environment and Water and the Ministry of Trade and Tourism are responsible for decision-making in the area of marine environmental protection. The coordination is achieved within the framework of the activities included in BSEP (Black Sea Environmental Program). Some boards for cross sectorial coordination also exist in the field of Biodiversity, environmental protection, water management, planning). In recent years the coordination mechanism has improved even if it is still underestimated the importance to coordinate ICZM activities with other sector policies.

Many research and cooperation projects have been realized or are going on. The themes developed concern the sustainable development, sustainable transport, climate changes, marine spatial planning.

Romania

Romanian legislation in ICZM is under a process of evaluation for revision and ensuring of its implementation.The existing ICZM legal framework supports Romania in fulfilling the requirements of national and EU legislation related to ICZM in order to achieve sustainable development of the Romanian coastal zone. In recent years, efforts have been focused in the implementation and development of the related Plans and programmes.

Several Plans related to different ICZM aspects have been adopted in recent years (ICZM strategies, spatial planning, marine strategies and sustainable development). In particular the National Plan for Integrated Coastal Zone Management (draft emission 2006-2007) aims to guide and support national, regional and local level government agencies to achieve sustainable development of coastal and marine areas through better integration, coordination, communication and participation. It's important to mention various coastal management plans, such as the Urban planning for the Black sea Coastal Zone (2010-2011), the Master Plan for severe protected areas (2007) and the Strategic Action Plan for the Rehabilitation of the Black Sea (updated in 2009). A focus on the sustainable development is also taken by the Romania National Tourism Development master plan 2007-2026. The institutions that manage the activities related to ICZM policies have not changed in the recent years. In 2004 the National Committee of Coastal Zone (NCCZ) has been set up in order to ensure an integrated coastal zone management.

The National Committee of Coastal Zone has the following responsibilities:

- Endorsing the plans regarding integrated coastal zone management and local and regional spatial planning;
- Endorsing the studies regarding environment impact of activities having an important impact in the coastal zone as well as the environment audit for the existing ones;
- Endorsing the projects regarding establishing of natural parks and reserves.
- NCCZ, through the Permanent Technical Secretariat (PTS), is empowered to inform the competent organizations about critical situations in the coastal zone which need rehabilitation actions and initiating of specific projects.

The National Institute for Marine Research and Development “Grigore Antipa” (NIMRD) is responsible for the Permanent Technical Secretariat (PTS) activities. Under the National Committee, Working Groups (WG) consisting of key experts from relevant authorities and research institutes providing advice and guidance on specific topics such as monitoring and control of the coastal environment, coastal spatial planning, coastal erosion, action planning and strategy development etc. were set up (Fig. 1.1).

The National Committee of Coastal Zone (NCCZ), legally based on the provisions of the ICZM legislation (Governmental Emergency Ordinance no. 202/2002 regarding coastal zone management approved with further modifications and amendments through the Law no. 280/2003), has been set-up in June 2004 by the Government Decision no. 1015/2004, in order to ensure an integrated coastal zone management. The Secretary of State for Water of the Ministry of Environment, Waters and Forests chairs the committee in which approximately 40 authorities, institutions and stakeholders (NGOs) are represented.

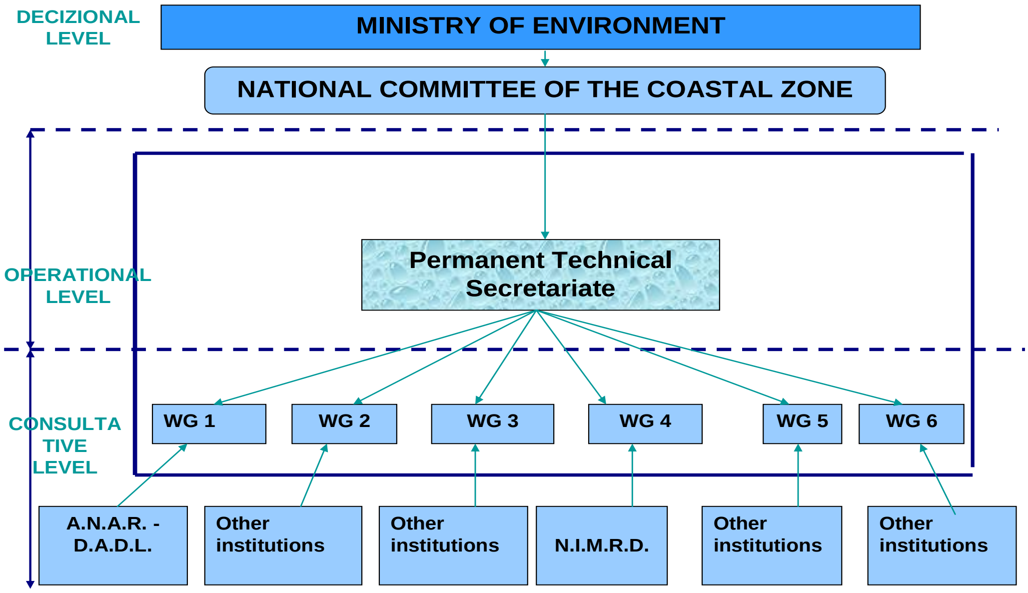


Fig. 1.1 National Committee of the Coastal Zone chart (Romania)

Turkey

Turkey has a number of laws and policies that address coastal planning, environmental protections and sustainable use of resources. The National Committee on Turkish Coastal Zone Management has been established since 1993. A relative effort in Turkey relating to coastal zone management is a report sponsored by the Priority Actions Programme (PAP) of UNEP-MAP (Gunay, 1987). A follow up report on the same theme was presented at the 14^{th} session of the United Nations Economic Commission for Europe in Portugal. In 1990, internationally funded Project, with the title "Coastal Zone Management in Turkey" was launched by a grant from the World Bank's METAP Programme to the Turkish Government.

The Turkish National Committee on Coastal Zone Management (KAY) is a national committee which is a national network with international connections. It is legally set up under the framework of the Higher Education Law. The Turkish National Committee on Coastal Zone Management (KAY) has contributed to the development of coastal policies in Turkey, by providing expert opinions on various coast-related developments, by publishing a newsletter, and by organizing a national conference series entitled The National Conference on Coastal and Marine Areas of Turkey - "The Turkish Coast". Furthermore, the national committee has been a lead organization in the international MEDCOAST initiative.

Ukraine

The only Ukrainian initiative to include the approach of the integrated coastal zone management into the national policies and planning dates back to the year 2002, when a Draft Law "On coastal zone" was developed. Due to various reasons it has not been adopted by the Parliament till now. Therefore, the issues of coastal zone management are regulated by cross-sectoral acts in land and water management, marine activities.

Development of coastal areas is planned in compliance with the same legal enactments as for the development of other territories of the state (e.g., National regional development strategy of

Ukraine until 2015, National programme for the formation of the environmental network of Ukraine for 2000-2015, National programme of conservation and restoration of the Sea of Azov and the Black Sea environment, Law of Ukraine "*On planning and development of territories*" with application of certain additional land use planning, environmental and sanitary and hygienic requirements connected with the natural features of the sea coastal area. Development of the territories is accomplished in accordance with the long-term comprehensive and target-oriented national and local programs.

As the sea coastal areas include not only lands but also the adjacent water area, the planning and use of these areas are associated, as a rule, with the planning of the adjacent lands uses. However, the integrated system of planning the sea area uses is inoperative in Ukraine. The vivid fact is that this particular essential management aspect is, practically, never discussed in the fundamental monograph "*Environmental management of sea*" wherein the many-years research of the Institute of Market problems and Economic and Environmental Studies have been consolidated. Still, the policy in the sphere of uses of the sea is not left unattended by the authorities.

In accordance with the Law "*On exclusive (sea) economic zone of Ukraine*", Ukraine pursues, within its exclusive economic zone, exploration, development and extraction of living and non-living resources of the sea in water, at sea bottom and in the subsoil beneath the seabed as well as implements other steps aimed at conservation and restoration of the living resources, scientific research and support of shipping. As far as that seas and the sea subsoil are referred to the significant all-national objects in compliance with the Water Code of Ukraine, their planning and use are reflected in the sectorial programs and the programs of social and economic development of the country. However, the environmental activity remains, most probably, the main kind of the activity in the sea water areas.

An example of the sectorial planning as applied to the use of sea areas can be presented by the National programme for the formation of the environmental network of Ukraine for 2000-2015 which provides for establishment of two exclusively marine national parks (Great and Small Zernov's *Phyllophora* Fields of 130.000 km^2 total area) and a series of coastal reserves that are going to include the coastal water areas (in particular, Meotida, Jarylgach, Kinburn spit, etc.). The National special-purpose program for the development of reserves for until 2020 is being developed now. We note that the first tangible success in the establishment of the sea reserves was achieved (the Great Zernov's *Phyllophora* field has been given a status of the reserve).

1.1.2. International commitments of the target countries towards ICZM

The Bucharest Convention and its Protocols together with their implementation plan, SAP (2009), constitute the regional legal/policy framework for the protection of the Black Sea environment. The Black Sea Commission (BSC) is made up of one member from each of the six Black Sea national governments. Six regional activity centres and six thematic advisory groups of the BSC contribute to the regional implementation scheme.

At a regional level, the four priority transboundary problems for the Black Sea ecosystem, re-confirmed by Black Sea Transboundary Diagnostic Analysis (TDA, 2008) and by the Strategic Action Plan for the Environmental Protection and Rehabilitation of the Black Sea (SAP, 2009), are (1) eutrophication/nutrient enrichment, (2) changes in marine living resources, (3) chemical pollution (including oil), (4) biodiversity/habitat changes, including alien species introduction. The BS SAP (2009) defined the comprehensive set of Ecosystem Quality Objectives (EcoQOs) to manage these four transboundary environmental issues (SAP, 2009.

The Causal Chain Analyses in the Black Sea TDA (2008) found that four trans-boundary problems cannot be dealt with individually. It is stated that "*improvements in management of one* *problem will have knock-on effects for other problems, and addressing individual causes is likely to improve the situation with regard to at least two, if not more, of the four environmental problems*". Clear, coherent scientific understanding of coastal (land and water) margins and efficient management of human activities in these areas are vitally important for achieving all four SAP (2009) EcoQOs.

In particular, through signing the BS-SAP (2009) countries confirmed (Article 3.1) to adhere to the following governance and management approaches: (i) Integrated Coastal Zone Management (ICZM); (ii) The Ecosystem Approach; and (iii) Integrated River Basin Management (IRBM).

The geographical scope for the basin is defined by the Bucharest Convention and its Protocols as the marine and coastal waters of the Black Sea proper. However, in terms of linkage to the Mediterranean, the Turkish Straits System as well as the Azov Sea and the Kerch Strait can also be considered in the context of the marine and coastal governance such as ICZM.

ICZM is also aimed to integrate coastal governance issues with the events within the catchment basins of rivers draining into the sea. Hence, the Black Sea with its watersheds (catchment area), being one of the Large Marine Ecosystems (LME) of the world with ecology dissimilar from that of the adjacent seas and ocean, has to be considered in this context either.

The combined application of ICZM and IRBM was affirmed as a legally binding general obligation in the updated Protocol on the Protection of the Marine Environment of the Black Sea from Land-Based Sources and Activities (LBSA, 2009), which is urging countries (Article 4f) "*to endeavour applying the integrated management of coastal zones and watersheds*".

Another Protocol, relevant for ICZM is the Black Sea Biodiversity and Landscape Conservation Protocol to the Convention on the Protection of the Black Sea Against Pollution (BLC, 2002). At least two its articles are directly relevant to the issue of ICZM. Under its Article 3, the Protocol applies to *coastal zone*, which have to be designated by each Contracting Party, including wetlands. Importantly, the Contracting Parties have also committed themselves "*to encourage introduction of intersectorial interaction on regional and national levels through the introduction of the principles and development of legal instrument of integrated coastal zone management seeking the ways for sustainable use of natural resources and promotion of environmentally friendly human activities in the coastal zone*" (Article 7).

The regional Black Sea institutional framework for the protection of the marine environment involves two regional organizations: primarily the Commission on the Protection of the Black Sea Against Pollution (Black Sea Commission, BSC), established *de jure* in 1992 (BSC, 2000) through Article 17 of the Bucharest Convention and supported by the United Nations Environmental Programme, and the Organization of the Black Sea Economic Cooperation (BSEC), also established in 1992. The Black Sea Commission was established exclusively for the protection of the Black Sea marine environment and is composed of the Black Sea coastal states, while BSEC, as a regional economic cooperation forum, includes even states not falling within the ecological limits of the Black Sea Catchment. BSC and BSEC have granted each other the observer status.

Institutionally the Black Sea Commission (BSC) is the intergovernmental organization responsible for the implementation of the Convention for the Protection of the Black Sea Against Pollution (Bucharest Convention), its four Protocols and Strategic Action Plan, aiming at preserving the Black Sea ecosystem as a valuable natural endowment of the region, while ensuring the protection of its marine and coastal living resources as a condition for sustainable development of the Black Sea coastal states, well-being, health, and security of their population.

The Permanent Secretariat of the BSC started functioning in 2000. One of its subsidiary bodies is the ICZM Advisory Group, which actively supports the ICZM activities of the BSC. The group is responsible for the annual ICZM report of the BSC, submitting also regularly data on the state of the coast and development of ICZM in the Black Sea states. The annually reported data covers development of policy/legislation, projects and different ICZM indicators in the fields and sectors of: population and geography, energy, water and wastewater, biodiversity, coastal erosion, economy, tourism, solid waste management, agriculture, industry, transport, and climate.

The international commitments of **Bulgaria** towards ICZM are:

- 1972 Convention on the Protection of the World Cultural and Natural Heritage, UNESCO, 1972;
- Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention), approved by Decision 389/18.11.1974 of the Council of Ministers, effective in Bulgaria since 24.01.1976, amended by Protocol from 12.03.1982, effective for Bulgaria since 02.27.1986;
- MARPOL Convention and Annexes to the Convention, 1978.
- Convention on the Conservation of European Wildlife and Natural Habitats - ratified on 25.01.1991, in force in the Republic of Bulgaria since 01.05.1991;
- Convention on the Protection of the Black Sea against Pollution, signed and ratified in 1992, enforced in 1994;
- Agreement on the Conservation of Populations of European Bats (EUROBATS), 1994;
- Convention on Biological Diversity, ratified on 29.02.1996, in force since 16.07.1996;
- Convention on the Conservation of Migratory Species of Wild Animals, ratified on 23.07.1999, effective since 01.11.1999
- Convention on Fishing and Conservation of Living Resources;
- Protocol on Protection of the Black Sea Marine Biological and Landscape Diversity to the Convention on the Protection of the Black Sea against Pollution, signed in 2002, ratified and enforced in 2004;
- Protocol on the Protection of the Marine Environment of the Black Sea against Pollution from Land Based Sources;
- Protocol on Cooperation in Combating Pollution of the Black Sea Marine Environment by Oil and Other Harmful Substances in Emergency Situations;
- Protocol on the Protection of the Marine Environment of the Black Sea during Unloading;
- Minutes of the Eighth Extraordinary Meeting on Protection of the Black Sea Ecosystems against Pollution;
- Strategic Action Plan for the Rehabilitation and Protection of the Black Sea 1996 (updated on 17 April 2009 with the adopted Strategic Action Plan for the Environmental Protection and Rehabilitation of the Black Sea);
- Contingency Plan to the Protocol on Cooperation in Combating Pollution of the Black Sea by Oil and Other Harmful Substances Contingency Plan Annexes;
- Declaration on the Protection of the Black Sea, signed in Odessa;
- Declaration on Water and Aquatic Ecosystems in the Black Sea Region;
- Declaration of Ministers of Environment of the countries participating in the Convention on the Protection of the Black Sea against Pollution (Sofia Declaration);
- European Landscape Convention, 2000;
- European Plant Conservation Strategy, 2008;
- Council Directive 92/43/EEC, dated 21.5.1992, on the conservation of natural habitats and of wild fauna and flora;
- Council Directive 79/409/EEC, dated 2 April 1979, on the conservation of wild birds
- Recommendation of the European Parliament and of the Council of 30 May 2002

concerning the implementation of Integrated Coastal Zone Management in Europe (2002/413/EC);

- Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning;

Table 1.1. International conventions on the Prevention of Marine Pollution Bulgaria is party in

No.	Convention on the Prevention of Marine Pollution	Adoption
1	Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction	April 1972
2	International Convention relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, 1969	Enforced in May 1975
3	Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972, with amendments to the annexes relating to incineration at sea and others	Enforced in August 1975
4	Vienna Convention for the Protection of the Ozone Layer	March 1985
5	Convention on the prompt notification of nuclear accidents	September 1986
6	Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency	September 1986
7	Athens Convention relating to the Carriage of Passengers and their Luggage by Sea (PAL Convention), 1974	Enforced in April 1987
8	Montreal Protocol on Substances that Deplete the Ozone Layer	September1987
9	International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC), 1990	Enforced in May 1995
10	International Convention on the Control of Harmful Anti-fouling Systems on Ships (AFS)	October 2001

Moldova is a party to about 26 International Environmental Conventions. Among them are the following:

- Convention on International Trade in Endangered Species of Wild Fauna and Flora (Washington, 1973);
- Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 1991); ratified in 1993;
- Convention on the Conservation of European Wildlife and Natural Habitats (Bern, 1979); ratified in 1993;
- Convention on the Protection of Transboundary Watercourses and International Lakes (Helsinki, 1992); ratified in 1993;
- Convention on Transboundary Effects of Industrial Accidents (Helsinki, 1992); ratified in 1993;
- Convention on Biological Diversity (Rio de Janeiro, 1992); ratified in 1993;
- United Nations Framework Convention on Climate Change (Rio de Janeiro, 1992), ratified in 1995;
- Convention on Long-Range Transboundary Air Pollution (Geneva, 1979); ratified in 1995;

- Convention on Cooperation for the Protection and Sustainable Development of the Danube River (Sofia, 1994); ratified in 1999;
- Convention on Wetlands of International Importance Especially Waterfowl Habitat (Ramsar, 1971); ratified in 1999;
- The United Nations Convention to Combat Desertification (Paris, 1994), ratified in 1999;
- Convention on Access to Information, Public Participation in Decision-Making Process and Access to Justice in Environment (Aarhus, 1998); ratified in 1999.
- Agreement on the Conservation of African-Eurasian Migratory Species (Hague, 1995); ratified in 2000;
- European Landscape Convention (Florence, 2000), ratified in 2001;
- Cartagena Protocol on the Biosafety to the Convention on Biological Diversity; ratified in 2003;
- Convention on Migratory Species of Wild Animals (Bonn,1979); ratified in 2000;
- Stockholm Convention on Persistent Organic Pollutants (Stockholm, 2001); ratified in 2004;
- Convention on Plant Protection Service (Rotterdam, 1998); ratified in 2004.

Romania's commitments towards ICZM are the following:

- 1972 Convention on the Protection of the World Cultural and Natural Heritage, UNESCO, 1972;
- Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention), approved by Decision 389/18.11.1974 of the Council of Ministers, effective in Bulgaria since 24.01.1976, amended by Protocol from 12.03.1982;
- MARPOL Convention and Annexes to the Convention, 1978.
- Agreement on the Conservation of Populations of European Bats (EUROBATS), 1994;
- Convention on the Protection of the Black Sea against Pollution, signed and ratified in 1992, enforced in 1994;
- Convention on Fishing and Conservation of Living Resources;
- Protocol on the Protection of the Marine Environment of the Black Sea against Pollution from Land Based Sources;
- Protocol on Cooperation in Combating Pollution of the Black Sea Marine Environment by Oil and Other Harmful Substances in Emergency Situations;
- Protocol on the Protection of the Marine Environment of the Black Sea during Unloading;
- Minutes of the Eighth Extraordinary Meeting on Protection of the Black Sea Ecosystems against Pollution;
- Protocol on Protection of the Black Sea Marine Biological and Landscape Diversity to the Convention on the Protection of the Black Sea against Pollution, signed in 2002, ratified and enforced in 2004;
- Contingency Plan to the Protocol on Cooperation in Combating Pollution of the Black Sea by Oil and Other Harmful Substances Contingency Plan Annexes;
- Declaration on the Protection of the Black Sea, signed in Odessa;
- Declaration on Water and Aquatic Ecosystems in the Black Sea Region;
- Declaration of Ministers of Environment of the countries participating in the Convention on the Protection of the Black Sea against Pollution (Sofia Declaration);
- European Landscape Convention, 2000;
- European Plant Conservation Strategy, 2008;
- Strategic Action Plan for the Rehabilitation and Protection of the Black Sea

1996 (updated on 17 April 2009 with the adopted Strategic Action Plan for the Environmental Protection and Rehabilitation of the Black Sea);

- Council Directive 92/43/EEC, dated 21.5.1992, on the conservation of natural habitats and of wild fauna and flora;
- Council Directive 79/409/EEC, dated 2 April 1979, on the conservation of wild birds
- Recommendation of the European Parliament and of the Council of 30 May 2002 concerning the implementation of Integrated Coastal Zone Management in Europe (2002/413/EC);
- Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning.

Turkey has been a party from the start to two different UNEP regional seas programmes: the Mediterranean Action Plan (1975) and the Black Sea Strategic Action Plan (1996).

The international efforts for management of the Black Sea's coastal and marine areas are more recent when compared to those for the Mediterranean. UNEP's effort at initiating the 10th regional seas programme in the Black Sea produced the Bucharest Convention signed in 1992. However, the work needed for commencing the programme was carried out in the scope of the Global Environmental Facility (GEF) Project (Black Sea Environmental Programme - BSEP) between 1995-1998 and 2005-2007 (BSERP, 2007; BS SAP 1996).

The ICZM component of the BSEP included four main issues:

a. Delineation of the national coastal zone boundaries;
b. Creation of the national network for ICZM;
c. Preparation of the national report; and
d. Execution of at least one pilot Project by each country related to ICZM.

The Science for Stability and Science for Peace Programmes of NATO have supported very significant research projects on various marine problems since the mid 1980s. These include the projects abbreviated as TU-Fisheries, TU- Black Sea, TU-Waves, and the follow up Project of the TU-Black Sea (BSC, 2009).

In **Ukraine** the international cooperation is accomplished along several directions and encompasses the regional activities, the activities on the Ukraine-EU level and the activities pursued by Ukraine together with other countries on a bilateral basis. The cooperation format provides for a financial support of the national programs and projects, and for a technical assistance. Regretfully, such cooperation is still primarily unilateral: the assistance in kind of consulting or financial aid is aimed at Ukraine and the Black Sea region countries until now. Along with that, it is not possible to assert that the donor countries extend such assistance without seeking to profit. Their benefit lies in accumulation of experience, extension of their footprint, extension of their management and production technologies, localizing and prevention of the potentially hazardous events and processes which negative impacts can expand on the donor countries as well, etc.

The ICZM significance was also stressed in the Strategic Action Plan for restoration and protection of the Black Sea (SAP) which was approved of and signed by the authorised representatives of the Black Sea countries in 1996.

The SAP envisaged a development of the ICZM coordinated regional strategy which had to be completed before the end of 1998. By this time the countries also planned to approve the national legal and other tools required for implementation of the ICZM. That process had to be coordinated by inter-sectoral commissions on ICZM which establishment was planned before the end of 1997. Also it was envisaged to develop the national ICZM plans with the involvement of the parties concerned.

Regretfully, but the deadlines of these tasks that require, primarily, the management efforts were wrecked practically in all countries. Causes of such situation deserve a separate analysis. In the context of this section it is possible to note that a lack of proper attention to the ICZM, that was due to insufficient understanding of the practical value of this approach, weak institutional framework and law-enforcement mechanisms and problematic determination and adherence to priorities in the period of transition to the market economy and privatization processes in the countries of the region.

In 2002 the countries somewhat adjusted the SAP. The changes most of all referred to revision of the deadlines of the formulated tasks. Specifically, the development of the ICZM regional strategy was prolonged until 2005. The draft of such strategy was developed and placed on the Black Sea Commission website but the document was not approved, moreover it does not have the determined status. Having said all that, we state that the draft strategy contains adequate recommendations for improving the legislation, establishment of the institutional basics of the ICZM, development of the economic mechanisms, pilot projects, enhancement of proper education and advanced training as well as implementation of the monitoring and reporting system.

The progress achieved by the countries in the ICZM sphere was presented in the SAP Report for 2001-2006 that was prepared by the Black Sea Commission. It was mentioned in the Report that a certain progress was achieved in establishment of the ICZM legal and institutional framework in Romania and Bulgaria where the appropriate target laws were adopted and, to a certain extent, in Ukraine. The aspects of planning and management of the coastal zones have been more developed in these countries than in other countries. Along with that, the Report emphasised that neither of the Black Sea countries demonstrated a permanent and really effective political support of the ICZM process.

Within the frame of cooperation between Ukraine and the EU at least two productive directions can be singled out. Having set the Euro-Atlantic integration as a strategic goal of its national development, Ukraine makes certain efforts to achieve it. In particular, on June 14, 1994, an Agreement on Partnership and Cooperation between Ukraine and European Community and its participant countries was concluded, and somewhat later the action plan was developed and formulated in Ukraine that aspired to achieve the criteria required for the EU membership. This plan envisaged, above all, adaptation of the legal base, establishment of the appropriate institutions and other additional measures which are necessary for efficient law-making and administration of the law.

The approval and accomplishment of the National program for adapting the Ukrainian legislation to the EU legal base became a component of this plan that was aimed at the achievement of the accord between these systems. The process of adapting the legislation is still on-going. It is systematic and includes several stages. The priority spheres of the legislation of Ukraine being adapted at the first stage of the Program are those that are considered important for regulation of land matters, territorial development, environmental protection, health and life of people, etc. Therefore, it is possible to expect that the legal tools that regulate territorial planning and development in Ukraine will be harmonized with the appropriate legal instruments of the EU.

The other direction of cooperation concerns a provision of the technical assistance to Ukraine and other Black Sea countries with a view of strengthening the institutional and management levers, including those in the field of the territorial planning, protection and balanced use of sea and coastal ecosystems. In particular, one of the ICZM technical assistance demonstration projects for Georgia, Ukraine and the Russian Federation (Environmental Collaboration for the Black Sea Project, EuropeAid/120117/C/SV/Multi) is implemented as of now (October, 2008) in Tskhaltminda village (Georgia) while in Ukraine the efforts are focused on further improvement of the ICZM legal tools.

Achievements of all Black Sea countries, including Ukraine, are the results of the pilot project on the implementation of the spatial planning methodology and ICZM "Functional zoning of Gelenjik resort area in Krasnodar region of the Russian Federation". It became possible due to the other EU technical assistance project - EuropeAid Technical Assistance to the Black Sea Environmental Programme (2002 - 2004). Finally, speaking about a bilateral cooperation development in the ICZM sphere it is worthwhile to point out that it also has a nature of technical assistance and has a pragmatic meaning. Within the frame of such cooperation financial resources were involved and the experienced of the partnership countries was used in order to implement the ICZM principles at the local level.

1.1.3. An inventory of existing measures applied in coastal zones and an analysis of the need for additional actions in order to achieve the objectives set out (for maritime spatial plans and integrated coastal management strategies)

On 23 July 2014 the DIRECTIVE 2014/89/EU of the European Parliament and of the Council was elaborated establishing a framework for Maritime Spatial Planning which entered in force in September 2014. The European Parliament and of the Council has also under disscussion and debate a Proposal for a establishing a framework for maritime spatial planning and integrated coastal management launched on 12 March 2013, at present provisionary.

Based on these two important documents, important objectives and steps for ***maritime spatial plans and integrated coastal management strategies*** have been underlined, applicable to all EU countries and seas**.** They are:

- Member States will be required to establish and implement maritime spatial plans and integrated coastal management strategies.
- Maritime spatial plans should at least map the actual and potential spatial and temporal distribution of maritime activities in marine waters.
- Integrated coastal management strategies should contain an inventory of existing measure applied in coastal zones and an analysis of the need for additional action for the appropriate management of activities in coastal zones.
- The plans and strategies will need to be mutually coordinated, provided they are not integrated, and be reviewed at least every 6 years.
- All relevant stakeholders and authorities should be appropriately consulted on the draft plans and strategies and have access to the results once available.
- Plans and strategies should be based on best available data that should be collected, as far as possible, by making use of existing instruments established under other EU initiatives.
- Member States have to cooperate together and with third countries to ensure that plans and strategies are coherent across coastal zones and marine regions.
- Plans and strategies will need to be subject to applicable procedures in relation to strategic environmental assessments.
- Member States will need to designate the authority or authorities for the implementation of the Directive and will need to report to the Commission on the implementation of the Directive on a regular basis.

1.1.3.1. Establishment and implementation of maritime spatial plans and integrated coastal management strategies (Article 4) is referring to:

- definition of maritime spatial plans and integrated coastal management strategies;
- **main objectives** (Article 5) and **minimum requirements** fulfillment;
- particularities of the regions, sub-regions, sector activities, the marine waters and coastal zones concerned and potential climate change impacts;
- include or build **mechanisms** that have been or are being established before the Directive entry into force of this.

1.1.3.2. Objectives for maritime spatial plans and integrated coastal management strategies

OBJECTIVES for **maritime spatial plans and integrated coastal management strategies,** consisting in **ecosystem-based approach** to facilitate the co-existence and **prevent conflicts** between competing sector activities in marine waters and coastal zones. The following have been nominated:

- **Common minimum requirements for maritime spatial plans and integrated coastal** (Article 6)
  - establishing operational steps and measures for the main objectives;
  - being **mutually coordinated;**
  - ensuring **effective trans-boundary cooperation** between Member States, national authorities, stakeholders of the relevant policies sector;
  - identify the **trans-boundary effects of MSP and ICZM on** marine waters and coastal zones in cooperation with the **competent authorities** of these countries (Art. 12, 13).
- **Specific minimum requirements for maritime spatial plans** (Article 7)
  - inventory of existing measures applied in coastal zones and an analysis of the need for additional actions;
  - integrated and cross-sectorial policy implementation and consider interactions between terrestrial and maritime activities;
  - specific activities for **integrated coastal management strategies as following.**
- **Specific minimum requirements for integrated coastal management strategies** (Article 8) referring to:
  - an inventory of **existing measures applied in coastal zones** and an **analysis of the need for additional actions in order to achieve the objectives set out**
  - *utilization of specific natural resources including installations for the extraction of energy and the production of renewable energy*
  - *development of infrastructure, energy facilities, transport, ports, maritime works and other structures including green infrastructure*
  - *agriculture and industry*
  - *fishing and aquaculture*
  - *conservation, restoration and management of coastal ecosystems, ecosystem services and nature, coastal landscapes and islands*
  - *mitigation and adaptation to climate change.*
  - providing **integrated and cross-sectorial policy** implementation and consider **interactions between terrestrial and maritime activities**

- **Purpose and aims of the plan**

A maritime spatial plan is a strategic and future-oriented document. The aim it is:

- to prevent or mitigate conflicts;
- to strike a balance between environmental and socio-economic objectives for maritime space;
- to set up spatial priorities.

1.1.3.3. The inventory of existing measures applied in coastal zones

The inventory of existing measures applied in Black Sea countries coastal zones are mainly related with the following component:

A. **Data collection and exchange of information**

Black Sea countries still have collected maritime available data but need exchange of necessary and improved information about Maritime Spatial Planning (MSP) field, maritime spatial plans and integrate coastal management strategies to can be used in this aim.

- The existing collected data should be re-evaluated, systematized, up-dated, completed, classified and have to include:
    - Environmental, social and economic data in the field presented before
    - Marine physical data in marine waters and geomorphological data in coastal zones usually registered by lack of monitoring system in the sea countries
- Data collection and exchange shall make use, as far as possible, of instruments and tools developed under the Integrated Maritime Policy.

B. **Cooperation with Member States**

In the case of Bulgaria and Romania as Member States, the cooperation (also in the maritime area) is ensured and both have the obligation of MSP Directive implementing, harmonizing the EU legislation and following the same recommended steps on maritime spatial plans and integrated coastal management strategies. The cooperation takes into account issues of a transnational nature, such as cross-border infrastructure and has planned common projects applications under evaluation in the frame of the DG-MARE competition.

The cooperation started to be pursued through regional and institutional cooperation structures (each country ministries of regional development, transports, environment and different marine institutions) covering the coastal zone and marine region or concerned, trying to link dedicated network with other developed Member States and competent authorities with similar marine region.

C. **Cooperation with third countries**

Black Sea countries not member states, Turkey and Ukraine started also to make efforts to coordinate their integrated coastal management, to elaborate ICZM strategies and to design maritime spatial plans according the international and EU (countries) knowledge, experience and recommendation. The fact is шгьш in the Black Sea region the initiative to standardize all kind of research, approach and methodologies started long time ago and also in the field of ICZM and the new MSP the collaboration has been based on common research project initiatives.

D. **Specificities of Black Sea countries. Review of national policies.**

1.1.3.4. Measures applied in coastal zones and an analysis of the need for additional actions in order to achieve the objectives set out (for maritime spatial plans and integrated coastal management strategies)

BULGARIA

The main policy action undertaken in Bulgaria to protect the coastal zones was the adoption of the Black Sea Coast Spatial Planning Act by the Council of Ministers, approved in 2008 with the objectives to:

- create conditions for the stable and integrated development, spatial planning and protection of the Black Sea coastline;
- provide free public access to the coast;
- ensure a sustainable use of the natural resources;
- prevent or decrease pollution;
- protect the coast against erosion; and to
- restore and protect the natural landscape and the cultural and historical heritage.

The law distinguishes two development zones for which specific restrictions with regard to the density of buildings, the maximal building height as well as the minimal space for green areas have been stipulated.

"Zone A" covers the Black Sea waters up to a distance of 200 m and 100 m of the coast, measured from the shoreline. The following activities are prohibited or restricted in Zone A (Art. 10):

- The construction of fences, access restrictions, the exploitation of resources, the discharge of wastewater, the treatment of waste, the use of insecticides and fertilizers and polluting industries.
- The construction of ports, coastal protection measures and technical infrastructure are allowed outside the beaches. For other constructions, a density limit of 10 % has been set. On beaches, only some tourist facilities are allowed.

"Zone B" - covers the zone up to 2 km, measured from the border of Zone A, but not determined urban territories. Activities here are regulated, but less strictly than in Zone A. The regime of protected areas within the borders of Zone A or B is not affected by the Black Sea Coast Spatial Planning Act.

Promulgated in the State Gazette of 19 July 2013, the Bulgarian Parliament adopted a decision imposing a moratorium on deals, change of use and construction works involving state property in the territory of development zones *"A"* and *"B"* under the *Black Sea Coast Spatial Planning Act*. Exceptions shall only be allowed for infrastructure projects of highest national or municipal importance.

These restrictions shall apply for a period not longer than 12 months. During this period, the Council of Ministers has to propose a program for the preparation of maps of the islands and the sand dunes on the Bulgarian Black Sea Coast and to submit a report on the plots - public or private property of the State - located in zones "A" and "B",

In the Black Sea Coast Spatial Planning Act the territory of the littoral is limited to the coastal beach strip, part of the aquatory and part of the hinterland with two zones, which extend to 2 km in depth. However, the territories of the coastal municipalities are also regarded as the object of spatial planning. Members of the Association of Black Sea Municipalities are 21 municipalities. According to the joint Operational Programme "Black Sea 2007-2013", the entire

Northeast Region and Southeast Region of NUTS 2 are defined as coastal. These boundaries go beyond the zone of active impact of the Black Sea (Fig. 1.2), which in some parts of lower altitude of the coast and flatland nature may reach maximum up to 40 km.

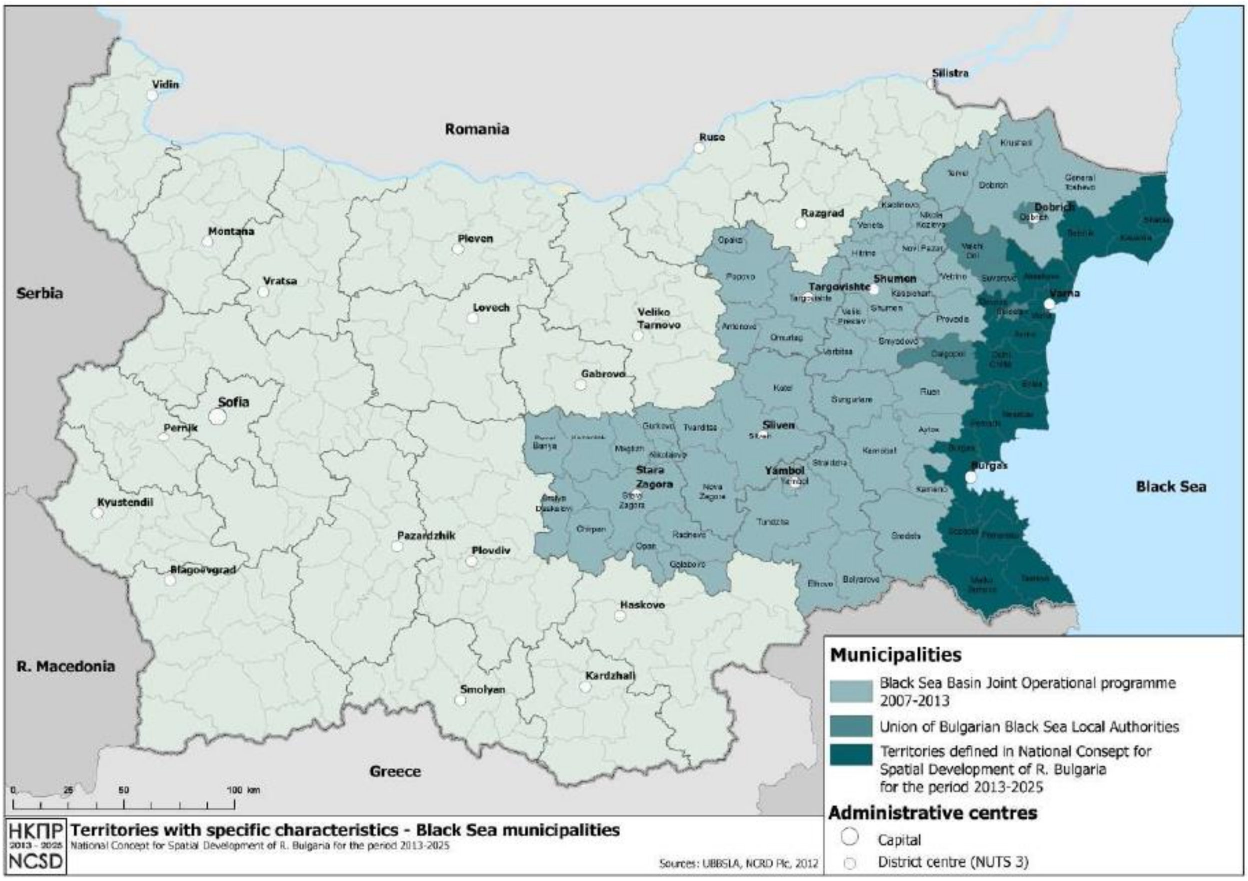


Fig. 1.2 Territories with specific characteristics - Bulgarian Black Sea municipalities

Administrative Competencies

The central administrative power for spatial planning is the Ministry of Regional Development and Public Works and its executive agency, *Geozashtita*. The Ministry is responsible for regulation, spatial planning and land use in Bulgaria, *Geozashtita* mainly deals with the implementation as well as the maintenance of coastal protection activities. In the framework of the EU Water Directive, the *Basin Directorate for Water Management in the Black Sea Region* has been appointed as the responsible body for water management in Bulgaria. In addition, the *Ministry of Environment and Waters* is responsible for water, biodiversity protection and climate change.

At local level: Land-use plans of the Bulgarian coastal municipalities. These plans are for the management and development of the territory of the municipality.

ICZM Key legal framework:

- Territorial, Urban and Rural Development Act (April 1973)
- Spatial Development Act (2 January 2001)
- Black Sea Coast Spatial Planning Act (promulgated in State Gazette (SG) No. 48/2007)
- Regional Development Act (promulgated in the State Gazette No. 50/2008)
- Law of the Forests (29 December 1997)
- Soils Act (6 November 2007)

Moreover, several plans and programmes have been adopted, both at national and local level: River Basin Management Plans (Varna region), Environmental Plans (National Environmental Strategy, Biodiversity Conservation Action Plan, Protected Areas Management Plan etc.) and Sustainable Development Plans (National Strategy for Sustainable Development of Tourism). However, Bulgaria has neither developed a strategy nor an action plan for Integrated Coastal Zone Management (ICZM) and there is no authority competent to implement the ICZM principles.

Competencies

- *The Ministry of Regional Development / Ministry of Investment Planning*

The Ministry of Regional Development and Public Works was responsible for managing the implementation of the relevant State Policy and for regulations with regard to spatial planning and land use in Bulgaria482.

Following the new structure of the Council of Ministers adopted by the new government of Bulgaria in May 2013, the Ministry of Regional Development and Public Works has been divided in two new ministries – the Ministry of Regional Development and the Ministry of Investment Planning.

The Minister of Regional Development shall now manage the implementation of the state policy with regard to spatial planning, co-ordinate the activity of the central and regional bodies, of the local governments and administrations and provide guidance for and exercise control over spatial planning activities.

- The District Governor implements the State Policy at the district level.

- The Municipal Councils and mayors implement the State Policy at the district level.

- The Black Sea Basin Directorate is responsible for the management of the Black Sea coastal waters.

The Investment Planning Minister shall manage and control investment activities and shall also be responsible for the issuance of construction permits.

- *The Ministry of Environment and Waters*

The Ministry of Environment and Waters is responsible for water, biodiversity protection and climate change and also for the collection, publication and dissemination of information about the environment. The Executive Environment Agency (EEA) and the Regional Inspectorates of Environment and Water (RIEW) support the Ministry. The RIEW of Varna and the RIEW of Burgas are responsible for the Black Sea coast.

- *The Basin Directorate for Water Management in the Black Sea*

The Basin Directorate for Water Management in the Black Sea Region - Varna was established by the Minister of Environment and Water in 2002, to comply with the Water Framework Directive 60/2000 of the European Union and national legislation.

The Black Sea Basin Directorate is responsible for the management, planning, monitoring and collection of information on water, including 100 % of the Bulgarian territorial sea waters.

- *Municipalities*

Municipal bodies play an important role with regard to the protection of the environment486. They are, for example, responsible for the safe disposal of municipal waste and for urban wastewater treatment plants. They are also responsible for the information of the public on the state of the environment, for controlling compliance with environmental legislation and for the adoption of local spatial development plans.

Weaknesses with regard to the division of responsibilities:

Competencies are not yet organised in Bulgaria. The Ministry of Environment and Water and the Ministry of Regional Development are together responsible for Integrated Coastal Zone Management and sustainable development, the Ministry of Environment and Water and the Ministry of Trade and Tourism for the protection of the coastal environment. However, recently, coordination between the Ministries has been improved and the many initiatives to improve the existing legal framework reflect the will of the Bulgarian authorities to implement ICZM principles and to bring the Bulgarian law in line with the EU recommendation.

Problems and constraints for the development of ICZM

The results of the existing legal and administrative system of coastal management are negative because of the lack of co-ordination and ongoing negative behaviour towards the environment.

- An insufficient and ineffective definition of the responsibilities of the state agencies and other subjects of authority for different sectors and activities at the coasts, i.e. coastal beach strip, beaches and dunes, coastal lakes, fisheries and some tourism establishments.
- A need for improvement of the implementation and enforcement of the existing and well defined environmental legislation for the area.
- A strong need for new laws or amendments of existing laws, including a need of strengthening of local governments.
- Insufficient real instruments for public participation in the decision-making process for development projects of the coast.
- A need for an adequate planning and development of the environmental and technical infrastructure in the region.
- A need for a structural economical reform in all sectors.
- A need for new tools and procedures for the co-ordination of conflicting sectoral interests and the conflicting interests of all the parties involved in the coastal development and preservation.
- Increased pollution or damage of natural resources.

After 2007, the s Bulgarian state begun an active sector policy related to the application of the principles of ICZM, presenting:

- Amendments to the legislation
- Strategic planning
- Kind of property and ownership
- Have A Maritime Strategy is in a process of development establishing the Main objectives
- Implemented measures terrestrial Spatial planning
- Water management in the Black Sea Basin
- Maritime activities
- Public investments along the coast
- Coast survey
- The general development plans of the municipalities along the Black Sea coast specify
- Biodiversity protection
- Fisheries and aquaculture
- Agricultural practices
- Forest policy
- International commitments of the target countries to ICZM
- International Convention applying
- Public participation

- Good practice and completed projects
- Measures applied with the preparation of specialized spatial plans
  - Management plan strategies are prepared for protected areas and protected zones under Natura 2000 develop management plans
    - Scope and content of the management plan for the Black Sea basin:
    - Marine Fisheries and aquaculture
    - Forestry development plans
  - Mandatory procedures under EIA and Ecological Assessment
  - Applicable measures for lands next to coastal areas
  - Measures on other ecological aspects:
  - Implemented measures on purity of bathing water
  - Providing urban areas with water treatment

MOLDOVA

The Republic of Moldova borders with Ukraine and Romania. The frontier with Romania basically follows the river Prut and on a short stretch, of about 600 m, the Danube. The border with Ukraine consists of three sectors. The northern sector lasts between the villages Criva and Naslavcea, following the divide between the Dniester and Prut river basins. The eastern sector partly follows the Dniester river course and partly cross the Podolian Plateau. The southern sector of the Moldavian-Ukrainian border starts at the village Giurgiulesti and lasts in the vicinity of Cismichioi, Basarabeasca, and Palanca.

As a result of the political agreement between Moldova and Ukraine, a new delimitation of the territories of the two countries was undertaken in 2001 in the vicinity of the town Basarabeasca. Consequently, the area of the Republic of Moldova as of 01.01.2002 increased by 0.144 km totaling 33483.5 km^2 (Statistical Yearbook, 2002).

ROMANIA

- **Current situation of the maritime spatial planning framework in Romania**

In Romania, coastal pressures are high and affect the shore, and therefore common measures have been necessary to be taken.

- ***The following types of data have been collected in monitoring system***
  - Environmental, social and economic data collected
  - Marine physical data in marine waters and geomorphological data in coastal zones.

- ***The ecosystem approach has started to be applied***

Between coast and sea in both senses (from land to sea and from sea to the send) the pressures and the high instability are similar given by strong winds, waves, storms, the opensea, withut closed areas, combined currents, the variability of temperatures, salinity, density, due to the Danube impact, etc. The influence of the rivers discharging into Black Sea is important, costal erosion, and flooding, urbanization, tourism, naval industry have an impact on the coast and the sea environment. The MSP Directive is well waited in Romania to put in practice similar tools and practical approach from the coastal to maritime space.

- ***Part of economic and social data have been collected***
- ***Specific amendments of legislation have been applied***

In present, there is a variety of regulatory processes by which licenses, permits and other authorizations have to be obtained for specific proposals or activities, such as transport, fisheries, or offshore drilling. Some regulators can impose restrictions on activities E.g. in the Danube Delta Biosphere Reserve marine area or the Vama Veche - 2 Mai Marine Protected Area. These regulatory regimes are changing over time due to the developments of the activities in the marine environment and status of marine ecosystem (E.g. diminishing of fish stocks due to overfishing imply restrictions on fishery activities, exploration for and extraction of oil, the building or extensions of ports, other infrastructure measures). Some of these regulatory processes have a spatial dimension in the sense that there are defined areas of sea, where particular activities are promoted or restrained.

- ***A National ICZM Law was elaborated and a National ICZM Committee was created***
- ***For Maritime Spatial Planning, the authority is not yet established***

In Romania, maritime activities are not separated from the coast, they are continuing, with simultaneous/reciprocal influence. The authority for the MSP was not established, but the obligation is to start the expertise groups organizing and authority establishing in the first 6 months from the directives entering in forces. There are three ministries playing the role of partially implementing the directives for maritime space, but the leadership has not been established. These are:

- The Ministry of Environment, Waters and Forests, as leader of the National Committee of Coastal Zone (NCCZ/2004) and the Integrated Coastal Zone Management Law/2002 elaboration;
- The Ministry of Transports and Infrastructure, with the Inter-ministerial Group for the implementation of the Roadmap for creating an Information Exchange (CISE- Commission for Maritime Surveillance) at the national level, established in 2010 to the initiative of the Inter-Ministerial Committee on the Integrated Maritime Policy (hereinafter called the Inter-Ministerial Committee/2014);
- The Ministry of the Regional Development and Public Administration, responsible for the territorial planning in Romania;
- Each of these ministries could assume the MSP responsibility and coordination.

- ***Pilot cases have been studied***
- ***Some spatial conflicts have been identified***
- ***Some problems have been identified***

The Romanian coastal area is under strong pressures for development or expansion of sectors which are not always compatible. There are identified some conflicts and failure in their resolving has political as well as economic costs, and in the long term may reduce the potential to realize new economic opportunities. The classic perceived conflict is that of environment-development, though development objectives are not necessarily incompatible with environmental conservation, and in practice environmental impacts are often felt most intensely by other economic sectors.

The problem of the present legislation is mainly the lack of the enforcement, which in turn is partly due to the fact that some important steps have not taken, such as classification of the coastal zone into functional areas (land use planning) and also the establishment of a Coastal and Marine

Data and Information System preparing, needing to collect information from all providers involved or available.

Spatial planning in coastal areas according to ICZM principles and maritime spatial planning represents a new domain for Romania, which must be urgently implement and used for the existing spatial planning system and established in the legal and institutional framework. The central body responsible for spatial planning activity has to promote, together with the central body for environmental protection, the EU MSP recommendations and the technical regulation framework for these categories of plans. Although some specific legislative acts already are in force in the marine and coastal zone, they have to be enriched, coordinated and implemented, the main problem being the sectorial approach to regulation which leads to sector overlap and insufficient stakeholder involvement in implementation. This is planned to start in the first month of 2015.

- ***A data base, infrastructures, expertise and maps have been created***

In Romania, spatial planning is a concern of the EEZ. In 2006, the current inventory of the EEZ for the Black Sea begun. For 8 years now, NIMRD has been doing this as an exercise under some project involvement, but it became a national responsibility for the maritime integrated monitoring leadership.This was the beginning of an ongoing process of information, constantly improved. Since then, maps have undergone many changes and updates to reflect operations and to outline suggestions for priority or exclusion zones. Important maps correspond to not only to a spatial plan, but set a status quo of the moment. The maps are essential tools for highlighting types of exploitation density for various applications in marine space for different analyzes (enlargement, conflict, installation, movement).

There have been mapped several activities: ship routes, anchoring areas, protected areas (Natura 2000 marine protected areas), extraction of oil, natural gas and pipeline network, fishing areas and telecommunication cables. The mapping exercise identified the dominant sources and risk areas, pollution of the Black Sea coast. Spatial plans are always updated for the marine space (Fig. 1.3) and detailed several case studies, detailing for the Danube Delta marine part in the north and for the south in the area Eforie and Mangalia - Vama Veche (Fig. 1.4). There are areas for which there is no access to information (extraction of sand and gravel and military areas).

On the sea coast there is a good GIS infrastructure and specialized team, a significant endowment which was already created under the Competence Center for Space Technologies - COSMOMAR (“Space Technology for Sustainable Development of marine and coastal Black Sea”), hosted by NIMRD Constanta. The center aims to use space technology and remote sensing data, developing environmentally friendly bio-technologies and technical solutions applicable in space programs and to support the development of small, medium and large local and regional access opportunities offered by the national or European space. The Center aims to collect and archive oceanographic data, in order to maximize their use, promoting the exchange of information on national and international level.

The mapping of current uses of and pressures on the 12 NM zone of the Romanian Black Sea (territorial sea according to the UNCLOS framework) has been produced. The map covers also those land areas which have a direct impact on the sea area due to environmental hotspots. An overview of the current uses in the marine area has been mapped: shipping routes, anchorage areas, nature protection areas (Natura 2000, RAMSAR sites and World Heritage sites), marine protected areas, as well as areas of coastal defense and engineering, tourism, military activities, gas and oil exploitations and connecting pipelines, fishing, and telecom cables. It is the start of a continuous process for Romania to take stock of the marine uses with more information added at different stages of development. Consequently, the maps shown in Fig. 1.5. need to be regularly updated and revised to reflect changes in patterns of use and also derive suggestions for priority uses. It is important to note that the maps do not correspond to a maritime spatial plan with the aim of minimizing and solving conflicts between uses competing for space in the marine area. Instead, the maps simply state the respective status quo of marine uses in the Romanian Black Sea area. Anyway, the mapping of marine uses is an essential tool for highlighting the density of uses and different spatial demands (Fig. 1.6-1.7).

Based on the new MSP Directive obligation of implementing the IMP or ICZM and MSP committees' integration in the future a better connection between the sea and the coast and suitable leading will be created .

Taking into account the experience over the last 10 years, in different projects, the national legislation on the Integrated Coastal Zone Management under revision, including MSP experience, discussions and debates have already been conducted in Romania, with the aim of:

- Efficiency increasing in decision making process: preparing new links and proposals;
- Better delineation of the coastal area already finished;
- Better linking between the marine environment and coastal zone (e.g. beach erosion control);
- Improvement of the building up regime within the area close to the beaches.

NIMRD Constanta has elaborated different kind of marine space maps: thematically, integrated, sectorial, pilot cases.

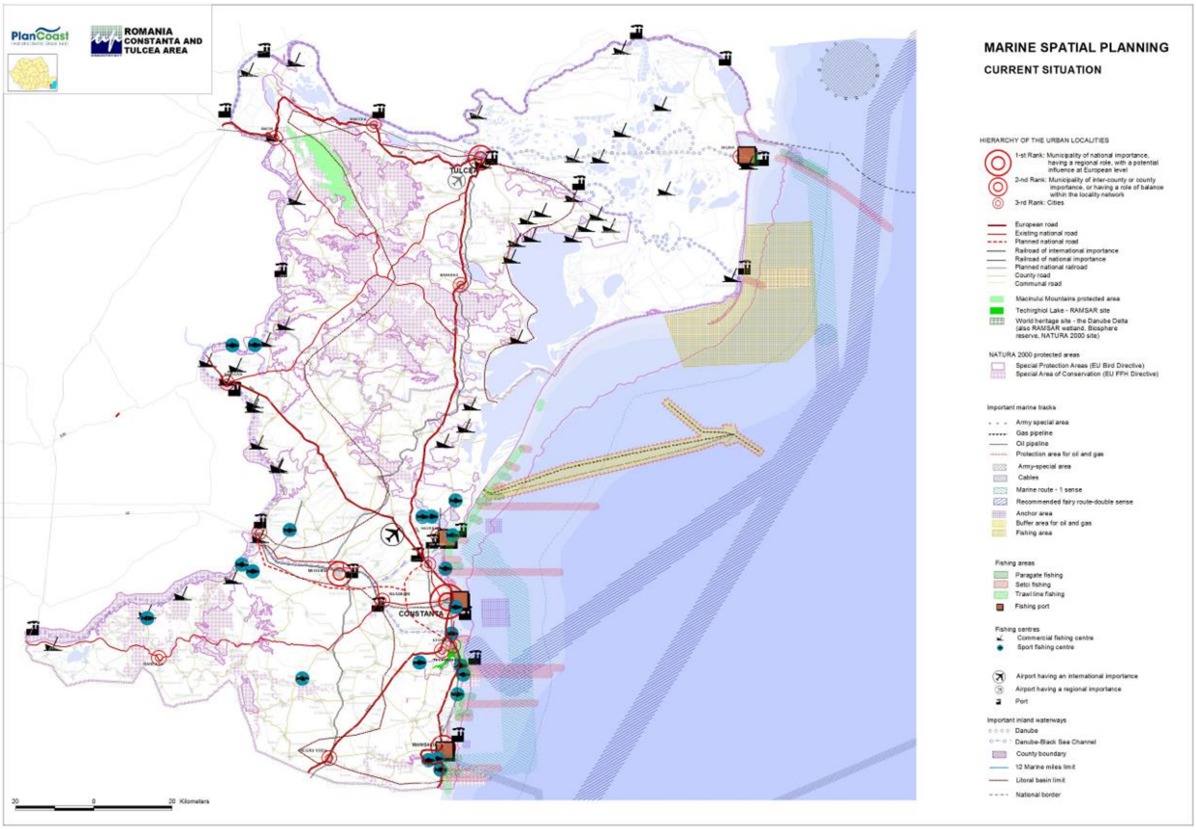


Fig. 1.3 Integrated Maritime Map (PlanCoast)
(Source: Urban-INCERC Bucharest and NIMRD Constanta, 2007)

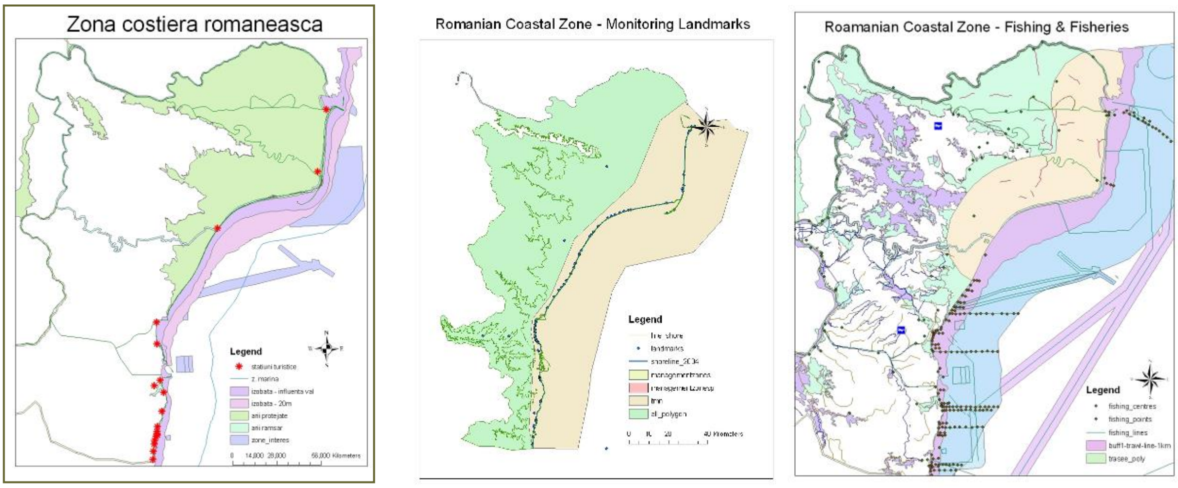


Fig. 1.4 Thematic maritime maps: coast lines, coastal domestic points and pressures, marine uses/PlanCoast
(Source: Urban-INCERC Bucharest and NIMRD Constanta, 2007)

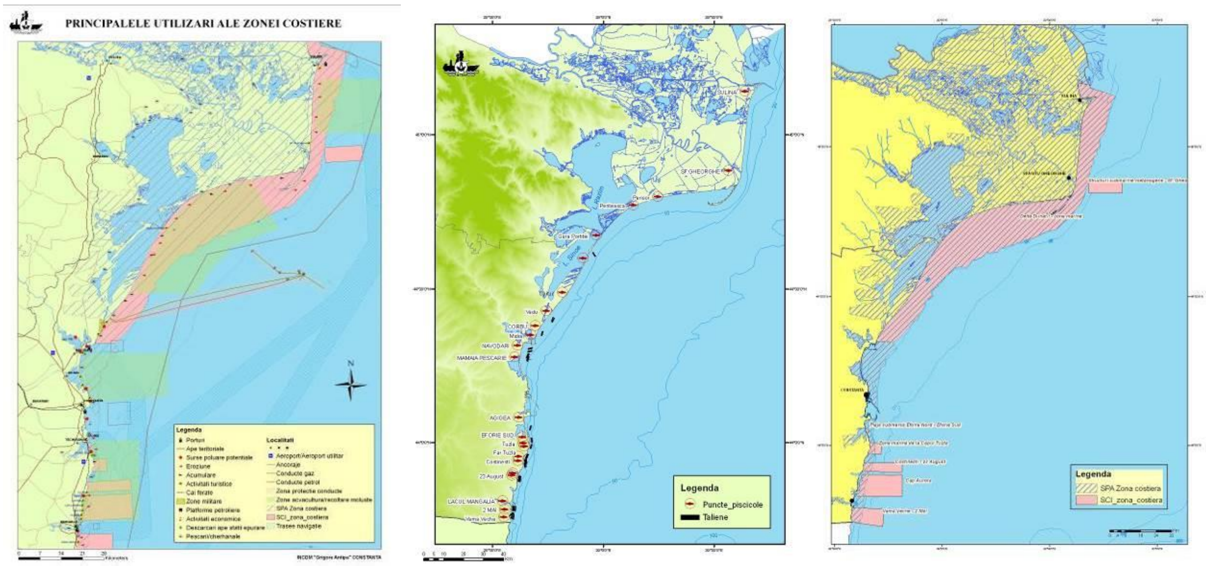


Fig. 1.5 Examples of integrated MSP maps -
a. Main maritime uses b. Marine fisheries c. Marine Protected Areas
(Source: NIMRD Constanta, 2009-2014)

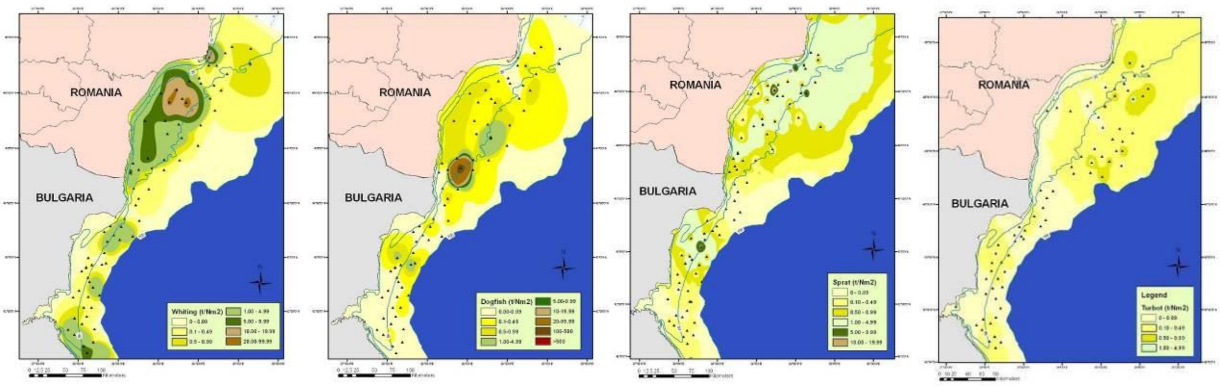


Fig. 1.6 Examples of thematic MSP maps in transboundary approach between Romania-Bulgaria (SRCSSMBSF-88)

- Distribution of some marine fish species (a.whiting b.dogfish, c.sprat, d.turbot) *(Source: NIMRD Constanta, 2009-2014)*

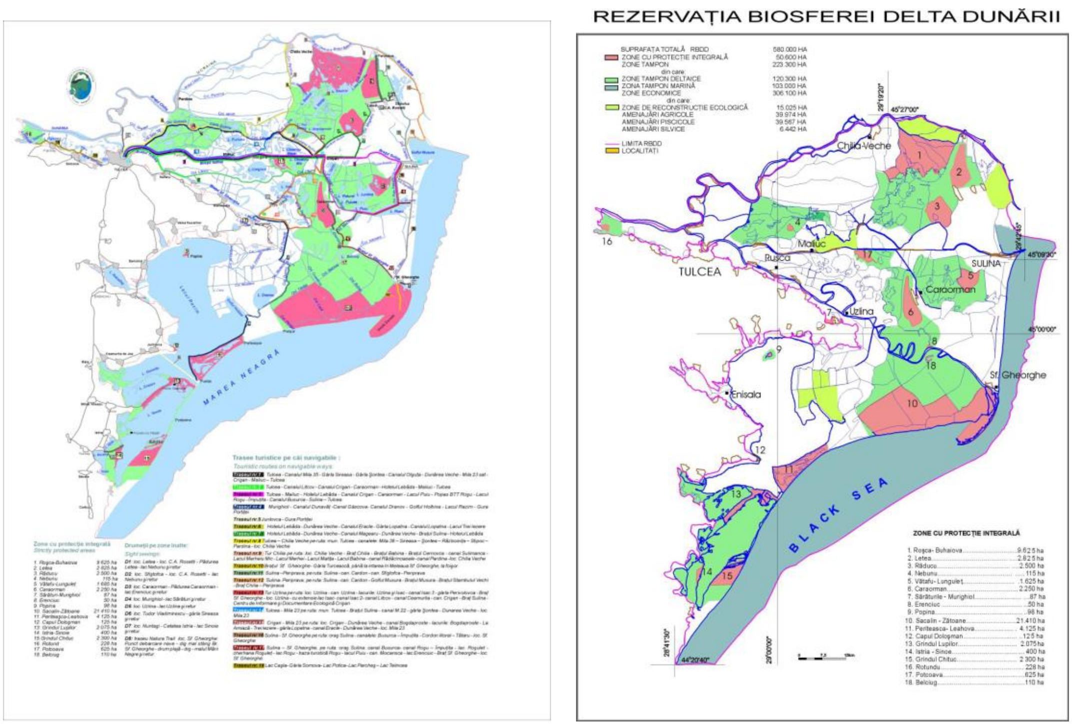


Fig. 1.7 Danube Delta maps of tourism routes on (a) navigable channels and (b) wetland protected areas (PEGASO) *(Source: DDNI Tulcea)*

The minimum requirement for maritime spatial planning (MSP Directive, Articles 6, 7) for Bulgaria and Romania is correlated with terms of implementation:

- Term for MSP Directive was the data of entering into force, 20 days after 28 August 2014, the day of publication in the Official Journal of the European Union;
- Transposition, harmonization of the law and its regulations in these countries, in accordance with the possibilities and needs to take place until September 18, 2016;

- Maritime spatial plans must to be established at national level as soon as possible, and no later than March 31, 2021. When all data will be collected and sectorial plans ready, they have to be put together to can be integrated. Unfortunately there are non-authorized plans or they are elaborated as exercises, data base needing new up-grading, up-dating, calibration, control;
- The Spatial Plan shall be reviewed at least once at every 10 years and continuously up-dated;
- It requires the application of the ecosystem approach principle;
- It recognizes the link between coastal and marine activities and reference to the need to consider interactions between the land and sea, so as it was specified the first time in 30 May 2002 on the of Integrated Coastal Zone Management (ICZM) implementation in Europe, ICZM Protocol in the Mediterranean (13 September, 2010), Barcelona Convention (2010/631/EU).

On the other hand, The ***Romanian ICZM legal framework*** consists of the main legislative documents:

- Governmental Emergency Ordinance no. 202/2002 regarding coastal zone management approved with further modification and amendments through Law no. 280/2003;
- Government Decision no.1015/2004 regarding the Regulations of the organization and operation of the National Committee of the Coastal Zone;
- Government Decision no.749/2004 for establishing of the responsibilities, criteria and the delineation manner of the land stripe close to the coastal zone to preserve the environment, patrimonial and landscape values close to the shore;
- Government Decision no.546/2004 regarding the approval of the methodology for delineation of public state domain in the coastal zone.

Complementary legislation, policy development (if any):

- Governmental Decision no. 1213/2006 concerning the setting up of the framework procedure of environmental impact assessment for certain public and private projects;
- Governmental Decision no. 898/2004 concerning the approval of guidance for exploitation of groundwater and of the interface areas between freshwaters and marine waters;
- Governmental Decision no. 317/2004 regarding the use of coastal wetlands known as areas of anchoring;
- Common Order no. 38/1044/671/2004 of the Ministry of the Environment and Waters, the Ministry of Transport, Construction and Tourism and the Ministry of Health approving the code of conduct for recreational activities in the coastal area;
- Order no. 374/2004 of the Ministry of Environment and Water approving the Action Plan for the conservation of Romanian Black Sea cetaceans;
- Law no. 597/2001 concerning certain protection measures and authorizing the construction in the coastal zone of the Black Sea, with further modifications and amendments

Taking into account the experience over the last 10 years, the national legislation on the integrated coastal zone management is under revision which will conduct to:

- Increasing efficiency in decision making process;
- Better delineation of the coastal area;
- Better linking between the marine environment and coastal zone (beach erosion control);
- Improvement of the building up regime within the area close to the beaches.

TURKEY

Integrated Coastal Management (ICZM) is built on community based conservation and co-management. It is a state concern and could be underlined the main stages and progress at the country level. Very few and new steps in MSP and plans elaboration:

- Legal, political and institutional frameworks for ICZM in Turkey;
- International commitments of the target countries towards ICZM;
- Coastal legislation, International Legislation;
- Implementation of management policies and plans;
- Planning institutions and instruments;
- Tools and methodologies;
- Spatial Planning, Planning Issues;
- National Achievements in the Field of ICZM;
- Most common and major problems facing the implementation of ICZM in Black Sea coastal areas;
- Specificity of ICZM in the Black Sea region;
- Inventory of Environmental, social and economic data collected;
- Marine physical data in marine waters and geomorphological data in coastal zones;
- Biodiversity;
- Industry, Agriculture, Fisheries, Submarine cables and pipeline routes;
- Land and Marine based Sources of Pollution;
- Air, Soil, Marine Pollution;
- Anthopogenic pressures and impacts;
- Damage to natural and cultural resources;
- Protected areas and valuable natural sites/ecological network;
- Public participation processes.

The types of spatial plans that have been utilized in Turkey are the "*environmental profile plans*", "*framework land use (development) plans*", and "*detailed land use (application) plans*".

Environmental profile plans, a macro planning effort at scales 1/100000, 1/50000 and/or 1/250000, are a potentially significant tool for coastal management. Environmental profile plans for some parts of the Black Sea coast have already been completed such as illustrated in Figures no. 1.8-1.10.

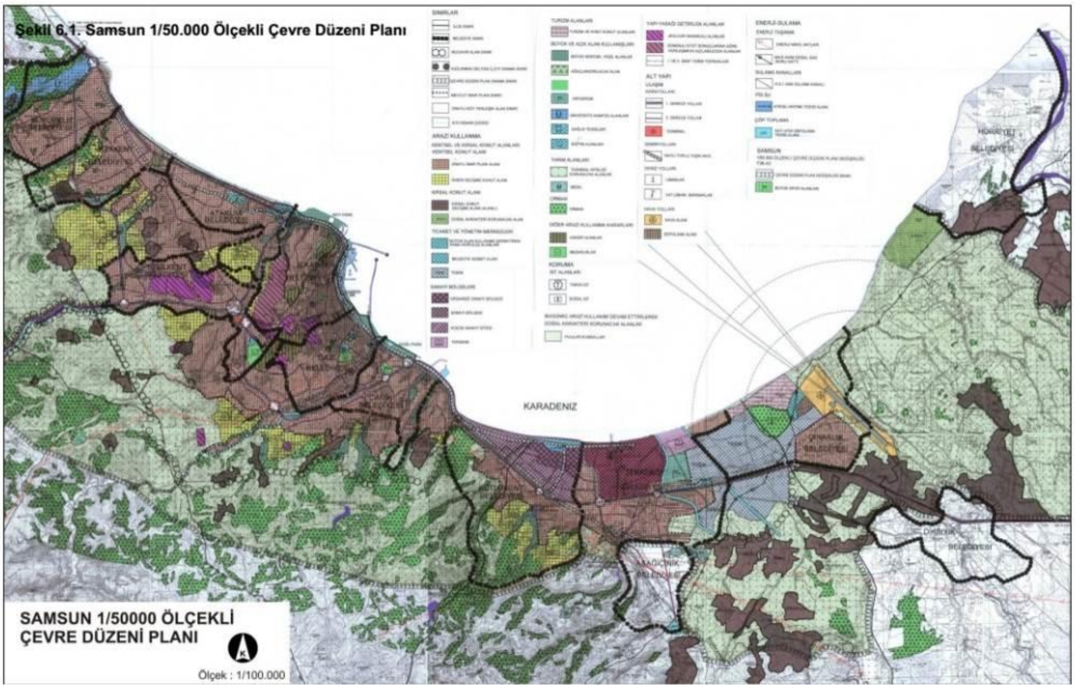


Fig. 1.8 Samsun Environmental Implementation Plan
(Source: http://www.csb.gov.tr/gm/mpgm/index)

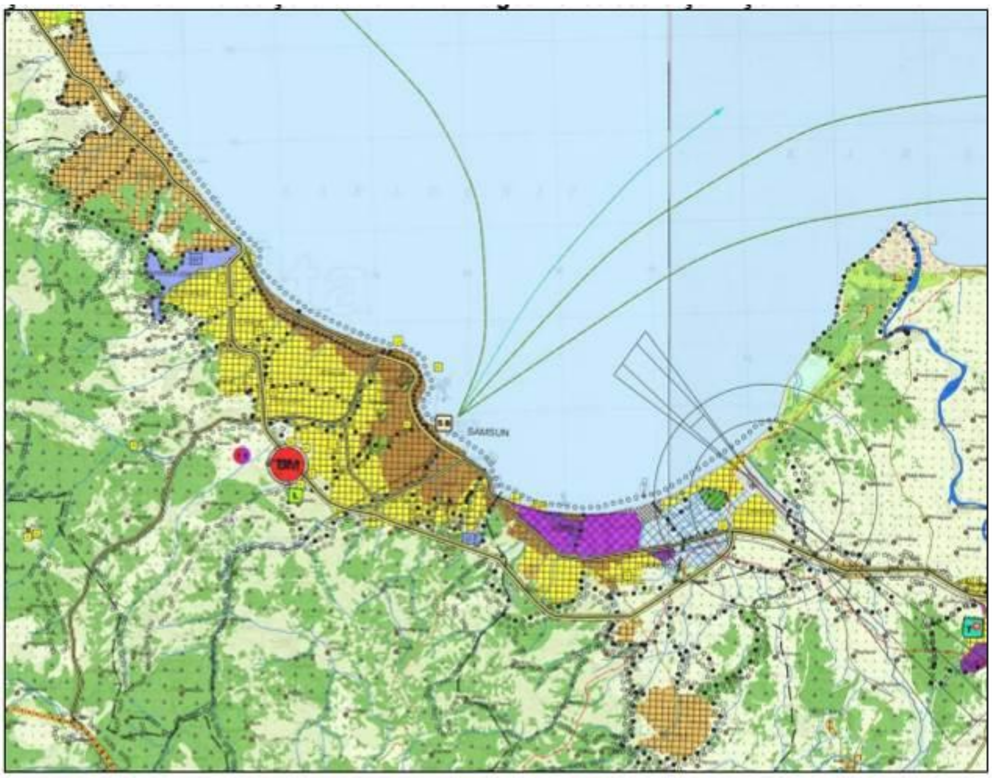


Fig. 1.9 Samsun - Tokat - Çorum Planning Region Environmental Implementation Plan (1/100.000) *(Source: http://www.csb.gov.tr/gm/mpgm/index)*

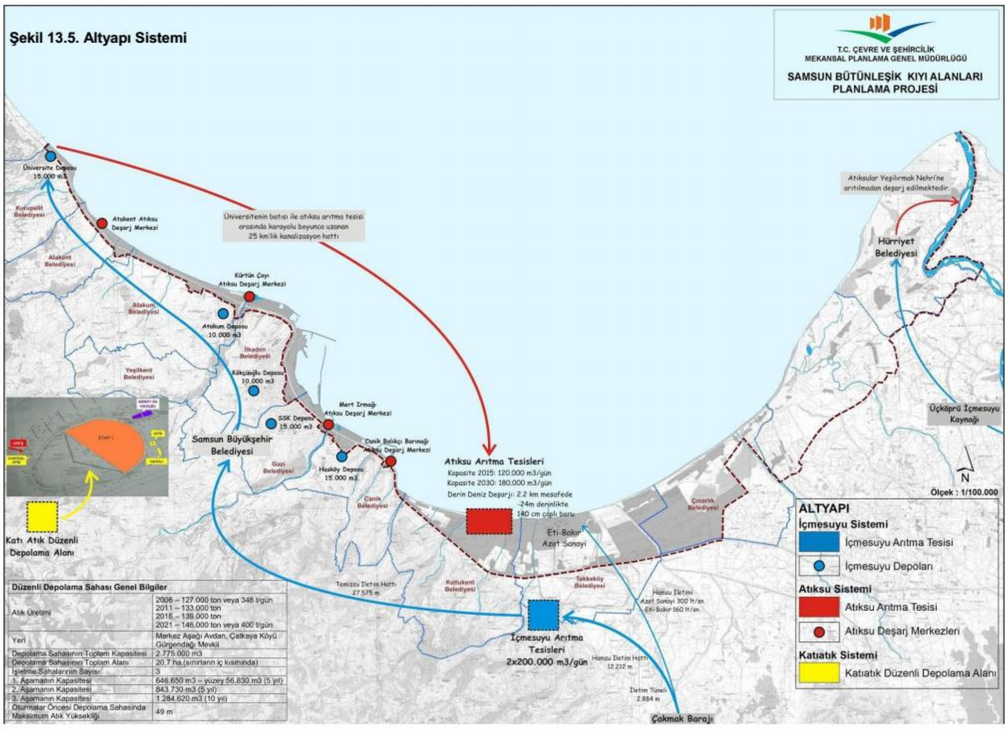


Fig. 1.10 Samsun Infrastructure System
(Source: http://www.csb.gov.tr/gm/mpgm/index)

In the coastal zone of Turkey, it has been taken into account that such plans could aim towards:

- Application of national and regional policies and decisions;
- Optimal uses of and benefits from natural and social resource potentials;
- Protection of natural, cultural and historic resources and values like watersheds, forests and agricultural land, etc.;
- Provision of spatial decisions for location, size, density and distribution of urban centres, industry, tourism, commerce and other uses, as well as for regional infrastructural facilities such as transport, energy production, etc.,
- Achievement of compatibility of uses (sectors), and of the balance between use and protection and;
- Description of the principles of collaboration and coordination among different administrations (Sonmez, 2002).

- **Tools and methodologies**

In Turkey, the use of remote sensing and Geographic Information Systems (GIS) in various applications by public and private institutions, universities and non-governmental organisations has shown noticeable increase since the 1990s.

Nowadays, despite several shortcomings inherent within the process, EIA is standard tool for addressing major development projects in the coastal zone. But it is difficult to confirm that the present use of EIA in Turkey provides the full range of expected benefits.

Applications: Environmental profile plans for some parts of the Black Sea coast have already been completed. Samsun, Sinop, Artvin and Rize Draft Integrated Coastal Area Management and Planning Project Plans are given at Fig. 1.11-1.13.

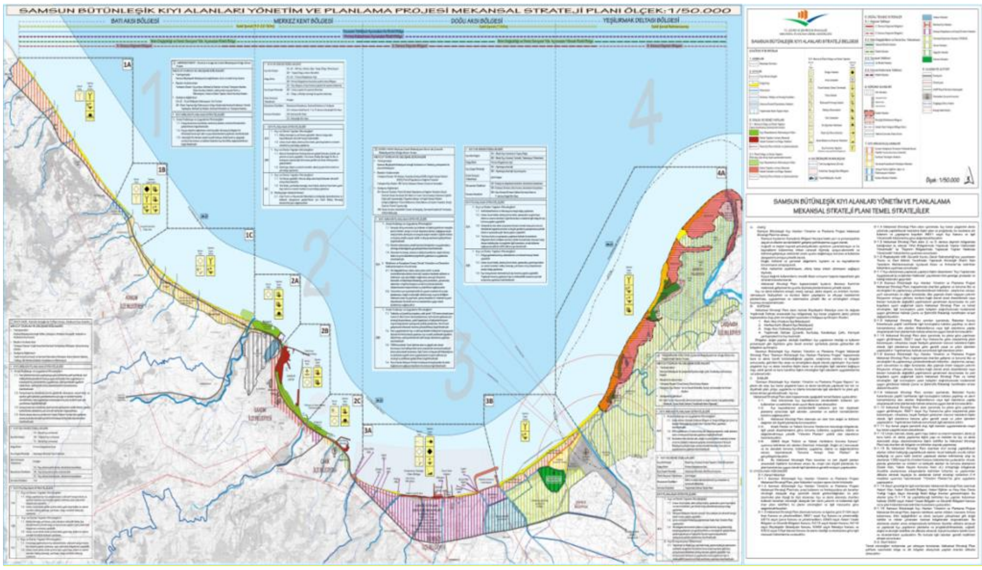


Fig. 1.11 Samsun Integrated Coastal Area Management and Planning Project Plan (Draft)
(Source: http://www.csb.gov.tr/gm/mpgm/index)

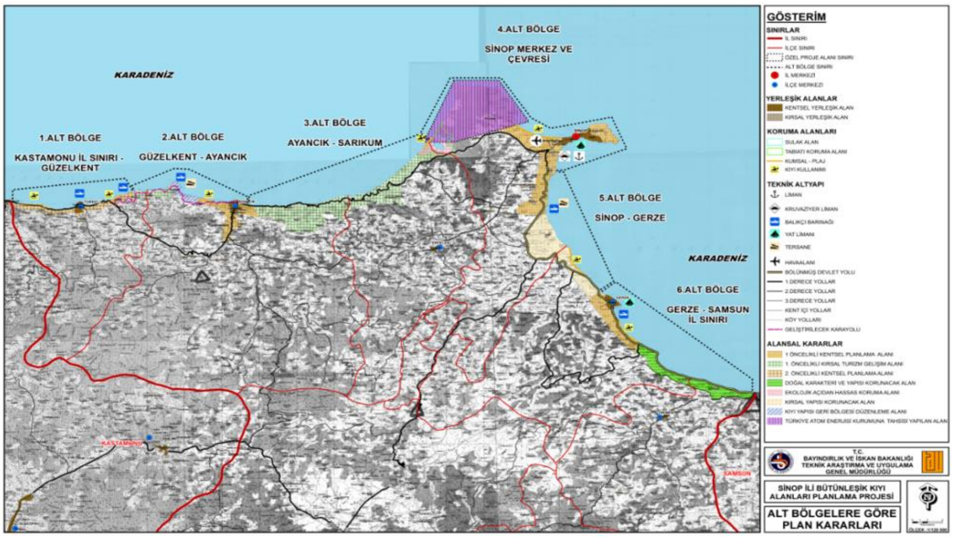


Fig. 1.12 Sinop Integrated Coastal Area Management and Planning Project Plan (Draft)
(Source: http://www.csb.gov.tr/gm/mpgm/index)

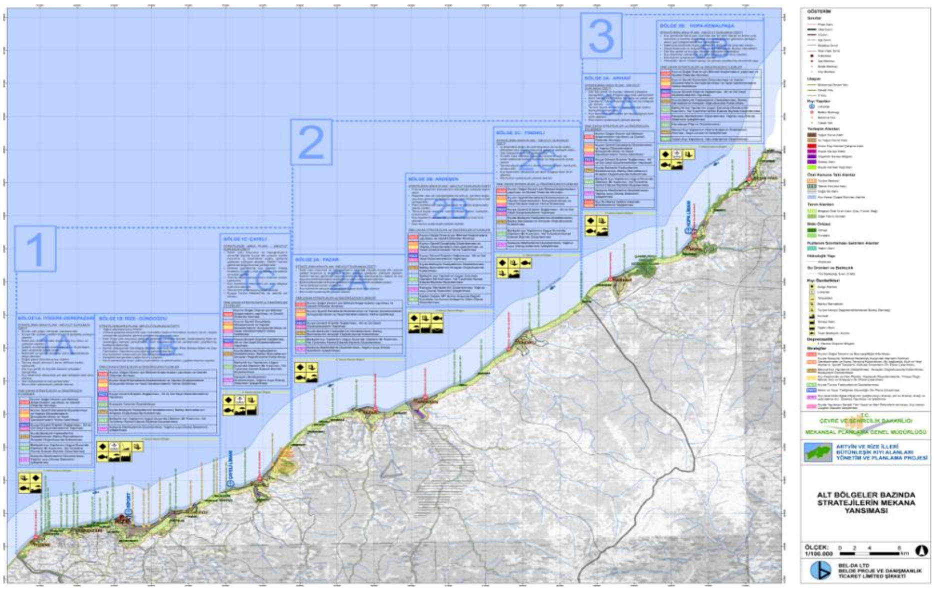


Fig. 1.13 Artvin and Rize Integrated Coastal Area Management and Planning Project Plan (Draft) *(Source: [http://www.csb.gov.tr/gm/mpgm/index)](http://www.csb.gov.tr/gm/mpgm/index)*

UKRAINE

The **Spatial planning** system in Ukraine includes:

- **Facilities for planning** (land and national, private, communal facilities, ownership of local communities);
- **Institutional framework** (legislative, executive, judicial and local authorities, institutions, organizations and enterprises that are subjects of planning and land use);
- **Regulatory legal framework** (laws, statutes and regulations governing the relationship that formed when planning development and land use);
- **Resources providing** (human, property, financial and other resources needed for development planning and land use);
- **Monitoring** of the environment;
- Development of **information systems**;
- **International obligations** in the sphere of environmental protection;
- Development of **new methods and methodology** of taking measurements.

The Strategy of Territorial Administration Ukraine today is uncertain, due to institutional decline of the roles and responsibilities of local management of coastal territorial formations in the coastal marine environmental management and lack of stable funding sources to solve environmental problems coastal and coastal zones. At the same time coastal marine waters and coastal strip is predominantly natural basis (production factor) operation economic complexes coastal territorial units. In this respect there is a direct involvement of local authorities in maintaining its natural system for spatial securing favorable conditions of social and economic development.

The national support for a vision of the key areas of use and development of the area is reflected in the approved strategic documents (including the General Planning Scheme in Ukraine State Regional Development Strategy of Ukraine until 2015. To implement these programs and policies formed relevant legislative framework. In this respect, it is worth Ukraine to call such laws as “On the Fundamentals of Urban Development”, “On the promotion of regional development”, "Planning and Development", and others. The Ukrainian State Research Institute of Urban Design (DIPROMISTO) developed the concept and draft Development Code of Ukraine.

Since the term "coastal" applies not only strip of land, but also the adjoining areas, the planning of its uses is usually directly associated with the planning application on:

- port facilities cannot be developed without the use of waters
- resorts and recreational activities are not limited to using only coastal resources and apply also the nearby sea water (bathing, yachting etc.).
- **but a complete system of planning specifically for marine areas in Ukraine does not work/exist**.

Coastal waters and **the coastal zone** should be considered as a special specific object management with the release of spatial boundaries of the dominant role of local governments. Coastal wetlands are associated with water dwellers by default. In Ukraine special importance is attached to the coastland of the Black Sea and the Sea of Azov as it joins diverse wetlands located in numerous limans, lagoons ands inlets of the coast. Seawater dynamics is observed due to swells, currents and tidal events. As far as the Black Sea has, practically, no high and low tides (their maximum value does not exceed 8 cm), its dynamic parameters are closely connected with wind conditions and runoff of the Danube, the Dnieper and the Dniester (Nature of Odessa Region, 1979).

The management of sea natural resources should be based on rational combination of elements national, sectorial and territorial management to prevent conflicts between marine natural resources and promoting integrated solution of environmental problems and seas coast. Regional planning is a key component of territorial plans, it has specific content and is defined as the process of regulation and land use areas.

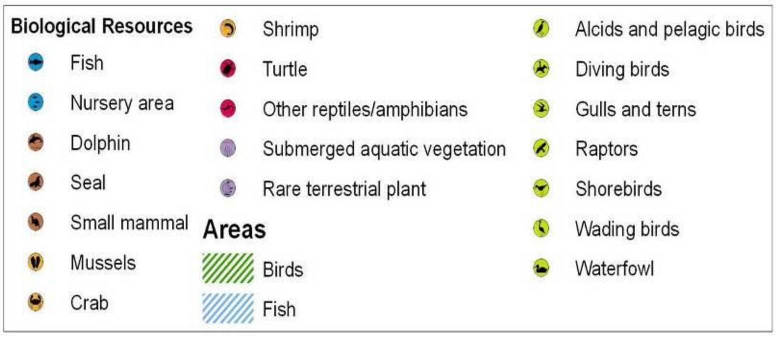
Within the framework of the some projects (BSERP Project, 2005, PlanCoast, 2005-2007) and under the Permanent Secretariat of the Black Sea Commission request in the Ukrainian Scientific Centre of Ecology of the Sea (UkrSCES) prepared ecological sensitivity maps of the Black Sea coastal zone of Ukraine in MARPLOT system to be included to the Regional Contingency Plan.

A first coast and sea **data base** was created, including risk assessment. Maps according to the Environmental Sensitivity Index Guidelines Version 3.0 (NOAA) in English language have been created. In parallel, work on creation of these maps was carried out using GIS technologies, certificated software - (Arc Editor 9.1) and certificated basic maps (M. 1-200000).

The mapping is dedicated mainly to the coastal zone, including also marine space. The maps were continually up-dated in time and sectorial developed. They contain three general types of information, such as:

a. Classification of the coastal strip - type of coast (structure, bias, granulometric structure of deposits, etc.), ranking of the types of substratum on a degree of oil penetration into the depth of deposits, energy loading (intensity of wave and tidal activity), natural stability to oil, ease of cleaning up;

b. Information on biological resources - biological productivity of coast site, specific structure of flora and fauna of the shore strip and sea water areas, sensitivity to oil pollution; areas of distribution, inhabiting, nesting and spawning;



c. Information on anthropogenic use - Areas of the coastal strip having the status of nature protection territories, places and objects of cultural, historical and archeological value, and also beaches, parks, water intakes, objects of household activities etc.

Table 1.2 List of charts per region name of the coastal zone/Ukraine

List of charts	**Region name of the coastal zone**
Square 1	Coastal zone of Kilia Mouth - Lake Shahany
Square 2	Tuzlovskii Firth (Shahany-alibi-Burnas) - Budakskyy Firth
Square 3	Dniester Firth - Odessa Bay
Square 4	Coastal zone from Ilyichevsk to village Rybakivka
Square 5	Coastal zone from the village Rybakivka to Tendrivskoyi Spit
Square 6	Coastal zone of Tendrivskoyi Gulf - Dzharylhatska Gulf
Square 7	Coastal zone of Karkinitskoyi - Dzharylhatskoyi - Kalanchatskoy Bays
Square 8	Karkinitska Bay
Square 9	North-West coastal zone of the Crimean Peninsula
Square 10	Peninsula Tarkhankut
Square 11	West Coastal zone of Crimea Peninsula (Kalamitska Bay)
Square 12	From city Lucullus to Foros
Square 13	Coastal zone from Foros to Alushta
Square 14	From Alushta to Cape Meganom
Square 15	From Coastal zone of the Meganom Cape to Feodosia Bay
Square 16	Chauda Cape - Cape Opuk
Square 17	Coastal zone of the Kerch Strait

Taking into consideration the ever higher anthropogenic impact on the sea, accumulation of the living matter leads to the advent of high ecological risk sources.

The conventional works devoted to ecological monitoring of the sea provide for launching long-term and costly expeditions across the entire sea and all depths, including very significant depths, can be replaced, in many cases, with less costly studies of the sore spots of the sea that have been identified in the coastal stretch (Fig. 1.14).

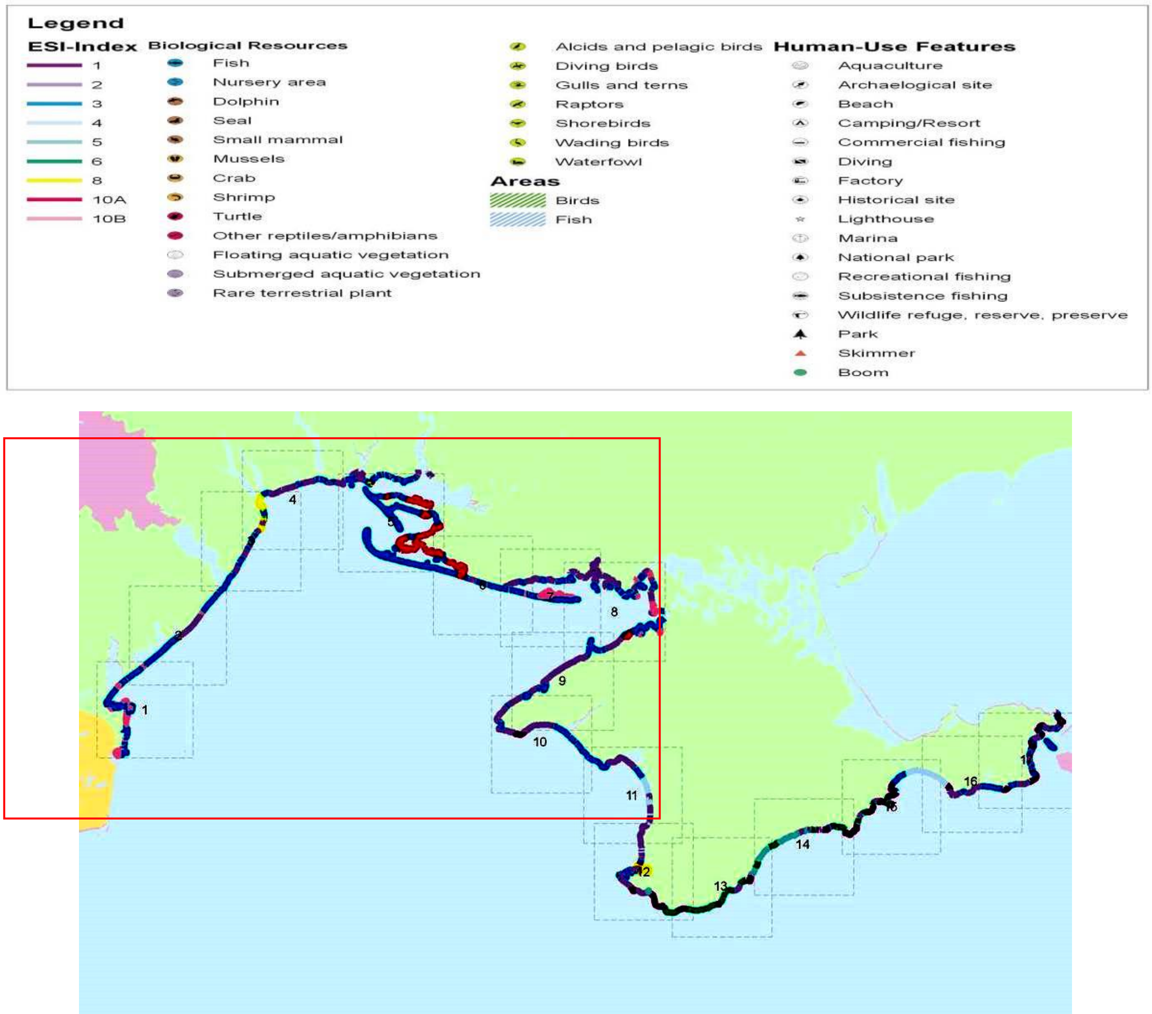


Fig. 1.14 ESI map of the coastal zone (Ukrainian part of Black Sea)

Different kinds of approaches for spatial planning and for research purposes have been started. The Study Cases of Pilot Projects have also beed mentioned. One example in the aim of planning methods is presented in the following diagram (Fig. 1.15).

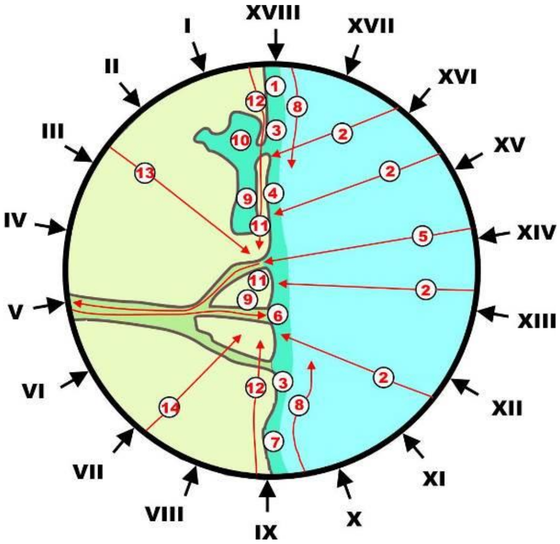


Fig. 1.15 Diagram illustrating an example of interaction of natural and anthropogenic factors in the coastal zone of the Black Sea

***Legend**: Fig. 1.15*

Natural factors assessment

a. High diversity, number and biomass of vegetation and animals in the contour (boundary) biotopes of the sea
b. Spawning migration of fish from the high sea towards the coast (at least 90 species)
c. Feeding of young fish at coats (about 95 species)
d. Feeding of adult fish at the coast (more than 80 species)
e. Spawning migration of transitory fish from the sea into rivers (13 species)
f. Passage of young fish from rivers into deltas and in the coastal zone of the sea(13 species)
g. Wintering migration of adult fish along the coast.
h. Wintering and feeding migration of young fish along the coast.
i. High number and biomass of organisms in limans, lagoons and river deltas.
j. Feeding of sea fish and their fry in limans and lagoons (more than 30 species)
k. Nesting of colonial and other bird species in river deltas and limans (to 150 species)
l. Seasonal migration of birds having their stay in the coastal zone (to 300 species)
m. Striving of land birds to the coastal zone.
n. Striving of land mammals to the coastal zone.

Anthropogenic factors assessment

I. Industry.
II. Agriculture
III. Cattle farming
IV. Fishery
V. Hydraulic power industry
VI. Municipal facilities
VII. Resorts
VIII. Night entertainment facilities on shore
IX. Extraction of living resources

X. Extraction of mineral resources
XI. Artificial reefs
XII. Sea transport
XIII. Dumping
XV. Coast protection
XVI. Ecological control
XVII. Ecological education and upbringing
XVIII.Complex management of the coastal zone

Table 1.3 Structure of economic activities related to the coastal zone

	Main Fields	Activities
1	Marine transportation	Services to passenger and cargo fleet, port facilities and land-based infrastructure
2	Offshore operations	Activities pursued on the fleet, at floating factories, in fishing ports, canneries and fish breeding
3	Sea industrial cycles	Development of raw resources of the shelf and the World Ocean
4	By-port industrial production	Industrial processing of export and import raw materials
5	Recreation	Services to the resort and recreation industries and public tourist facilities
6	Export/import and technical activities	Formation of special economic zones, joint entrepreneurship and establishment of technopolitan sites and technological parks

The main parameters of research Data Base which have been registered in the frame of some projects are:

Sea Data Base

- General meteorological information;
- Hydrology and hydrochemistry;
- Geology;
- Pollution in bottom sediments;
- Pollution in water;
- Metals in water;
- Metals in bottom sediments;
- Poly aromatics in water;
- Poly aromatics in bottom sediments;
- Chlorine organics in water;
- Chlorine organics in bottom sediments;
- Radioactive elements in water;
- Radioactive elements in bottom sediments;
- Macrozoobenthos;
- Phytoplankton;
- Photosynthetic pigments;
- Meyobenthos;
- Microphytobenthos;
- Macrophytobenthos;
- Methods.

Coast Data Base

- Geography
- Urban
- Roads, railways
- Pipelines
- Electrical
- Agriculture
- Land using

- Pollution sources
- Underwater and coastal pollution sources
- Rivers as pollution sources
- Ports and shipping pollution sources
- Industrial pollution sources
- Domestic pollution sources

- Natural-recreation potential
- Reservations and protected territories
- Recreation resources
- Mineral waters and mud's
- Bio resources

The consideration for the impact of anthropogenic factors evaluation permitted for the beginning to focus attention on various activities, uses and factors with impact on the costal and marine ecology. There were registered the following field of activities and their impacts.

Table 1.4 Fields of activities and their impacts on the sea and coast

IDENTIFIED FIELD	CORRESPONDING ACTIVITIES
Industry	- pollution with sewage containing chemical and radioactive substances
Agriculture	- pollution with organic and mineral substances, pesticides in water and soil, soil erosion, sea bottom silting, eutrophication
Cattle Farming	- pollution with sewage, eutrophication
Fishery	- genetic degradation of natural populations resulting from release into water bodies of the breed which was obtained by crossing closely related fish
Hydraulic Power Industry	- obstacles for spawning migration of transitory fish
Municipal Facilities	- pollution with sewage and storm waters, microbial contamination
Resorts	- pollution with sewage water, microbial contamination
Night entertainment facilities on shore	- noise and light pollution of the coastal zone
Extraction of living resources	- reduction of the numbers of individual populations of industrially extracted species
Extraction of mineral resources	- ruination of bottom communities, bottom silting
Artificial reef construction	- increase of the number of attachable plants and animals, spreading of filtering organisms
Sea transport	- ruination of costal bottom communities, advent of alien species
Dumping	- ruination and destruction of bottom communities, bottom silting
Coastal protection	- worse habitat conditions, establishment of stagnation sites in the coastal zone
Environmental protection	- positive consequences
Ecological control	- positive consequences
Ecological education and upbringing	- positive consequences
Complex management of the coastal zone	- positive consequences

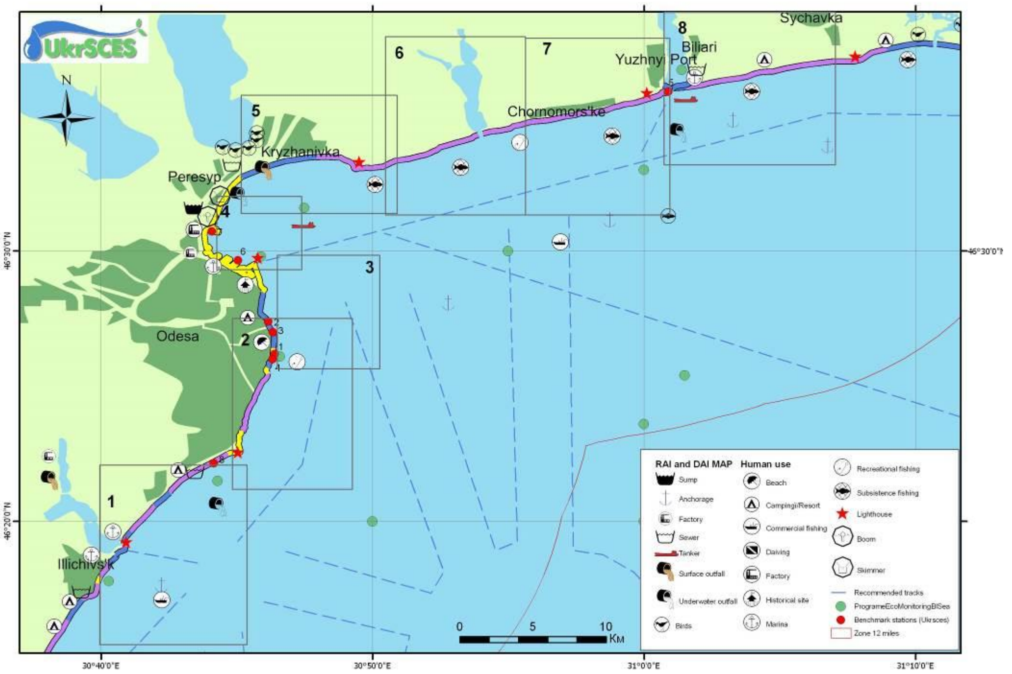


Fig. 1.16 Map of the Pilot Case Odessa. PlanCoast Project *(Source: Richard Lisovsky)*

Ukraine also started to prepare a layered matrix of conflicts for the Coastal Atlas preparing based on projects results (Fig. 1.16).

The developed scheme can be very usefully applied when determining basic **environmental measures** to be taken in the coastal zone of the sea. To this end, there was an attempt to consolidate scientific data pertaining to natural and man-caused ecological processes at the sea boundaries, land and fresh water areas in the context of the integrated management of the costal stretch which made it possible to design a consolidated matrix of expert assessments concerning ecological processes and conflicts in the coastal stretch of the Black Sea, which is a more step forward (Table 1.5).

Considering the consolidated matrix, the environmental impact assessment (EIA) for any kinds of contemplated human activities connected with the use of the sea is to be based upon a study of specific ecological conditions of a particular costal stretch site.

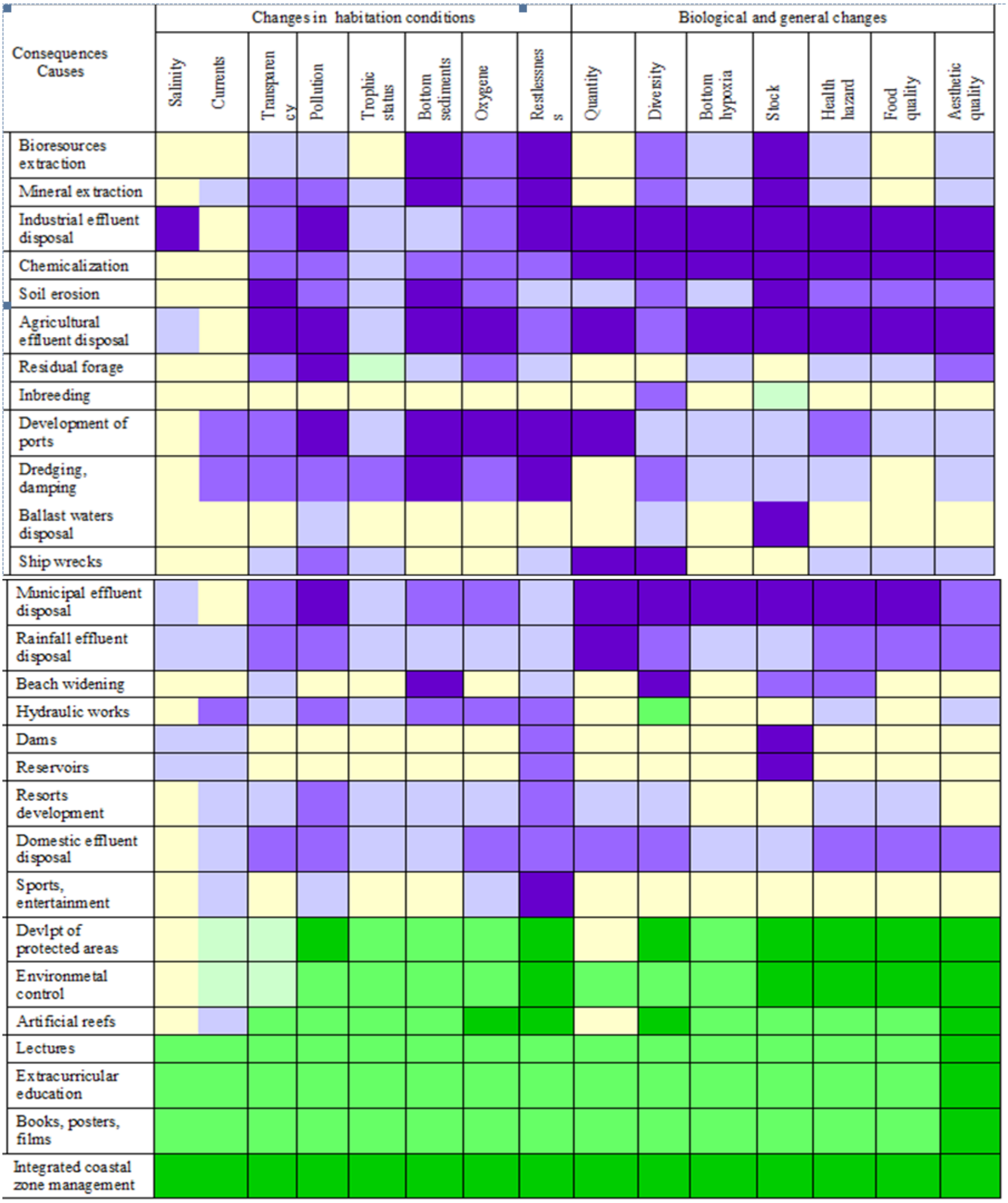
Table 1.5. Consolidated matrix of expert assessments concerning ecological processes and **conflicts in the coastal stretch** of the Black Sea

LEGEND:

……						
1	**2**	**3**	**4**	**5**	**6**	**7**

Effects: 1- extremely negative; 2- negative; 3- rather negative, than positive; 4- undefined; 5- rather positive, than negative; 6- positive; 7- extremely positive.

Factors: I. Industry, II. Agriculture, III. Fishery, IV. Marine shipping, V. Communal services, VI. Coast protection, VII. Hydropower engineering, VIII. Resorts, tourism, IX. Nature conservation, X. Environmental education.



The issues related to management and structure of the Ukrainian Black Sea coastal zone are closely connected with the general features of the region as well.

1.1.3.5. Needs for additional actions in order to achieve the objectives set out (for maritime spatial plans and integrated coastal management strategies)

Table 1.6 Objectives inventory for maritime spatial plans (white box) and integrated coastal management strategies (gray box) on Black Sea countries

MSP&ICZM OBJECTIVES / Specifical requirement	**COUNTRIES**									
	BG		RO		TR		UA		MD	
Ecosystem-based approach	x		x		x		x		x	
Conflicts identified										
Operational steps ICZM	x		x		x		x			
Operational steps MSP	x		x			x	x			
Mutually coordination	x			x	x			x		
Transboundary cooperation	x		x							
Transboundary effects of MSP and ICZM		x		x		x		x		x
ICZM Competent authorities	x		x		x		x			
ICZM legislation	x									
MSP Competent authorities		x		x		x		x		x
Inventory of existing measures	x		x		x		x			
Specifical activities ICZM		x		x		x				
Analysis of needs	x			x		x		x		
Ecological Data Base and Monitoring	x		x		x		x			
Economic Data Base	x		x		x		x		x	
-utilisation of specific natural resources	x		x		x		x		x	
-energy	x		x		x		x			x
-transport, ports	x		x		x		x			
-agriculture	x		x		x		x			
-industry	x		x		x		x			
-fishing and aquaculture	x		x		x		x			x
coastal ecosystems conservation restoration and management	x		x							
Social data base	x		x		x		x		x	
Interactions between terrestrial and maritime activities		x		x		x		x		x
ICZM Mapping	x		x		x		x		x	
MSP Mapping	x		x				x			
MSP Plans		x		x		x		x		x
ICZM Strategies		x		x		x		x		x

- According to the results obtained the number of conditions and measures necessary for the implementation of the MSP and ICZM are enough to make this possible.
- In spite of the fact that Bulgaria and Romania are Member States also Turkey (which implement ICZM) and Ukraine (which perform mapping) have been prepared to implement and to develop the fields of ICZM and MSP in the Black Sea Basin.

- All countries started to apply the ecosystem-based approach, made first operational steps for ICZM, have inventory of existing measures, and have long terms of ecological Monitoring and Data Base.
- Needs for additional actions and measures in order to achieve the objectives set out (for *maritime spatial plans and integrated coastal management strategies)* are registered in the authorities nomination, laws and regulations elaboration, transb-boudary cooperation, MSP national plans, ICZM Strategies.

The comparative analysis on the existing measures and the results obtained led to identifying other important needs, under the institutional, environmental and social aspects:

- **Institutional Needs**
    - Need for strong supportive legal frameworks
    - Need for capacity development
    - Need for cross-sectorial decision making process
    - Need for addressing multi-use conflicts through MSP
    - Need for stakeholder driven planning
- **Environmental Needs**
    - MSP's catalytic role for sustainable development
    - Need to address multiple, cumulative impacts
- **Social Needs**
    - MSP complementing traditional management approaches
    - Reconciling top-down, large scale planning with bottom-up and more localized management

Table 1.7 Necessity of risks avoiding according with the a significant necessity of investments in infrastructure

SUBJECTS	OPPORTUNITIES	RISKS
Energy and Pipelines	New pipelines Fossil fuel development Marine renewables Regional development	İncreased oil transport and Bosphorus strait constraints Environmental damage associated with new energy transport Need for effective communication Infrastructure development
Transport	Growth of shipping Development of ferry services Short sea shipping Cruise activity New infrastructure Gas and oil shipping Leisure development	Substandard shipping and maritime accidents Administrative barriers to shipping
Environment	Improved monitoring and communication İmplementation of EU regulations and regional agreements	Eutrophication Nutrient enrichment Marine living resources biodiversity
Economic Use	services related to energy transport infrastructure development agriculture development increased tourism	low investments in infrastructure administrative barriers environmental pressures caused by land use

Detailed ways for elaboration of the integrated coastal management strategies and maritime spatial plans are presented.

I. The main steps for maritime spatial plans elaboration

For the elaboration of the maritime spatial plan are nominated 8 steps with specific aspects (Table 1.8).

Table 1.8 The steps of elaborating a maritime spatial plan

No.	STEPS	ACTIONS
Step 1	**General Context Evaluation**	-establishment of the general frame for the planning process; lists of opportunities, constraints from national, international policies, legislation,
Step 2	**Vision Creation**	-added to a set of scopes and objectives, short document with objectives
Step 3	**Data-Information Collecting**	-according to objectives
Step 4	**Spatial Conflicts Analyze**	-identification of the main solutions for resolving
Step 5	**Development and Solutions**	-identification of the specifically problems in the presence of stakeholders
Step 6	**Results Transposition in a Strategic Plan**	-for the coast and the sea, based on memories and plans
Step 7	**Plan implementing**	by a very simplified process
Step 8	**Evaluation of results of the Plan implementing**	After some years long-term

II. Schemes/Steps regarding the main steps for integrated coastal management strategies recommended to be followed at regional level (Fig. 1.17)

Fig. 1.17 Integrated coastal management strategies diagram

In conclusion, maritime activities and uses in the Black Sea are not so complex and developed like in other coasts and seas. However, as European Sea included in the Mediterranean basin, the Black Sea should have similar objectives and approach for sustainable development in wise reasons. Sharing the same sea and its resources, the Black Sea countries use to standardize all kind of methodologies. Important steps have to be done to include MSP and ICZM, too, based on common interests, some similarities and hopes for a better life in spite of the present geostrategic evolution which makes differences. MPS and ICZM will also help the harmonization with and between several other important EU policies, including the Marine Strategy Framework Directive, the Water Framework Directive, the Nature and Habitats Directives and the Biodiversity Strategy. Other relevant EU policies are the Integrated Maritime Policy, Strategy on Climate Change Adaptation, the Renewable Energy Directive, the Motorways of the Sea Initiative and the Common Fishery Policy.

The next steps are related to the legislation harmonization, the review of the existing ICZM and MSP possibilities, actions, data base and maps calibration, interaction between ministries, institutions, nomination of responsible authorities, different stakeholders. It is proved by this study that all Black Sea countries wish and have resources, possibilities to prepare maritime spatial plans and integrated management strategies. They should develop transboundary approach and to action for a better expertise development.

1.1.4. Interaction between terrestrial and maritime activities

The range of the **Bulgarian Black Sea coast** is determined by a number of factors: pollutant type, physiographic characteristics of the regions, their importance in terms of economy, culture, biodiversity, etc., as well as the size and duration of the impact.

Cliffs and high plateaus as Cape Kaliakra and Cape Emine are densely populated with sea birds and therefor have a high index of sensitivity, although their physical characteristics do not suggest such. Coastal lakes, wetlands and estuaries involve increased sensitivity of the territory towards the land.

Interactions between onshore and offshore activities are rendered in the ***spatial planning*** as a requirement of the Spatial Development Act for preparation of development plans. These plans should include the land and 200 m marine area from the sea coast. The EIA reports analyse the water-land interaction and assess the possible impacts. The plans must be coordinated with the authorities involved in maritime activities - Maritime Administration, Port Administration, Basin Directorate, the Navy, Agency for Fisheries and Aquaculture.

Best practices when concerning the interaction between onshore and offshore:

- Determining and updating the boundaries of protected areas along the coast in the period of 2013-2014

The diagram below (Fig. 1.18) shows that 18 of the 19 protected onshore areas under Natura 2000 have marine territory (protected areas for conservation of birds and habitats are shown in blue and green; the middle red line outlines the shore, the dotted red line shows the 2 km strip). Under protection is over 76% of the coastline, including water areas near the coast.

The Water Management Plan in the Black Sea River Basin and proposed update /under the Water Framework Directive.

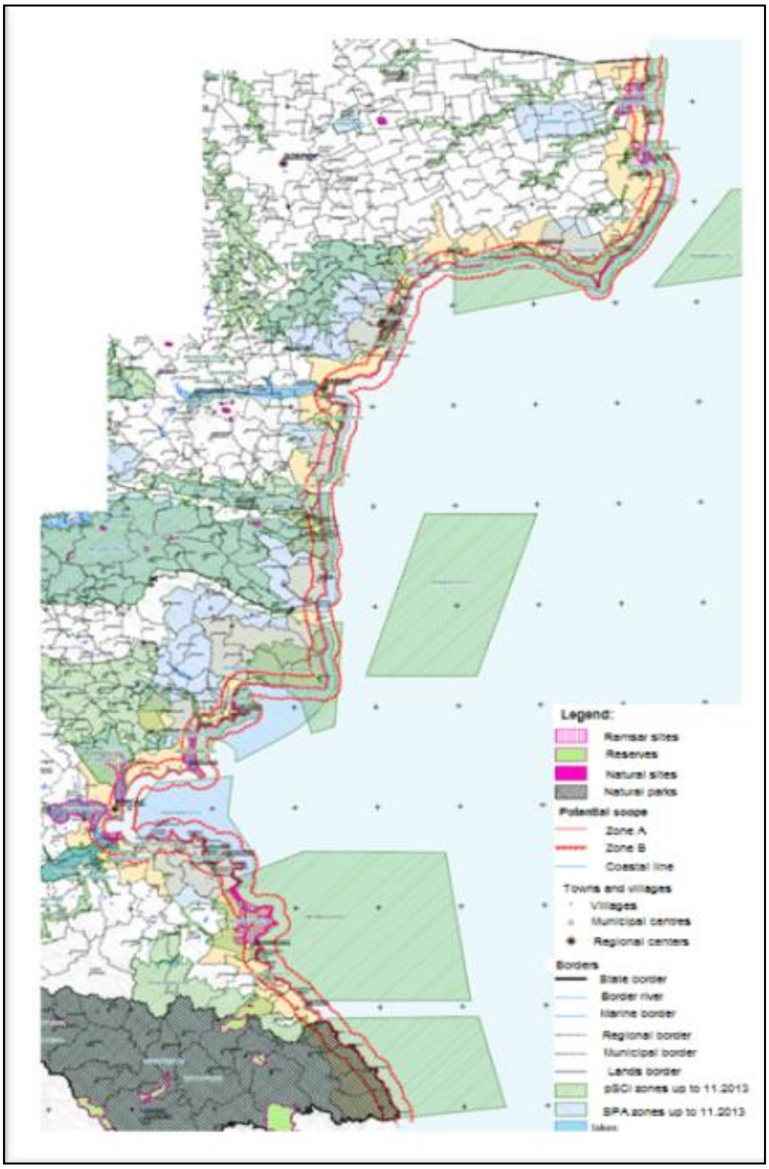


Fig. 1.18 Diagram of protected areas in the Bulgarian coastal zone

The Plan analyzes the use of water offshore and onshore; the quality of surface and underground water; the impact on the coastline including sources of pollution; landslides and abrasion in the coastal area; protected areas and protected territories; water protection zones; agricultural activities, etc. The analyses and conclusions in the Plan serve as the basis for determination of the measures for environmental protection.

The legislation requires in cases of implementation of procedures for the construction of facilities in the coastal area or offshore area that the BSBD and RIEW make decisions under the Environmental Protection Act and the Waters Act after concurrence of the investment proposals with the other authorities - Maritime Administration, the Navy, the Agency for Fisheries and Aquaculture.

An initial assessment report on the state of the marine environment has been prepared under Articles 8, 9 and 10 of the Marine Strategy Framework Directive 2008/56/EC. The report contains analysis of the interaction between offshore and onshore activities. *Priorities and further steps for the improvement of the costal water quality and the condition of the coastal sea habitats have been* *underlined. Based on the analyses, an action plan / programme has to be prepared, which needs to be financially supported.*

National Oil Spill Contingency Plan - the Plan introduces a classification of the coastline according to sensitivity level towards pollution from oil products from spills in the Black Sea and from ports (Fig. 1.19).

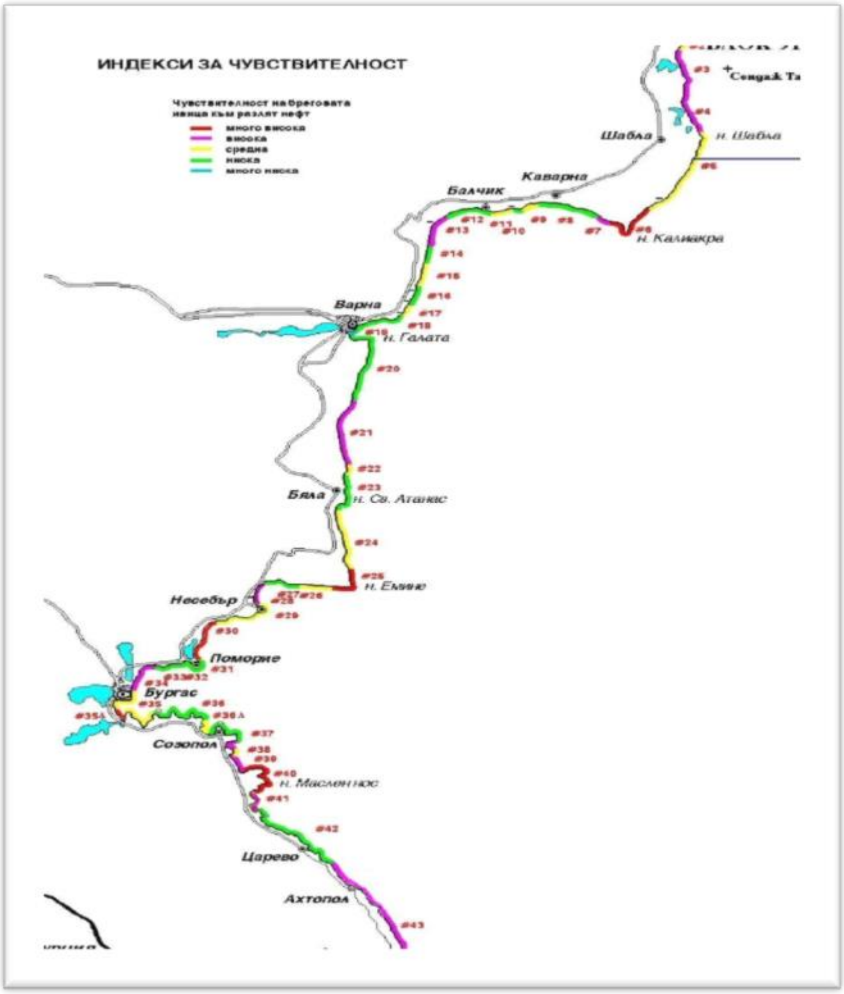


Fig. 1.19 Classification of the coastline according to sensitivity level towards pollution from oil products from spills in the Black Sea and from ports (Bulgaria)

The Plan needs to be updated due to the announcement of new protected marine areas and also according to the priorities and steps for improvement of the costal water quality contained in the report under Articles 8, 9 and 10 of the Marine Strategy Framework Directive. **It is necessary that the preventive activities and control over vessels in the Black Sea are significantly improved so that the pollution levels from marine vessels could be reduced.**

At the **Romanian Black Sea** coast the terrestrial space, adjacent to the marine areas (water and submerged land), has specifically processes and uses directly affect maritime in mutual manner. In Romania, maritime activities are not separated from coast, they are continuing, with simultaneous/reciprocal influence. The coastal pressures are high and affect the shore, and therefore common measures are necessary to be taken. The both senses pressures and the high instability are given from the sea to the coast and similar from the land to the sea. (strong winds, waves, storms, the open sea, without closed areas, the combined currents, the variability of temperatures, salinity, density, due to the Danube impact etc.). The influence of the rivers discharging into Black Sea is important, mainly due to the Danube, coastal erosion and flooding period; the urbanization, tourism, naval industry have an impact on the coast and the sea environment. The MSP Directive is well waited in Romania to put in practice similar tools and practical approach from the coastal to maritime space.

In **Ukraine** land policy means the formulated and documented intentions and principles of relationship of the entity to land. Land is viewed as the territorial basic, a natural resource and a means of production. Policy formulation envisages the objective, goals, and priorities that are necessary for planning measures. The measures make the integral component of projects and programs through which the policy is accomplished. When it concerns such entity of activity as the state, the national land policy (or any other policy) is to be reflected in a whole set of documents – strategies, laws and enactments, quality and management standards, regulatory norms, programs and projects and international agreements, etc. and, naturally, is not limited by the target documents. There exists no separate document where the state policy provisions referring to the land use, specifically coastal areas are described but these issues are, to a certain extent, described in numerous enactments and resolutions of a systemic and sectoral nature for the local, regional and national levels. The Land Code provisions viewing land as a territorial basis, natural resource and a means of production can be considered key ones. Therefore, the use and protection of the Sea Coastal Zone (SCZ) lands is, above all, a component of the national policy and the provisions referring to the SCZ land policy are reflected in the documents of the appropriate sectors.

The Main directions of the national policy of Ukraine in the environmental protection, use of natural resources and provision of ecological safety (approved by the Verkhovna Rada of Ukraine in 1998) and the Concept of the national environmental policy of Ukraine until 2020 (approved by the Cabinet of Ministers of Ukraine in 2007) delineate the national environmental policy.

We should also mention the document entitled "*National Environmental Policy of Ukraine: General Assessments and Strategic Guidelines*" which was developed within the frame of the technical assistance to Ukraine extended by the UNDP, however, this document is not official and is viewed as expert guidelines only. Still, all mentioned documents do not pay attention to the sea coastal zones. Certain general provisions of these documents may be considered as those that pertain to the SCZ management, and it is only the Concept that provides for *"development of the functional zoning scheme for the sea coastal areas and determination of the territories where various kinds of business and environmental protection activities can be pursued"*. Also, the Concept suggests orientation on the implementation of the integrated management of water and land resources.

Summing up the above, the key provision of the policy as to the SCZ (including the land aspects) may be formulated on the basis of the consolidated formulations contained in said documents and in other numerous enactments as follows:

• the SCZ is viewed as a special natural and economic complex which is unique because of its high biological productivity, vulnerability, availability of a considerable recreational and health-improvement potential, etc.;

• the peculiar feature of the CSC is that it is there localized are the facilities and the infrastructure of such an important industry of the state as sea transportation (port complexes, shipbuilding, navigational facilities and others);

• use of SCZ means a forced ban or restriction of certain kinds of business activity, and planning of the new activities should provide for assessment of the environmental impacts and strategic environmental assessment in a long-term perspective;

• the SCZ condition necessitates measures aimed at improvement of the environmental situation, termination of losses of the biological and landscape diversity and higher level of the ecological safety;

• use of the SCZ requires to implement a system of balanced integrated environmental management that provides for a sectoral and vertical integration;

• the priority uses of the SCZ should be the recreational and health-improvement, tourist, environmental protection and other activities that are based upon a non-consumptive exploitation of the natural potential;

• zoning of the sea coastal areas is a necessary element for planning a differentiated use of the land resources within the SCZ. Users of land and other natural resources in the SCZ are fully liable for their condition and restoration;

• higher economic liability of business entities for pollution of the environment. Such liability should be so high that the consequences of pollution cease to be problematic.

1.1.5. Conservation, restoration and management of coastal ecosystems, ecosystem services and nature, coastal landscapes and islands

The protection, restoration, management and promotion of an ecosystem requires institutional, social and technical solutions that are specific to each territory located in Bulgaria, Moldova, Romania, Turkey or Ukraine. They must be adopted by the stakeholders in the territories, the populations living there who draw some of their resources from it and have historical rights. Sharing the benefits that result from the sustainable promotion of an ecosystem, whether through tourism, selling harvested products, fishing, forestry or hunting, must be at the heart of all actions to protect ecosystems. In the long term, safeguarding the conservation of a natural environment and improving the well-being of the populations that depend on it inherently linked.

That is why the ecological management of a biological resource and the ecosystem that produces it has to be constructed by and for the rights holders and the users of the territory in question, taking into account their legitimate aspirations in terms of economic well-being and social, political and cultural recognition.

Some actions were identified, dedicated to the management of protected natural areas, the sustainable exploitation of biological natural resource and promotion of biological resources:

- Extend and improve the protection of ecosystems, notably with or for the benefit of local populations;
- Promote biodiversity, notably to the benefit of local population via the development of sustainable channels;
- Provide sustainable financing for biodiversity protection;
- Strengthen the policies and institutions responsible for biodiversity protection.

Despite the long history of ICZM and the application of the Ecosystem Approach (EsA), it is clear that considerable challenges remain in embedding both in decision making. Achieving a balance between strategic and local concerns is perhaps one of the most difficult issues that we face in coastal zone management, along with the question of how we ensure that a narrow focus on coastal issues does not undermine or conflict with policy in the marine and terrestrial domains.

As with the ICZM Protocol, the principles of the Ecosystem Approach (EsA) seek, for example, to promote an integrated approach to management that operates across both natural and social systems, and between different ecosystems. An understanding of the way in which natural and social systems are coupled is seen as particularly important because, it is argued, management decisions have to be seen in their economic and social context, i.e. people are an integral part of ecosystems. In keeping with ICZM, the principles proposed in the EsA therefore cover the conservation and renewable use of resources, and the sharing of benefits derived from natural resources throughout society.

Both the ICZM principles and those of the EsA recognize the inherently dynamic nature of ecosystems and the uncertainties involved in any attempt to manage them. Thus both sets of ideas seek to promote a holistic, adaptive and flexible approach to natural resource management. One of the merits claimed for the EsA is that it helps focus decision makers on longer-term, more sustainable perspectives rather than on shorter-term fixes that may ultimately fail to deliver lasting, cost-effective socio-economic and environmental benefits; it is certainly the case that longer time - perspectives may change cost-benefit or cost-risk assessments and so affect decision outcomes.

Understanding which combinations of threats are particularly devastating on which ecosystems, or which threats predispose systems to collapse given other threats, would aid in prioritizing which threats to address first. Finally, greater ecological understanding of community-level responses to threats and interconnectedness of ecosystems and their components would help to better predict impacts, restore systems, and mitigate threats. However, uncertainties and "ecological surprises" are sure to emerge. Therefore, systems need to be managed for resiliency so that they are capable of absorbing and adapting to physical and biotic stochasticity, be it human induced or not.

In the meantime, our knowledge of human threats to coastal marine ecosystems is developed enough to point to several critical management issues that can be addressed immediately. First, land–sea interactions are fundamental to the functioning of coastal and estuarine ecosystems. This permeable boundary means human activities on land are felt at sea and land-based pollutants, nutrients, sediments, diseases, and freshwater practices have some of the greatest negative effects on these coastal ecosystems. A watershed approach to improving water quality is essential for protecting nearshore marine ecosystems. However, where coastal watersheds are small, human populations sparsely distributed, or little rainfall occurs, such land-based threats are likely to be minimal and conservation can focus on ocean-based threats.

Second, overharvest of marine organisms reduces biodiversity, changes ecosystem functioning, and has contributed to system collapse or phase shifts. Many approaches to fisheries management, including multi-objective MPAs to promote population replenishment, changes in fishing gear, and privatization of fisheries hold promise for improving fisheries sustainability and should be pursued.

Finally, stakeholders and local communities must be integrated into plans for the Black Sea solutions. Many of the emerging management practices make the human element explicit. Most threats to the marine environment stem from essential or embedded human activities that cannot and should not be entirely removed. Instead, levels and/or locations of the uses can be modified, or alternative approaches that are compatible with ecosystem health can be pursued. Likewise, ecosystems need to be better integrated into human systems, such as with ecosystem service valuation.

But inevitably, as coastal populations grow, ocean exploration and exploitation increase, and new uses of the Black Sea emerge, more sophisticated and proactive approaches to protecting the sea and ensuring it long term sustainable use will be required. No single approach will work everywhere, but comprehensive, multi-sector, multi-objective management provides an essential framework for effective coastal conservation.

1.1.6. Mitigation and adaptation to climate change

The Black Sea itself is also affected by severe environmental degradation. In 1995, it was rated with the highest concerns in five out of seven environmental categories, making it the worst of any of the European seas *(Stanners and Boudreau 1995).* Some signs of recovery have been observed in the last years, but eutrophication remains a severe problem.

Agriculture in the Black Sea catchment is responsible for a considerable share of the area's total water withdrawal and the majority of its total water consumption. It therefore plays a key role in sustainable water resources management. However, in the future water resources will be exposed to climate change.

This assessment aims at identifying the most vulnerable regions and to explain the reasons of this vulnerability. It is based on a combination of the well-known Driver–Pressure–State–Impact–Response framework (DPSIR) and the vulnerability concept as defined by the Intergovernmental Panel on Climate Change (IPCC). Three distinctive climate change scenarios are used to assess their impacts on water resources for agriculture: (1) an increase in temperature; (2) a decrease in precipitation; and (3) a combination of the first and second scenarios. The data for this assessment is derived from a SWAT model (Soil and Water Assessment Tool).

The results show that the regions of the Black Sea catchment are impacted by climate change differently. Some countries benefit from climate change (e.g., Turkey, Ukraine, Romania, Moldova, Bulgaria) while others will encounter considerably worse agro-climatic conditions in the future (e.g., Montenegro, Austria, Bosnia–Herzegovina). Additionally, natural plant growth conditions mostly improve due to more suitable temperature conditions. In contrast, the deteriorating agricultural conditions mainly result from a diminishing irrigation potential that is caused by reduced precipitation.

The rate of global mean sea level (GMSL) rise has accelerated during the last two centuries. The long-term rate of rise between 1901 and 2010 was around 1.7 mm/year. Rates of GMSL rise during the more recent period of 1993 to 2010 are considerably higher at about 3.2 mm/year (EEA, 2014).

The causes of global sea-level rise over recent decades are now reasonably well understood. Thermal expansion and glaciers account for around 75% of the measured sea-level rise since 1971. During the last decade, most ice was lost from glaciers in Alaska, the Canadian Arctic, the periphery of the Greenland ice sheet, the Southern Andes and the Asian Mountains. Together these regions account for more than 80% of the total ice loss. The contribution from melting of the Greenland and Antarctic ice sheets has increased since the early 1990s. Changes in land water storage have made only a small contribution, but the rate of groundwater depletion has increased recently and now exceeds the rate due to storage in reservoirs (EEA, 2014).

Sea-level measurements for the European region are available from tide gauges (relative sea-level; sometimes more than 100 years) and from satellite observations (absolute sea level; since 1992). These measurements show significant differences in the rate of both relative and absolute sea-level change across Europe (EEA, 2014).

Trends in absolute sea-level in the North Sea are typically around 2 mm/year, except for some parts of the southern-most North Sea where they are larger. Parts of the English Channel and the Bay of Biscay show a small decrease in sea level over this period. The Baltic Sea shows an increase of between around 2 mm/year and 5 mm/year. In the Mediterranean Sea there are regions with increases of more than 6 mm/year, and with decreases of more than -4 mm/year. The Black Sea has seen an increase in sea level of between zero and around 5 mm/year (Fig. 1.20).

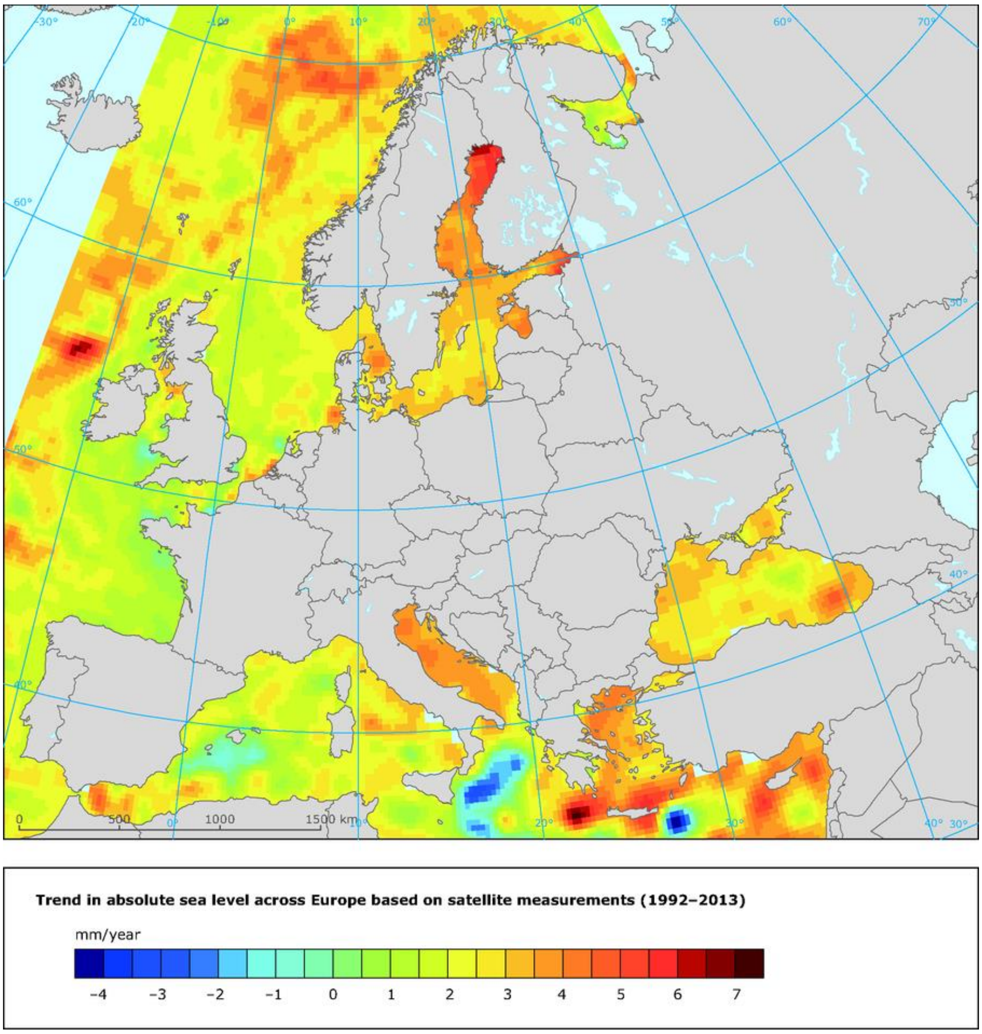


Fig. 1.20 Trend in absolute sea level in European Seas based on satellite measurements (1992-2013)
(Source: Collecte Localisation Satellite - CLS)

These big differences, even within a particular sea or basin, are due to different physical processes being the dominant cause of sea-level change at different locations. For instance, the Mediterranean Sea is a semi-closed, very deep basin, exchanging water with the Atlantic Ocean through the narrow Gibraltar Strait only. It is a concentration basin where evaporation greatly exceeds precipitation and river run-off. Therefore, salinity is one of the main physical parameters influencing the thermohaline circulation and sea-level variability in the Mediterranean, which may counteract the thermal expansion due to a rise in temperature. Interannual wind variability, changes in global ocean circulation patterns, and the location of large scale gyres are further factors that can influence local sea level in the European seas. Trends in sea level from selected tide gauge stations in Europe can differ from those measured by satellites because of the different time periods covered and because tide gauge measurements are influenced by vertical land movement whereas satellite measurements are not. In particular, the lands around the northern Baltic Sea are still rising since the last ice age due to the post-glacial rebound (EEA, 2014).

Several factors, such as vertical land movement and projected changes in ocean circulation and storminess, cause local and regional sea level change to differ from the global mean. Projections for regional sea-level rise are available from the CMIP5 experiment with global climate models (CMIP5 - Coupled Model Intercomparison Project Phase 5 - Overview) (http://cmip-pcmdi.llnl.gov/cmip5/). Whilst there remains considerable uncertainty in the spatial patterns of future sea-level rise, around 70% of the world's coastlines are expected to experience a sea level change within ±20% of the projected global mean sea level change.

Relative sea level rise in European seas is projected to be similar to the global average, with the exception of the northern Baltic Sea and the northern Atlantic, which are experiencing considerable land rise as a consequence of post-glacial rebound (Church et al., 2013).

One study estimates absolute sea-level rise (which exclude changes in land level) around the UK for the 21st century in the range of 12 cm (the lower bound of the low emission scenario) to about 76 cm (the upper bound of the high emission scenario). Larger rises could result from an additional ice sheet term, but this is more uncertain (Lowe et al., 2009).

Another study estimated the plausible high-end scenario for 21st century sea-level rise on the North Sea coast of the Netherlands in the range 40 to 105 cm (Katsman et al., 2011).

Making multi-decadal regional projections for relatively small isolated and semi-isolated basins, such as the Mediterranean and the Black Sea, is even more difficult than for the global ocean. One study made projections for the Mediterranean Sea based on the output of 12 global climate models for 3 emission scenarios. The results project an ocean temperature-driven sea-level rise during the 21st century between 3 and 61 cm over the basin, which needs to be combined with a salinity-driven sea-level change between -22 and 31 cm (Marcos and Tsimplis, 2008).

With respect to the **climate change information**, there are several specific needs which have to be met:

- There is an obvious need to identify the climate parameters which appear to be a direct results of the Global Climate Change in the Black Sea coastal zone;
- There is a necessity of an adequate description of the results and the primary and secondary impacts of the Global Climate Change;
- There is a need of filling the data gap on sea level rise;
- New phenomena associated with climate change like forest fires occurred for the first time in the coastal zone during the recent years;
- The overall condition and the drainage capacity of the coastal systems of rivers, gullies and gulches have to be evaluated in order to assess the risk of flooding and occurrence of secondary disaster effects such as activating land-slides and land-falls in extreme weather conditions.

Territorial strategies for the coastal zones must be developed for adapting to the conditions of climate change which may include measures like building floodgates on big gulches and gullies, designation of buffer areas for controlled flooding and retention of flood waves, designing new wetlands, etc.

Reducing GHGs and mobilizing all available opportunities for keeping the 2^0 C target alive without harming economic growth is a global challenge that strains the capacity of world community to undertake joint actions.

Existing technologies for Renewable Energy Sources (RES) and a low carbon future are proven, feasible and, in most cases socially acceptable (Kontogianni et al 2013b). In the forefront of the international efforts to tackle climate change, European Union addresses the specific problem with the establishment of an ambitious legislative framework targeting the promotion of renewable energy sources (Green Paper COM (96) 576, White Paper COM (97) 599, Directive 2001/77/EC).

The most recent step toward this direction is Directive 2009/28/EC on the promotion of the use of energy from renewable sources, which endorses a mandatory target of a 20% share of renewable energy in energy consumption mix by 2020 for all member states. Separate national targets are specified for the fulfilment of this target, which range from a share of 10% in Malta to 49% in Sweden. By complying with the above targets, EU expects a lower dependence from imported energy and the reduction of greenhouse gas emissions. In this context, the leading role of wind energy is unquestionable.

The European Environmental Agency confirms that wind energy can play a major role in achieving the European renewable energy targets (EEA, 2009). It is also obvious that amidst global recession and financial crisis, the promotion of significant investments in renewables through financial stimuli is needed in order to implement the optimistic plans for the deployment of RES. Last but not least though, social constraints, particularly concerns regarding the visual impact of wind farms, may limit both onshore and offshore wind energy development. Especially for offshore, using only 4% of the European offshore area within 10 km from the coast and accounting for the restrictions imposed by shipping lane, gas and oil platforms, military areas, Natura 2000 areas etc. reduces the potential of exploitation by more than 90% (EEA, 2009).

Convention on the Protection of the Black Sea Against Pollution/Black Sea Commission

The Convention on the Protection of the Black Sea Against Pollution was signed in Bucharest in April 1992, and ratified by all six legislative assemblies of the Black Sea countries in the beginning of 1994.

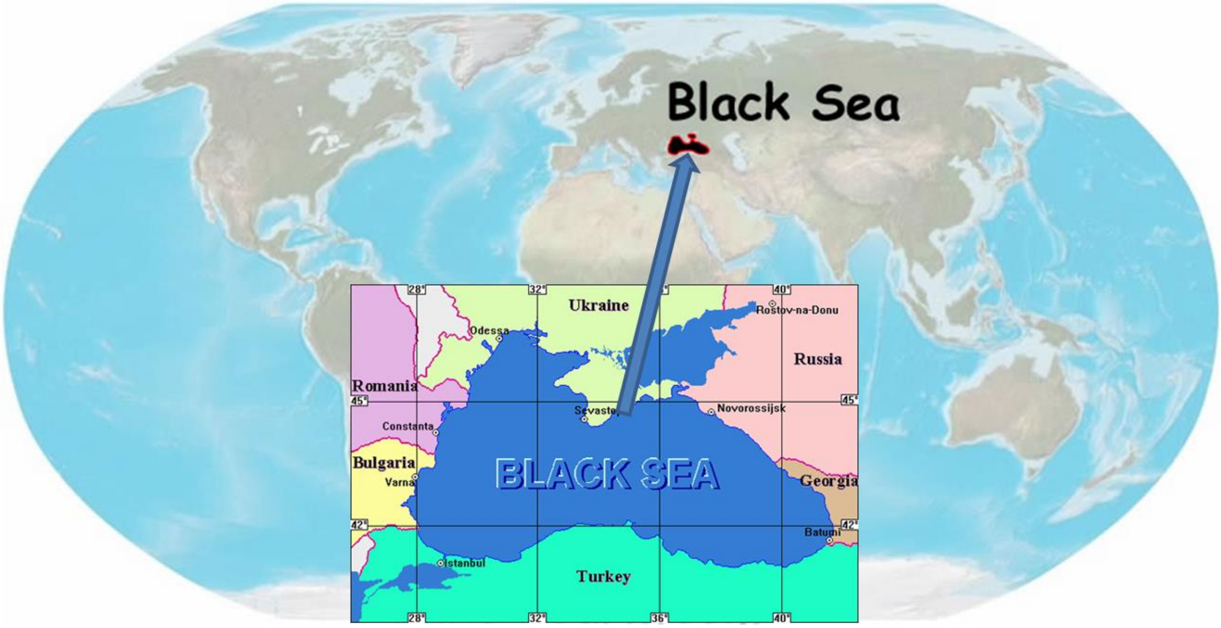


Fig. 2.1 Black Sea riparian countries (Contracting Parties to the Bucharest Convention: Bulgaria, Georgia, Romania, Russian Federation, Turkey and Ukraine**)**

Also referred to as Bucharest Convention, it is the basic framework of agreement, along with the specific Protocols and Resolutions, which are:

Protocols

- Protocol on Protection of the Black Sea Marine Environment Against Pollution From Land Based Sources ("LBS Protocol");
- Protocol on Cooperation in Combating Pollution of the Black Sea Marine Environment by Oil and other Harmful Substances in Emergency Situations;
- Protocol on the Protection of the Black Sea Marine Environment Against Pollution by Dumping; and
- Protocol on Black Sea Biodiversity and Landscape Conservation ("Biodiversity Protocol") (which has not yet been ratified by all of the Contracting Parties).

Resolutions

Resolution 1: Elaboration of a Protocol concerning transboundary movement of hazardous wastes and cooperation in combating illegal traffic thereof;

Resolution 2: Establishment of cooperation with Danube States for promoting the objectives of the Convention on the Protection of the Black Sea Against Pollution;

Resolution 3: Cooperation with intergovernmental organizations;

Resolution 4: Institutional arrangements related to the Convention on the Protection of the Black Sea against Pollution; and

Resolution 5: Initiation of action within the International Maritime Organization concerning prevention of pollution from ships which belong to countries not signatory to the Convention.

Structure

The implementation of the Convention is managed by the **Commission for the Protection of the Black Sea Against Pollution** and its **Permanent Secretariat** in Istanbul, Turkey. The Black Sea Commission comprises one representative of each of the Contracting Parties (Bulgaria, Georgia, Romania, Russian Federation, Turkey and Ukraine) to the Bucharest Convention.

The Permanent Secretariat is established to assist the Black Sea Commission. Its Executive Director and other officials (nationals of all Black Sea States) are appointed by the Black Sea Commission.

Concrete activities and work of the Permanent Secretariat are based on the Annual Work Programs of the Black Sea Commission in implementation of the Bucharest Convention. Concrete activities are the result of coordination with related or relevant national and regional projects/activities, International Financing Agencies and donors, national and regional policy measures and overall efforts of the countries to restore and preserve the environment of the Black Sea.

Strategic Action Plan for the Rehabilitation and Protection of the Black Sea (BS-SAP)

The Contracting Parties first adopted the Strategic Action Plan for the Rehabilitation and Protection of the Black Sea (BS-SAP) in 1996, which was later amended in 2002. Further revisions to the BS-SAP were adopted by the Contracting Parties at the 2009 Ministerial/Diplomatic Conference in Sofia, Bulgaria.

In the BS-SAP (both the 1996 and 2009 versions), the Contracting Parties elaborated on the goals and objectives that were laid out in the Bucharest Convention. Much of the BS-SAP was focused on how best to establish working relationships between the national frameworks of the Contracting Parties, outside states, and other groups that would be important in achieving the goals set out in the Bucharest Convention. The 2009 BS-SAP also formulated clear ecosystem quality objectives, corresponding targets (short-, mid- and long-term) to be achieved, and indicators of success.

The 1996 BS-SAP obligated the Commission to initially establish seven Advisory Groups (“AGs”) and seven Regional Activity Centers (“RACs”) that would focus on topics deemed to be a priority under the Bucharest Convention and the 1996 BS-SAP.

Table 2.1 Structure of the Commission for the Protection of the Black Sea Against Pollution and its Permanent Secretariat *(after Makarenko, 2014)*

The Commission for the Protection of the Black Sea Against Pollution						
Permanent Secretariat						
Advisory Groups						
AG ESAS	AG PMA	AG LBS	AG ICZM	AG CBD	AG FOMLR	AG IDE
Environmental Safety Aspects of Shipping (AG ESAS)	Pollution Monitoring and Assessment	Control of Pollution from Land Based Sources	Development of the Common Methodologies for Integrated Coastal Zone Management	Conservation of Biological Diversity	Environmental Aspects of Fisheries and Other Marine Living Resources Management	Information and Data Exchange
Regional Activity Centers						
Environmental Safety Aspects of Shipping (AC ESAS), Varna, Bulgaria	Pollution Monitoring and Assessment (AC PMA), Odessa, Ukraine	Control of Pollution from Land Based Sources (AC LBS), Istanbul, Turkey	Development of Common Methodologies for Integrated Coastal Zone Management (AG ICZM), Krasnodar, Russian Federation	Conservation of Biological Diversity (AC CBD), Batumi, Georgia	Environmental Aspects of Fisheries and Other Marine Living Resources Management (AG FOMLR), Constanta, Romania	Information and Data Exchange (AC IDE), Permanent Secretariat, Istanbul, Turkey
National Focal Points						
Bg, Ge, Ro, Ru, Tr, Ua	Ua, Bg, Ge, Ro, Ru, Tr	Tr, Bg, Ge, Ro, Ru, Ua	Ru, Bg, Ge, Ro, Tr, Ua	Ge, Bg, Ro, Ru, Tr, Ua	Ro, Bg, Ge, Ru, Tr, Ua	Bg, Ge, Ro, Ru, Tr, Ua

The **Advisory Groups to the Black Sea Commission** are its main source of expertise, information and support to in implementation of the **Black Sea Strategic Action Plan (BS-SAP)**. There are seven Advisory Groups, as follows:

- ESAS - Advisory Group on the Environmental Safety Aspects of Shipping
- PMA - Advisory Group on the Pollution Monitoring and Assessment
- LBS - Advisory Group on Control of Pollution from Land Based Sources
- IDE - Advisory Group on Information and Data Exchange
- ICZM - Advisory Group on the Development of Common Methodologies for Integrated Coastal Zone Management
- CBD - Advisory Group on the Conservation of Biological Diversity
- FOMLR - Advisory Group on the Environmental Aspects of the Management of Fisheries and other Marine Living Resources

The Activity Centers support the activities of the Black Sea Commission's Advisory Groups. They are defined in the above mentioned seven strategic sectors.

The Advisory Groups are defined as follows:

Advisory Group on the Environmental Safety Aspects of Shipping, coordinated by the Activity Centre in Varna, Bulgaria (ESAS).

The Group coordinates the regional approach to emergency response, particularly the international response to accidents involving the extraction, maritime transport, handling and storage of oil and, where relevant, hazardous chemicals. It also coordinates, on behalf of the Commission, regional aspects of implementation of the MARPOL Convention defined in the BS-SAP. Furthermore, it assists with the elaboration of port-state-control procedures defined in the BS-

SAP. Particular attention are paid to developing a strong working relationship between Ministers of Environment and Transport both internationally and within corresponding national focal points. It collaborates closely with all relevant institutions and governmental bodies, international organizations (such as International Maritime Organization - IMO, Intergovernmental Oceanographic Commission - IOC) and the private sector (shipping, oil and gas industries).

Advisory Group on Pollution Monitoring and Assessment, coordinated by the Activity Centre in Odessa, Ukraine (PMA)

The work of this Group focuses upon the establishment of a regionally coordinated network of National Status and Trends monitoring programmes and the subsequent development of Environmental Quality Objectives. Specifically, the Group provides the following services: (1) Quality Assurance/Quality Control services for environmental chemical analysis; (2) Coordination of pilot monitoring activities; (3) Coordination of regional training exercises in monitoring; (4) coordination of regional multi-disciplinary expert consultations to develop common environmental objectives and standards for different water uses in the Black Sea. The Group collaborates closely with the Advisory Group on the Environmental Aspects of the Management of Fisheries and other Living Marine Resources for the development of a region-wide programme for monitoring the biological effects of pollution to be incorporated in the regional monitoring strategy. The Group collaborates with National Monitoring Networks and research institutions in all Black Sea countries, international research programmes and projects and bodies such as IAEA's Marine Environmental Laboratory (International Atomic Energy Agency), IOC's Expert Groups, UNEP (United Nations Environment Programme), WHO (World Health Organization) and WMO (World Meteorological Organization); (5) the coordination, in close cooperation with WHO, of programmes to monitor the quality of bathing waters and beaches and to assess the human health implications of the information gathered.

Advisory Group on Control of Pollution from Land Based Sources, coordinated by the Activity Centre in Istanbul, Turkey (LBS)

The Group provides technical support for actions related to the assessment and control of discharges of pollution from land-based sources (direct discharges, river inputs and diffuse sources, including atmospheric deposition). It covers the following areas: (1) the development and diffusion of improved methodology for measuring discharges of pollutants; (2) the gathering of data from National Focal Points regarding discharges; (3) the coordination of activities to improve permitting procedures; (4) the development/harmonization of pollution discharge models and scenarios in order to assist with the establishment of scientific criteria for setting permit levels/emission standards. The major partners of the Group are regional inspectorates of pollution (or their equivalent) and, at an international level, the Secretariat of the Global Programe of Action for Protection of the Marine Environment from Land-based Activities.

Advisory Group on Information and Data Exchange, coordinated by the Commission Secretariat (IDE)

This Group focuses its work on the improvement of information flow and data exchange. It is responsible for the following specific tasks: (1) Updating of the existing Black Sea Information System and Black Sea Geographical Information System; (2) Updating of the Black Sea Bibliography; (3) Strengthening of the e-mail network and improvement of Internet connection to the Web Server services for principle data centres and Ministries of Environment for the exchange of information and data, including exchange of meta data; (4) Development of the regional Internet facility comprising meta level information on environmental data (how to locate the data), sets of the new data obtained from various international programmes, including those of the Commission, copies of historical data opened for public use, data sets from main World data centres such as WDC, GRID and others; (5) Cooperation and data exchange with different international programmes in the Black Sea region (such as NATO-TU, EROS-21, CoMSBlack, etc., (6) Cooperation and data exchange with the NGO Network, (7) Organization of training on data exchange, and (8) Assistance to other networks in the region.

Advisory Group on the Development of Common Methodologies for Integrated Coastal Zone Management, coordinated by the Activity Centre in Krasnodar, Russia (ICZM)

The Group facilitates the exchange of information and experience on ensuring sustainable resource use, including recreational use by tourists in the coastal zones of Black Sea countries, and develops methodologies for coastal zone management, with particular reference to threats to the environment arising from the transition to market economies. The Group coordinates and supervises the elaboration of draft recommendations of the Commission in the field of integrated coastal zone management and, based on common methodology, assists with the introduction of contemporary principles of environmental management, such as “Best Available Technology” and “Best Environmental Practices”. On the basis of the agreed common principles and the achievements and experience gained in the Black Sea countries, the Group coordinates the preparation of Regional Integrated Coastal Zone Management Programme, as well as provides assistance for the preparation of national programmes. This Group works in very close cooperation with the Organisation for Economic Co-operation and Development (OECD) and any other appropriate international institutions.

Advisory Group on the Conservation of Biological Diversity, coordinated by the Activity Centre in Batumi, Georgia (CBD)

The Group provides coordination and technical support for actions taken to protect biological diversity in the Black Sea according to the provisions of the Odessa Declaration, Black Sea Strategic Action Plan, the UN Convention on Biological Diversity and the Pan-European Strategy on Landscape and Biological Diversity. The Group prepares inventories of the biodiversity and regularly updates them, in order to evaluate the trends and recommend remedial actions. It also gathers historical records of changes in biological diversity (a large amount of information is available for the Black Sea).The Group elaborates a Regional Biological Diversity Conservation Strategy as well as Draft Biological Diversity and Landscape Protection Protocol to the Convention on the Protection of the Black Sea Against Pollution. The Group coordinates the preparation of a Red Data Book on the endangered species.

Advisory Group on the Environmental Aspects of the Management of Fisheries and other Marine Living Resources, coordinated by the Activity Centre in Constanta, Romania (FOMLR)

The Advisory Group basically functions to coordinate activities and provide technical support for the protection and restoration of marine ecosystems. However, pending the adoption of the Fisheries Convention, the Advisory Group gathers the basic source of information related to the fisheries capture, stock, installed capacity and aquaculture projects. The data is gathered from all national authorities and includes historical records in order to document past changes in the production and stock in the region and its relationship to changes in marine ecosystems. It provide the basic source of information for future management strategies and for the implementation of the future Fisheries Convention. The Group develops proposals and, where appropriate, coordinates the following: (1) harmonization at the regional level of a legal and institutional framework aimed at sustainable use of living marine resources; (2) improvement of Black Sea fisheries resource assessment based on a regional approach; (3) development of projects for the protection and rehabilitation of living resources; (4) development of specific projects for aquaculture techniques which do not harm biological diversity. The Group closely collaborates with regional and international institutions (such as General Fisheries Commission for the Mediterranean - GFCM, Working Group for the Black Sea), governmental bodies and the private sector.

Cooperation under the Black Sea Commission

The 1996 BS-SAP also called for the Commission and all of the Contracting Parties individually to encourage and pursue coordination among various regional bodies, non-governmental organizations (NGOs), the United Nations and other agencies regarding the sustainable development of the Black Sea region. One group identified in the BS-SAPs is the **Organization of Black Sea Economic Cooperation (BSEC)**. BSEC includes all of the Contracting Parties of the Bucharest Convention, as well as many other non-coastal states from the Black Sea region. BSEC was created to increase economic cooperation among the states of the wider Black Sea region. In addition to the BS-SAPs, a joint task force (known as the DABLAS task force) was established in 2001 with the specific goal of coordinating the protection of the water and water-related ecosystems of the Danube River Basin and the Black Sea Basin (as the Danube empties into the Black Sea). The Commission, with the help of the United Nations Environment Programme (UNEP) and the United Nations Development Programme (UNDP)/Global Eenvironment Facility (GEF), has also drafted a Memorandum of Understanding with the **International Commission for the Protection of the Danube River (ICPDR)** to agree on common goals for protection of the two water systems.

As a result of the accession of Romania and Bulgaria to the European Union (“EU”) and Turkey also being a candidate for EU accession, the European Commission obtained observer status to the Bucharest Convention. The European Union is considered an “important partner of the Black Sea Commission, and provides substantial contribution to the protection of the Black Sea”. In 2008, the Ministers of Foreign Affairs of the EU countries and the countries of the wider Black Sea region issued a joint statement to initiate the Black Sea Synergy cooperation. The **Black Sea Synergy** is intended to encourage greater involvement by the EU in the Black Sea and to increase regional cooperation.

Furthermore, there were also a number of foreign states and representatives of other interested bodies who attended the 1992 Diplomatic Conference as observers. These observers were from Armenia, Greece, Moldova, Yugoslavia (former), the Danube Commission, UNEP, the International Maritime Organization, the World Health Organization, the Intergovernmental Oceanographic Commission, the World Meteorological Organization, and UNDP.

Black Sea Synergy

The Black Sea Synergy (BSS) was put forward by the European Commission (EC) in April 2007 (European Commission 2007). Three tightly interwoven factors were instrumental in the EU’s decision to launch this new initiative for regional cooperation in the Black Sea area:

A. The accession of Romania and Bulgaria to the EU on 1 January 2007 brought the Union closer to the Black Sea, a strategic area for both the EU’s and the continent’s stability (Tassinari, 2006). The sixth enlargement shifted the Union’s attention to a sea basin where security challenges raised increasing concerns. The area is a patchwork of political trajectories; with few democracies in the region, volatility is a major issue in many countries. It is also confronted with disparities in economic development and uneven levels of regional trade integration among coastal countries.

Poor governance and pervasive corruption have a corrosive effect on a number of states around the Black Sea. Moreover, unresolved conflicts in the former Soviet Union threaten the stability of the whole region.

B. Enlargement to Bulgaria and Romania, as well as growing EU concerns over energy security in the region in the wake of the 2006 Russian-Ukrainian gas dispute, prompted enhanced EU involvement in an area where it had so far kept a low profile. On the one hand, the Black Sea area had indeed been kept in the background of EU foreign policy, with the sum of bilateral policies implemented in the area resulting in the EU's having a 'partial picture' of the region and lacking a '*holistic approach'* (Tassinari, 2006). On the other hand, the design of an EU initiative for the Black Sea region also answered long-standing calls from Black Sea countries and organizations. The Black Sea Synergy was [thus] meant to bridge "an obvious gap in [the EU's] vision of the regions to its periphery" (Emerson, 2008).

C. The Black Sea Synergy was also launched in the context of the European Neighbourhood Policy (ENP). It stemmed from the need, noted by several EU actors, to give an impetus to the ENP. In December 2006 the European Commision issued a lukewarm assessment of the ENP's record on conflict resolution, an issue of utmost importance around the Black Sea. In this context, regional cooperation was deemed necessary to complement the bilateral dimension which had so far prevailed in the ENP. Most of the challenges faced by the EU in its Eastern neighbourhood, especially around the Black Sea, are indeed transnational (e.g. trafficking and organized crime, migration, environmental pollution) (Delcour&Manoli, 2010).

Through the BSS, the EU sought to increase cooperation with and between the countries surrounding the Black Sea. The Black Sea Synergy was designed as a flexible framework complementary to existing EU policies in the region, i.e. the ENP (relevant for five Eastern ENP countries: Armenia, Azerbaijan, Georgia, Moldova and Ukraine), the strategic partnership with the Russian Federation and the pre-accession policy for Turkey. Although an EU-framed initiative, the BSS was conceived as a collective endeavour, which aimed at:
- Stimulating democratic and economic reforms;
- Supporting stability and promoting development;
- Focusing on practical projects in areas of common concern;
- Responding to opportunities and challenges through coordinated action in a regional framework;
- Developing a climate more conducive to the solution of conflicts in the region.

The Black Sea Synergy was officially launched as a common endeavour at a Foreign Ministers' meeting in Kyiv on 14 February 2008 which involved all regional partners, EU Member States and EU institutions (Joint Statement, 2008).

One of the most important developments has been the initiative to establish sectoral partnerships in three key areas: environment, transport and energy. Romania helps to organize the Environment Partnership, Greece the Transport Partnership and Bulgaria the Energy Partnership. The Black Sea Environment Partnership has been the only one officially launched so far (notably, at a conference in Brussels on 16 March 2010). The partnerships are open to all partner countries wishing to participate, as well as to institutions that are active in the region, like the BSEC, the Black Sea Commission, the European Investment Bank (EIB) and the European Bank for Reconstruction and Development (EBRD). Reaching consensus among such a variety of actors and interests over specific projects is expected to be a cumbersome process.

The Black Sea Synergy has attracted considerable NGO interest. An alliance of 29 environmental NGOs met in Odessa on 7 February 2008 and adopted a position paper on "Greening the Black Sea Synergy" (June 2008). A Black Sea NGO Forum was launched in the framework of the Black Sea Synergy in 2008 by the Romanian Federation of Development NGOs and its partners throughout the region (with support from the Romanian Ministry of Foreign Affairs and the Black

Sea Trust for Regional Cooperation). The Forum meets regularly with a view to increasing the level of dialogue and cooperation among NGOs in the wider Black Sea region. The overall objective is to strengthen NGOs and their capacity to influence regional and national policies.

Organisation of the Black Sea Economic Cooperation

On 25 June 1992, the Heads of State and Government of eleven countries: Albania, Armenia, Azerbaijan, Bulgaria, Georgia, Greece, Moldova, Romania, Russia, Turkey and Ukraine signed in Istanbul the Summit Declaration and the Bosphorus Statement giving birth to the Black Sea Economic Cooperation (BSEC).

It came into existence as a unique and promising model of multilateral political and economic initiative aimed at fostering interaction and harmony among the Member States, as well as to ensure peace, stability and prosperity encouraging friendly and good-neighbourly relations in the Black Sea region.

The BSEC Headquarters - the Permanent International Secretariat of the Organization of the Black Sea Economic Cooperation (BSEC PERMIS) - was established in March 1994 in Istanbul.

With the entry into force of its Charter on 1 May 1999, BSEC acquired international legal identity and was transformed into a full-fledged regional economic organization: ORGANIZATION OF THE BLACK SEA ECONOMIC COOPERATION. With the accession of Serbia in April 2004, the Organization's Member States increased to twelve.

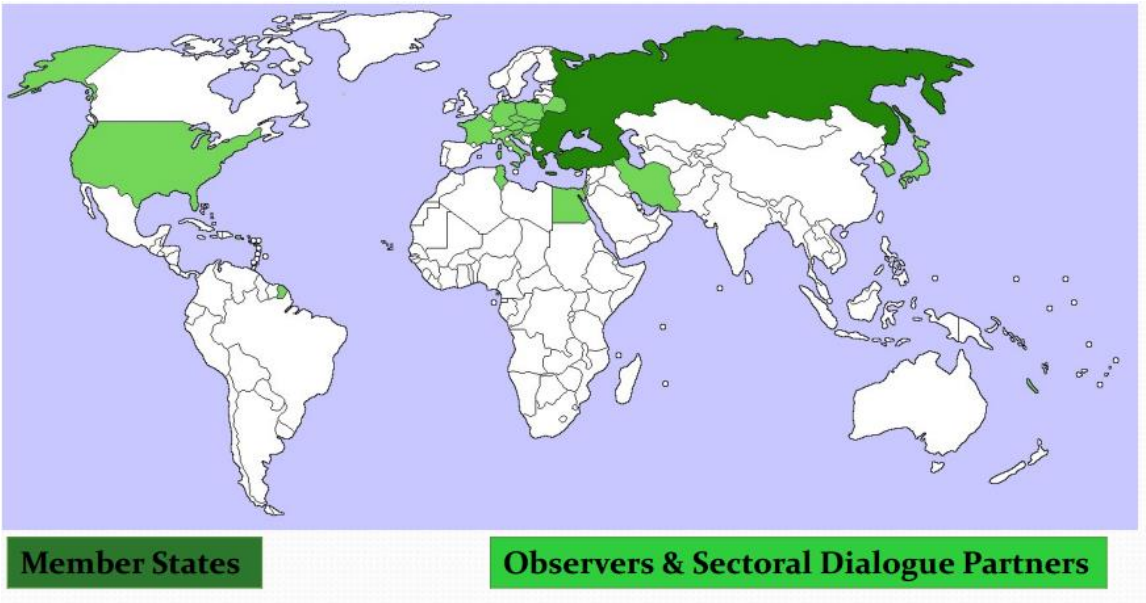


Fig. 2.2 Organisation of the Black Sea Economic Cooperation coverage
(Source: http://www.bsec-organization.org/)

According to the Charter of the Organization the following principles and objectives shall be promoted through the BSEC activities at various levels:

a) to act in a spirit of friendship and good neighborliness and enhance mutual respect and confidence, dialogue and cooperation among the Member States;

b) to further develop and diversify bilateral and multilateral cooperation on the basis of the principles and rules of international law;

c) to act for improving the business environment and promoting individual and collective initiative of the enterprises and companies directly involved in the process of economic cooperation;

d) to develop economic collaboration in a manner not contravening the international obligations of the Member States including those deriving from their membership to international organizations or institutions of an integrative or other nature and not preventing the promotion of their relations with third parties;

e) to take into account the specific economic conditions and interests of the Member States involved;

f) to further encourage the participation in the BSEC process of economic cooperation of other interested states, international economic and financial institutions as well as enterprises and companies.

BSEC covers an area of nearly 20 million km², a market of approximately 335 million people, and reaching an intra-BSEC trade volume of almost 300 billion US Dollars annually.

There are Five Related Bodies and Affiliated Centers:

- The Parliamentary Assembly (PABSEC)
- The Business Council (BSEC BC)
- The Black Sea Trade & Development Bank (BSTDB)
- The International Center for Black Sea Studies (ICBSS)
- The BSEC Coordination Center for the Exchange of Statistical Data and Economic Information

International Commission for the Protection of the Danube River

The International Commission for the Protection of the Danube River (ICPDR) is an International Organisation consisting of 15 cooperating states and the European Union. Since its establishment in 1998, the ICPDR has grown into one of the largest and most active international bodies of river basin management expertise in Europe. The ICPDR deals not only with the Danube itself, but also with the whole Danube River Basin, which includes its tributaries and the ground water resources.

The Contracting Parties to the DRPC presently include Austria, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Germany, Hungary, Moldova, Montenegro, Romania, Slovakia, Slovenia, Serbia, Ukraine and the European Union. The Contracting Parties are represented by delegations to the ICPDR, led by Heads of Delegation.

The legal basis for this international co-operation is the Danube River Protection Convention, which applies to countries with territories of more than 2000 km² within the Danube Basin. Apart from those the following countries also co-operate with the ICPDR under the EU Water Framework Directive: Italy, Switzerland, Poland, Albania and the Former Yugoslav Republic of Macedonia. The Contracting Parties have also committed themselves to the development of the co-ordinated international River Basin Management Plan for the Danube River Basin as requested by the EU Water Framework Directive.

The goal of the ICPDR is to implement the Danube River Protection Convention (DRPC) and make it a living tool. In addition, the ICPDR is the body that coordinates the implementation of EU Water Framework Directive and EU Floods Directive in the Danube River Basin.

The International Commission for the Protection of the Danube River (ICPDR) works to ensure the sustainable and equitable use of waters and freshwater resources in the Danube River Basin. The work of the ICPDR is based on the Danube River Protection Convention, the major legal instrument for cooperation and trans-boundary water management in the Danube River Basin.

The International Commission for the Protection of the Danube River (ICPDR) is a transnational body, which has been established to implement the Danube River Protection Convention. The ICPDR is formally comprised by the Delegations of all Contracting Parties to the Danube River Protection Convention, but has also established a framework for other organisations to join. In 2000, the ICPDR contracting parties nominated the ICPDR as the platform for the implementation of all transboundary aspects of the EU Water Framework Directive (WFD). The work for the successful implementation of the EU WFD is therefor high on the political agenda of the countries of the Danube river basin district. In 2007, the ICPDR also took responsibility for coordinating the implementation of the EU Floods Directive in the Danube River Basin. Today national delegates, representatives from highest ministerial levels, technical experts, and members of the civil society and of the scientific community cooperate in the ICPDR to ensure the sustainable and equitable use of waters in the Danube River Basin. Since its creation in 1998 the ICPDR has promoted policy agreements and the setting of joint priorities and strategies for improving the state of the Danube and its tributaries.

This includes improving the tools used to manage environmental issues in the Danube basin, such as:

- the Accident Emergency Warning System,
- the Trans-National Monitoring Network for water quality, and
- the information system for the Danube (Danubis).

The goals of the ICPDR

- Safeguarding the Danube’s Water resources for future generation
- Naturally balanced waters free from excess nutrients
- No more risk from toxic chemicals
- Healthy and sustainable river systems
- Damage-free floods

The different bodies of the ICPDR are:

- Ordinary Meeting Group: taking the political decisions
- Standing Working Group: providing political guidance
- Technical Expert Groups and Task Groups: preparing the technical background documents

The work of the ICPDR is supported by a Secretariat located in Vienna, Austria.

The ICPDR mission is to promote and coordinate sustainable and equitable water management, including conservation, improvement and rational use of waters for the benefit of the Danube River Basin countries and their people. The ICPDR pursues this mission by making recommendations for the improvement of water quality, developing mechanisms for flood and accident control, agreeing standards for emissions and by assuring that these are reflected in the Contracting Parties' national legislations and applied in their policies.

The Danube River Basin comprises of an area of 801,463 km². It is the world's most international river basin, as it extends into the territories of 19 countries. The ecosystems of the Danube River Basin are highly valuable in environmental, economic, historical and social terms, but they are subject to pressures and pollution from agriculture, industry and cities - issues which are jointly addressed by the Danube Basin countries through the ICPDR.

The ICPDR acts as a platform for its contracting parties to coordinate responses to various environmental threats, formalised in the Danube Protection Convention of 1994. Since 2009, the Danube River Management Plan (DRBM) provides a roadmap for this. It contains a Joint Programme of Measures and aims to fulfil the EU Water Framework Directive (WFD). The ICPDR also implements the EU Flood Directive (EFD).

Black Sea Euroregion

The local and regional authorities of European seas have expressed for many years now, the will to develop cross-border and regional cooperation projects aimed at achieving greater prosperity, stability and security of their populations. For this reason, the Congress of Local and Regional Authorities (Council of Europe) decided to launch the initiative of establishing Euroregions around these seas such as, the Adriatic Euroregion and the Black Sea Euroregion project.

These Euroregions are new associative structures, which bring together coastal cities and regions in order to achieve a sustainable management of their sea basins according to the specific needs of coastal populations. Local and regional authorities belonging to the countries part of these Euroregions can promote cooperation projects ensuring the social and economic development, the reinforcement of regional and local democracy and territorial cohesion.

After the Adriatic one, the Congress of Local and Regional Authorities launched the Black Sea Euro-region initiative at the conference in Constanta, Romania, in March 2006, which was followed by conferences in Samsun, Turkey, in November 2006 and in Odessa, Ukraine, in June 2007. Territorial authorities taking part in the Black Sea Euroregion initiative met in Varna (Bulgaria) on 26 September 2008.

14 Territorial authorities from 4 countries signed the Constituent Act and Statutes of the Euroregion during the Varna Conference (organized by the Congress of Local and Regional Authorities of the Council of Europe, the Municipality of Varna and and the Union of Bulgarian Black Sea Local Authorities - UBBSLA). A result of the initiative launched by the Council of Europe Congress in 2006, this Euroregion is a platform for co-operation complementary to existing national intergovernmental co-operation initiatives, acting in the remit of regional and municipal competencies. It serves as a launching pad for multilateral initiatives using existing national, European and international financial instruments. The Euroregion takes the shape of a non-profit association designed to facilitate inter-regional and inter-municipal co-operation in the Black Sea basin.

The signatories of the Constituent Act and Statutes of the Euroregion are the following:

- City of Idjevan, Republic of Armenia
- Municipality of Bourgas, Republic of Bulgaria
- Municipality of Nessebar, Republic of Bulgaria
- Municipality of Shabla, Republic of Bulgaria
- Municipality of Varna, Republic of Bulgaria
- Autonomous Republic of Adjara, Georgia
- Region of Cahul, Republic of Moldova
- County of Braila, Romania
- County of Constana, Romania
- County of Galati, Romania
- County of Tulcea, Romania
- Municipality of Braila, Romania
- Municipality of Constana, Romania
- Municipality of Mangalia, Romania

In pursuit of its objectives, the BSER gives priority to the following areas of activity within the limits of the competences of local and regional authorities (Article 9 of the Constituent Act and Statutes https://wcd.coe.int):

a) Improving good governance practices;

b) Consolidating democratic stability;

c) Contributing to the sustainable development of the area with a view to safeguarding the sea and the main rivers of the Basin by protecting the environment, fishing and biodiversity and preventing oil-spills and waste water disposal;
d) Developing infrastructures, including energy systems, transport and communication networks;
e) Promoting investments in renewable energies;
f) Contributing to the monitoring of maritime transport risks and the needs of coastal areas;
g) Management of migration flows and integration of immigrants;
h) Supporting initiatives to promote sustainable tourism;
i) Launching multilateral programmes in the fields of culture, science, education, health, sport and youth;
j) Supporting economic initiatives

Lower Danube Euroregion

The Association of Cross-Border Cooperation "Lower Danube Euroregion" (ACT EDJ) is a non-governmental entity, founded in April 2009, by public institutions, from Romania: Galati County Council, Braila County Council and Tulcea County Council, from Ukraine: Odessa Regional Council, Odessa Regional State Administration and Reni District Council, and from Republic of Moldova: Cahul District Council and Cantemir District Council.

The goal of the Lower Danube Euroregion is to assist the sustainable development of the administrative-territorial units that constitute the Association, through the enlargement of the cooperation between members and the development of the profitable relations in all areas of common interest.

Fig. 2.3 Lower Danube Euroregion *(Source: http://www.crpm.org/)*

The Euroregion Lower Danube comprises border areas on the Black Sea coast in the Ukraine, Moldova and Romania. Due to the historical background, the political and ethnic situation and, not least, lengthy visa procedures, cross-border co-operation in this area is particularly difficult. The Ukrainian part of the Euroregion, i.e. the area around the cosmopolitan city of Odessa with its important seaport, co-operates with the rather rural areas on the Moldavian and Romanian part of the border, which are characterised by a number of small and medium-sized towns.

The Euroregion formed several commissions whose task is to deal with the various aspects of cross-border co-operation. This allows co-operation in all areas of everyday life, including, but not limited to economic co-operation, an area where, without doubt, the most urgent problems need to be solved. In addition to this, the Euroregion addresses ecological, social and cultural issues. It tackles everyday border problems, as well as the important matter of cross-border crime.

A strategy for the Black Sea

The EU Parliament adopted a resolution on 20 January 2011 for an EU Strategy for the Black Sea Region to be launched. Parliament stressed that the main objective for the EU and the EU Member States in this strategy is to establish an area of peace, democracy, prosperity and stability founded on respect for human rights and fundamental freedoms and providing for EU energy security. It considered that good governance, the rule of law, promotion of respect for human rights, migration management, energy, transport, the environment and economic and social development should constitute priority actions. The resolution encourages priority financing for small-scale development projects and stresses the need for a projectbased approach with a view to including local authorities, business communities, NGOs or other civil society organisations.

It encourages the development of synergies between the various EU policies that come into play in the Strategy, particularly the Structural Funds, the Research and Development Framework Programme and the Trans-European Transport Networks in order to ensure the sustainability of the actions financed so that opportunities created by one economic development initiative can be taken up by another, complementary initiative.

Blue Growth Strategy

The Blue Growth communication adopted in September 2012 is the maritime strand of the Europe 2020 strategy and an update of the Integrated Maritime Policy (http://ec.europa.eu/maritimeaffairs/policy/blue_growth/).

This strategy consists of three components:

1. Targeted effort towards specific activities (focus areas) identified as being the most promising sectors for growth development: coastal tourism, blue energy, aquaculture, blue biotechnology and marine minerals mining.

2. Cross-cutting tools which are specific, policy integrated measures across sectors including Maritime Spatial Planning, Integrated Coastal Management, Marine Knowledge 2020 initiative and maritime surveillance.

3. Sea-basin strategies

Other aspects that are crucial for a sustainable growth in the blue economy are the development of the appropriate skills, marine and maritime research and access to finance. The EC extended the dialogue on sustainable development of the blue economy of the Black Sea to all Black Sea countries during a conference held in Bucharest, Romania on 30 January 2014.

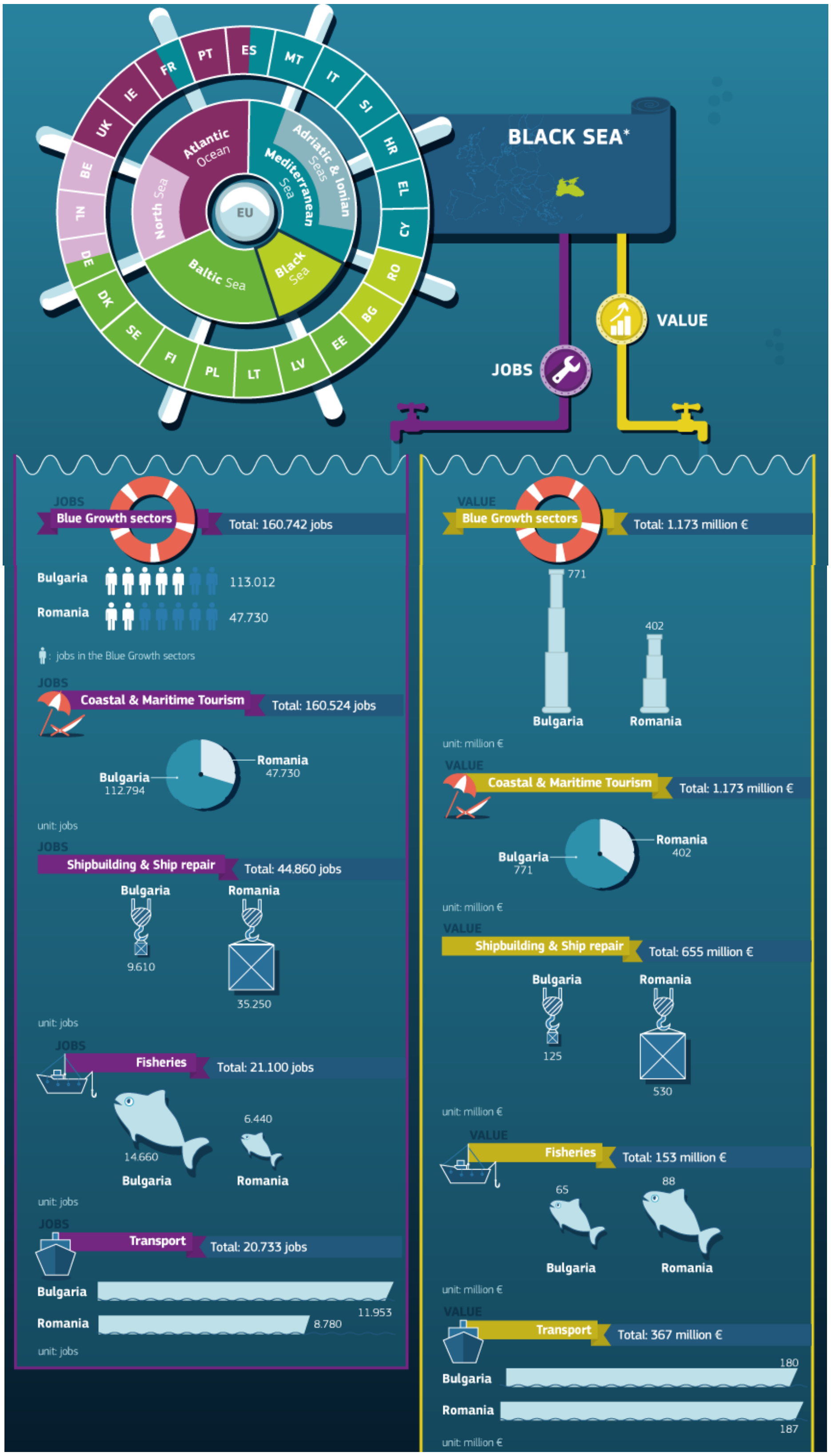


Fig. 2.4 Blue Growth infographic: Blue Economy figures for the Black Sea EU countries *(Source: http://ec.europa.eu/maritimeaffairs/policy/blue_growth/infographics/#_Black_Sea)*

Europe 2020

Europe 2020 is the EU's ten-year growth and jobs strategy launched in 2010. It aims to create within the EU the conditions for economic growth:

- Smart, through more effective investments in education, research and innovation;
- Sustainable, thanks to a decisive move towards a low-carbon economy;
- Inclusive, with a strong emphasis on job creation and poverty reduction.

The Cohesion Policy is the EU's main investment tool for delivering the Europe 2020 goals within EU Member States.

Black Sea JOP

Black Sea Basin Joint Operational Programme 2007-2013

The **Black Sea Basin Joint Operational Programme 2007-2013** (Black Sea JOP) is a programme under the European Neighborhood & Partnership Instrument (ENPI) of the EU. It aims to contribute to: "a stronger and sustainable economic and social development of the regions of the Black Sea Basin" (www.blacksea-cbc.net).

The programme´s three specific objectives, are:

- Promoting economic and social development in the border areas;
- Working together to address common challenges;
- Promoting local, people-to-people cooperation.

There are 8 participating countries in the Black Sea JOP, i.e. Armenia, Bulgaria, Georgia, Moldova, Turkey, Ukraine, Romania, and Greece.

The Black Sea JOP aims at a stronger and more sustainable economic and social development of the Black Sea Basin regions. Through the Black Sea JOP, communities in the areas concerned will be encouraged to further develop their local economy, confront environmental challenges and promote greater interaction among people.

The Programme is financed by the ENPI and its budget amounts at 25,696,516 €. The participation of Turkey is financed by the IPA (Instrument for Pre-accession Assistance). The participating countries co-finance projects with a minimum of 10% of the EU contribution.

The co-financed projects must have direct cross-border impact, which shall be understood in terms of respecting at least two of the following conditions, as described below:

- Joint development: the project must be designed in common by partners;
- Joint implementation: activities must be carried out and coordinated among all partners, joint management of the project;
- Joint staffing: there should be one joint project manager, one joint financial manager etc.

Joint financing: each partner co-finances the project, the joint budget should be divided between partners according to the activities carried out.

Going further: Black Sea Basin ENI CBC 2014-2020

The participating countries to the European Neighborhood Instrument Cross Border Cooperation Black Sea Basin (ENI CBC BSB) programme include the following:

· EU Member States: Bulgaria, Greece and Romania
· Partner countries: Armenia, Azerbaijan, Georgia, Republic of Moldova and Ukraine
· Candidate country: Turkey
· Russian Federation.

Cross-border cooperation (CBC) on the external borders of the EU is a key priority both in the European Neighbourhood Policy and in the EU's strategic partnership with Russia. CBC under the European Neighbourhood Instrument (ENI) will build on CBC under its predecessor, the European Neighbourhood and Partnership Instrument (ENPI).

ENI CBC receives funding from the European Regional Development Fund, as well as the European Neighbourhood Instrument. Both sources of funding may be used on either side of the EU external border, for actions of common benefit. The ENI Regulation sets out the basis for CBC, further defined in ENI CBC implementing rules and ENI CBC programming document.

ENI CBC aims to "promote co-operation across the borders between EU Member States and the countries on the European Neighbourhood and Russian Federation" and it should contribute to the overall ENI objective of progress towards "an area of shared prosperity and good neighbourliness" between EU Member States and their neighbours. Due to its geographical location, Turkey also participates in the Black Sea Basin ENI CBC as a candidate country.

CBC under the ENI has 3 overarching strategic objectives:

A. Promote economic and social development in regions on both sides of common borders;

B. Address common challenges in environment, public health, safety and security;

C. Promotion of better conditions and modalities for ensuring the mobility of persons, goods and capital.

Each ENI CBC programme must contribute to at least one of the strategic objectives.

Taking the strategic objectives above into consideration, and based on the specific circumstances and requirements of the programme cooperation area, each programme shall focus on a maximum of 4 thematic objectives chosen within a list defined in ENI CBC programming document, that is:

1. Business and SME development (Strategic objective: A)
2. Support to education, research, technological development and innovation (Strategic objective: A)
3. Promotion of local culture and preservation of historical heritage (Strategic objective: A)
4. Promotion of social inclusion and fight against poverty (Strategic objectives: A, B, C)
5. Support to local & regional good governance (Strategic objectives: A, B, C)
6. Environmental protection, climate change adaptation (Strategic objective: B)
7. Improvement of accessibility to the regions, development of transport and communication networks and systems (Strategic objective: C)
8. Common challenges in the field of safety and security (Strategic objective: B)
9. Promotion of energy cooperation (Strategic objective: B)
10. Promotion of border management, and border security (Strategic objective: C).

The promotion of local cross-border "people-to-people actions is not considered as a thematic objective but as an important modality to be deployed in support of any of these objectives". This could include support for enhanced cooperation among local and regional authorities, NGOs and other civil society groups, universities and schools, chambers of commerce etc.

INTERREG IIIB NP CADSES: PlanCoast

PlanCoast was an INTERREG IIIB NP CADSES Project with the aim to develop the tools and capacities for an effective integrated planning in coastal zones and maritime areas in the Baltic, Adriatic and Black Sea regions.

The main achievements of PlanCoast were:

- Introduced the completely new spatial planning instrument Maritime Planning;
- Linked Integrated Coastal Zone Management (ICZM) and Maritime Planning with the processes of statutory spatial planning in selected number of pilot projects;
- Spread the use of modern geographical information systems (GIS) for an effective transnational planning;
- Contributed to the creation and implementation of EU policy on coastal zones and maritime areas, such as the Green Book and Blue Book, and led to creation of numerous national laws and strategies.

PlanCoast had 16 partners representing the spatial planning departments or responsible regional authorities from Albania, Bosnia–Herzegovina, Bulgaria, Croatia, Germany, Italy, Montenegro, Poland, Romania, Slovenia and Ukraine.

Fig. 2.5 PlanCoast website *(Source: http://www.plancoast.eu/index.php?id=1)*

DG Environment: OurCoast

OurCoast was a three-year project commissioned by the Directorate General (DG) Environment of the European Commission to support and ensure the exchange of experiences and best practices in coastal planning and management. This initiative was made possible thanks to the European Parliament that voted a dedicated resource for this purpose into the EU budget in 2008. The three-year project has started in January 2009 after a tender procedure and with a budget of € 1 million.

The main final product of OurCoast was the ICZM Database - a comprehensive compilation of hundreds of case study summaries that reflect successful examples of ICZM tools applied throughout Europe. A multi-lingual website hosts the ICZM database and provides navigation and information about OurCoast in ten European languages. This has been done and complemented by a series of other activities, together with these of public interest for the implementation of ICZM in Europe. These include:

- Collection, description and evaluation of a minimum of 350 ICZM case studies;
- Comparative analysis of ICZM experiences leading to an overview of the state-of-the-art by theme and typical success and fail factors;
- Review of most relevant EU policies and legislation and their effects for the implementation of coastal zone management and marine planning;
- Development and validation of guidance for authorities for future integrated coastal and marine planning and for the design of policies and tools;
- Development of recommendations that can set the implementation agenda of ICZM for the next decade;
- Development of a contact list of EU, national, regional, local coastal and marine stakeholders and other interested parties on ICZM implementation;
- Organisation of a final stakeholders conference "Integrated Coastal Zone Management in Europa: the way forward", 27 - 28 October 2011 in Riga, Latvia.

OurCoast project has been developed by a consortium led by ARCADIS and its sub-contractor the Coastal & Marine Union (EUCC) (http://ec.europa.eu/ourcoast/).

EU Life Long Learning Programme: CoastLearn in the Black Sea (CLBS)

CoastLearn in the Black Sea (CLBS) was an EU Life Long Learning Programme Project and the project duration was 24 months (2010-2012). The aim of the CoastLearn in Black Sea (CLBS) was to mobilize the human resources in the tourism and coastal management sector in Black Sea in general and notably Sinop, Varna and Constanta by raising awareness among the local decision making mechanisms of the integrated coastal zone management in order to encourage people to utilize the coastal resources in a coherent and balanced way.

CoastLearn in Black Sea (CLBS) aimed for is raising awareness of the integrated coastal zone management among the tourism staff, coast related local authorities and other actors participating in the decision-making processes regarding the coastal management. To this end, the CLBS project ensured the recognition of the vocational skills and competencies in integrated coastal zone management.

The tangible outcomes of the project were:

- Needs Analysis Report
- Updated and upgraded Integrated Coastal Zone Management Learning Material
- Water Quality Management Module
- Sustainable tourism Module with the addition of QualityCoast content
- Coast Learn Black Sea web site

CoastLearn had an impact on the development of tourism sector with the presentation of its modules Sustainable Tourism and Water Quality Management. Tourism, one of the target sectors, was boosted in Black Sea basin, which has various prospective tourism destinations along its coastline. Furthermore, awareness was raised in the fisheries sector about biodiversity and marine and coastal environmental issues.

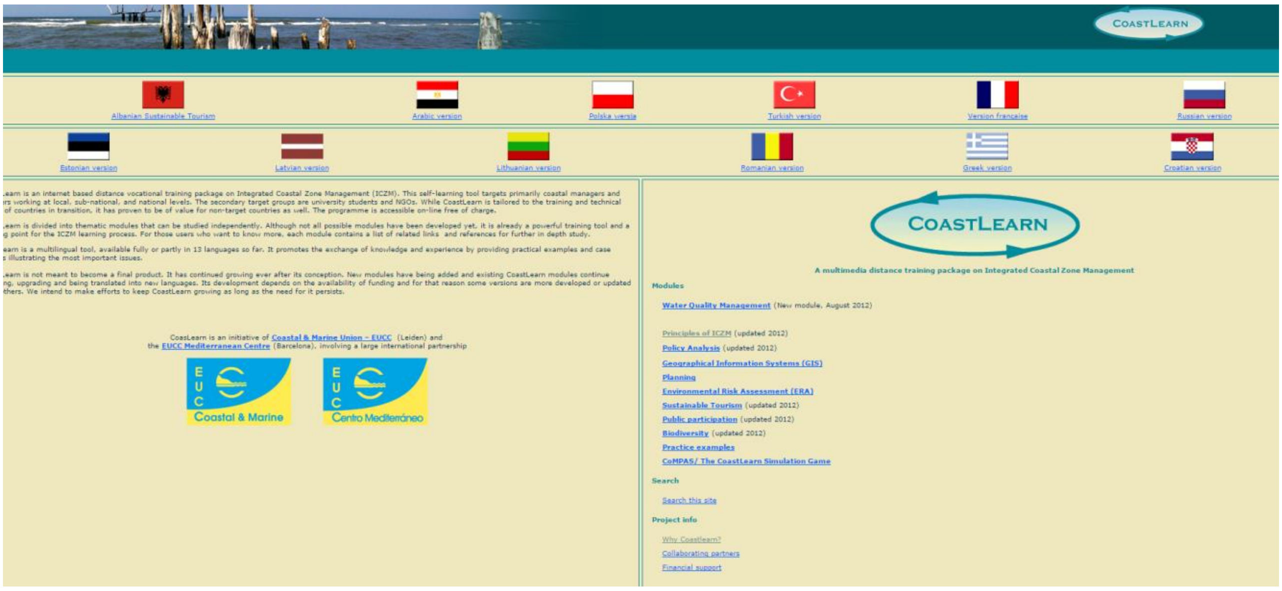


Fig. 2.6 CoastLearn website *(Source: http://www.coastlearn.org/)*

EC/FP7: People for Ecosystem-based Governance in Assessing Sustainable development of Ocean and coast (PEGASO)

The main objective of PEGASO (People for Ecosystem-based Governance in Assessing Sustainable development of Ocean and coast - FP7- ENV.2009.2.2.1.4 Integrated Coastal Zone Management Specific Programme: FP7 Collaborative Projects - Large scale integrating project, 2010-2014) is to build on existing capacities and develop common novel approaches to support integrated policies for the coastal, marine and maritime realms of the Mediterranean and Black Sea Basins in ways that are consistent with and relevant to the implementation of the ICZM Protocol for the Mediterranean.

PEGASO used the model of the existing ICZM Protocol for the Mediterranean and adjusted it to the needs of the Black Sea through three innovative actions:

- Constructing an ICZM governance platform as a bridge between scientist and end-user communities, going far beyond a conventional bridging.
- Refine and further develop efficient and easy to use tools for making sustainability assessments in the coastal zone (indicators, accounting methods, models and scenarios). They will be tested and validated in a multi-scale approach for integrated regional assessment through a number of relevant pilot sites.

- Implementation of a Spatial Data Infrastructure (SDI), following the INSPIRE Directive, to organize and standardize spatial data to support information sharing on an interactive visor, to make it available to the ICZM Platform, and to disseminate all results of the project to the end users and interested parties.

Fig. 2.7 Pegasso project website *(Source: http://www.pegasoproject.eu/)*

QualityCoast Programme

QualityCoast is the largest international certification programme for sustainable tourism destinations. Since 2007, more than 140 tourism destinations in 23 countries have been selected for a QualityCoast Award: coastal towns, resorts and islands.

QualityCoast is operated by the Coastal & Marine Union – EUCC and partly funded by the European Commission.

With the QualityCoast programme, the Coastal & Marine Union - EUCC aims to establish a world wide network of coastal communities that share similar values on sustainable development, nature and biodiversity, cultural heritage and identity, and social responsibility, at the same time maintaining high standards in the quality of their tourism.

EUCC's International is the main administrative body of the Union. It assists the Board in the preparation and implementation of the EUCC's policies and projects. EUCC-International includes staff members and many voluntary staff and interns. It is located in Leiden (NL).

Table 2.2 Global Sustainable Tourism Review: coast & islands of Bulgaria & Romania
How green, clean and responsible is your holiday destination?
(Source: http://www.qualitycoast.info/bulgaria-romania.htm)

	Island or coastal destination	Overall % sustainable	Quality-Coast Award	Marine life	Nature	Landscape	Coast	Environment	Clean sea	Beach award	Culture	Social	Hotels
1	Danube Delta (Romania)	39		🟢	🟢	🟢	🟢	🟢	🟢	🟡	🟡	🟢	🔴
2	Sozopol (Bulgaria)	37		🟡	🟡	🟢	🟢	🟡	🔴	🟢	🟢	🟢	🔴
3	Nessebar (Bulgaria)	37		🟡	🟡	🟢	🟡	🟡	🟡	🟢	🟢	🟡	🔴
4	Varna (Bulgaria)	35		🔴	🔴	🟡	🟡	🟡	🟡	🟢	🟢	🟡	🔴
5	Tsarevo (Bulgaria)	34		🔴	🟡	🟢	🟢	🟡	🟡	🟡	🟡	🟢	🔴
6	Sfântu Gheorghe (Romania)	33		🟢	🟢	🟢	🟢	🟡	🔴	🟡	🔴	🟡	🔴
7	Albena (Bulgaria)	33		🔴	🟡	🟡	🟢	🟡	🟢	🟢	🟡	🟡	🔴
8	Primorsko (Bulgaria)	33		🔴	🟡	🟢	🟡	🟡	🟢	🟡	🟡	🟡	🔴
9	Sunny Beach (Bulgaria)	33		🟡	🟡	🟢	🟡	🟡	🟢	🟢	🟡	🟡	🔴
10	Obzor (Bulgaria)	33		🔴	🟡	🟢	🟢	🟡	🟡	🟡	🔴	🟡	🔴
11	Mangalia (Romania)	32		🔴	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🔴
12	St.Constantine-Helen (Bulgaria)	32		🔴	🔴	🟡	🟡	🟡	🟡	🟡	🟢	🟡	🔴
13	Balchik (Bulgaria)	31		🟡	🟡	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🔴
14	Burgas (Bulgaria)	31		🔴	🟡	🟢	🟡	🟡	🟢	🟡	🟡	🟡	🔴
15	Pomorie (Bulgaria)	31		🔴	🔴	🟡	🟡	🟡	🟢	🟢	🟡	🟢	🔴
	Island or coastal destination	Overall % sustainable	QualityCoast Award	Marine life	Nature	Landscape	Coast	Environment	Clean sea	Beach award	Culture	Social	Hotels

Other projects with an ICZM component

***EC/FP7:* Building Capacity for a Black Sea Catchment Observation and Assessment System Supporting Sustainable Development (2009-2013) (EnviroGRIDS)**
http://www.envirogrids.net/index.php?option=com_content&view=article&id=3&Itemid=7

The Black Sea Catchment is internationally known as one of ecologically unsustainable development and inadequate resource management, which has led to severe environmental, social and economic problems. The EnviroGRIDS @ Black Sea Catchment project addresses these issues by bringing several emerging information technologies that are revolutionizing the way we are able to observe our planet. The Global Earth Observation System of Systems (GEOSS) is building a data-driven view of our planet that feeds into models and scenarios to explore our past, present and future. EnviroGRIDS aims at building the capacity of scientist to assemble such a system in the Black Sea Catchment, the capacity of decision-makers to use it, and the capacity of the general public to understand the important environmental, social and economic issues at stake. EnviroGRIDS will particularly target the needs of the Black Sea Commission (BSC) and the International Commission for the Protection of the Danube River (ICPDR) in order to help bridging the gap between science and policy.

General objectives: The scientific aim of the EnviroGRIDS project is to assemble an observation system of the Black Sea catchment that will address several GEO Societal Benefit Areas within a changing climate framework. This system will incorporate a shared information system that operates on the boundary of scientific/technical partners, stakeholders and the public. It will contain an early warning system able to inform in advance decision-makers and the public about risks to human health, biodiversity and ecosystems integrity, agriculture production or energy supply caused by climatic, demographic and land cover changes on a 50-year time horizon.

Joint Operational Programme "BLACK SEA BASIN 2007-2013": Strengthening the regional capacity to support the sustainable management of the Black Sea Fisheries - (SRCSSMBSF) (2011 - 2013)
http://www.rmri.ro/WebPages/SRCSSMBSF/
Project objectives:

- Cooperation between the Black Sea riparian countries for knowing and rationally managing the marine ecosystem and its resources, carrying out diagnostics of fish stocks status as well as advice on management strategies;
- Harmonization of methods and tools to assess the present state of fish stocks by scientific surveys, holistic models;
- Alignment of the common methods for sampling, processing and interpretation data from fisheries and stock assessment using analytic models;
- Awareness of the fishery organizations and decision–makers from national fisheries regarding the need to use in the management strategies of the advice from research and joint-regional stock assessment.

EC/FP7: Coordinating research in support to application of Ecosystem Approach to Fisheries (EAF) and management advice in the Mediterranean and Black Seas (CREAM) (2011-2014)

http://www.cream-fp7.eu

Project objectives:

- Harmonization of Data collection and exploitation
- Harmonizing the assessment methodologies
- Dialog scientists / international bodies
- Developing recommendations cooperation improvement
- To set up the basis for a future Network of Research organizations to coordinate fisheries research for the effective application of the Ecosystem Approach to Fisheries (EAF) in Mediterranean and Black Seas.

Joint Operational Programme "BLACK SEA BASIN 2007-2013" Industrial Symbiosis Network for Environment Protection and Sustainable Development in Black Sea Basin - (SymNet) (2011 - 2013)

http://www.projectsymnet.eu/

The project Industrial Symbiosis Network for Environment Protection and Sustainable Development in Black Sea Basin (SymNet) aims to minimize the environmental degradation in response to climate change effects while maximizing economic and social development in the Black Sea Basin by new and innovative approach called Industrial Symbiosis Strategy.

EC/BS-ERA.NET - FP7: Radiation background of Black Sea coastal environment (RACE) (2011- 2014)

EC/BS-ERA.NET - FP7: RACE - Radiation background of Black Sea coastal environment (2011- 2014)

Project objectives: to establish the level of radiation background and its sources in the Black Sea coastal environment.

The results of this project were aimed

- to allow the creation of scientific study of the radiological base-line levels on the coastal region of the Black Sea.
- to deal with the spatial distribution pattern and levels of radioactivity in the Black Sea marine environment. These data are be available for subsequent evaluations of the possible future environment contamination due to human activity. The radionuclide introduced in the environment could represent a threat for life in all its forms. Two major nuclear disasters, Chernobyl in 1986 and Fukushima in 2011, demonstrated how vulnerable the aquatic system is to these threats.

EC/BS-ERA.NET - FP7: Molecular Approaches for rapid and quantitative detections of Cyanobacteria and their toxins from coastal Black Sea (MARCY) (2011-2014)

Project objectives: improving detection systems of cyanobacteria & cyanobacterial toxins for a better pollution control and monitoring in coastal waters of the Black Sea. For this purpose, MARCY project aims to implement for the first time contemporary research methods for rapid and efficiently detection of cyanobacterial hazards in coastal areas of the Black Sea.

EC/FP 7: Option for Delivering Ecosystem-Based Marine Management (ODEMM) (2010 - 2014) https://www.liv.ac.uk/odemm/

Project objectives:

- Develop a set of fully- coasted ecosystem management options that would deliver the objectives of the Marine Strategy Framework Directive, the Habitats Directive, the European Commission Blue Book and the Guidelines for the Integrated Approach to Maritime Policy.
- Scientifically-based operational procedures that allow for a step by step transition from the current fragmented system to fully integrated management.

EC/FP 7: European Marine Observation and data Network (EMODNET)

EMODNET Chemistry 2 is built on EMODNET Chemistry pilot components of the EU's maritime policy, to deliver a marine observation infrastructure that offers the most effective support to the marine and maritime economy whilst supporting environmental protection needs, launched by the Directorate-General for Maritime Affairs and Fisheries (DG MARE).

Since September 2013, the European Marine Observation and Data Network (EMODnet) is supported by a dedicated Secretariat funded by the European Commission (tender MARE/2012/15). The Secretariat provides high-level coordination and technical support to guide the development of a central EMODnet Portal, monitor the various EMODnet projects and disseminate their results. The main aim is to develop a more coherent, effective, efficient and fit for purpose EMODnet, and to stimulate its use by industry, policy and scientific data users.

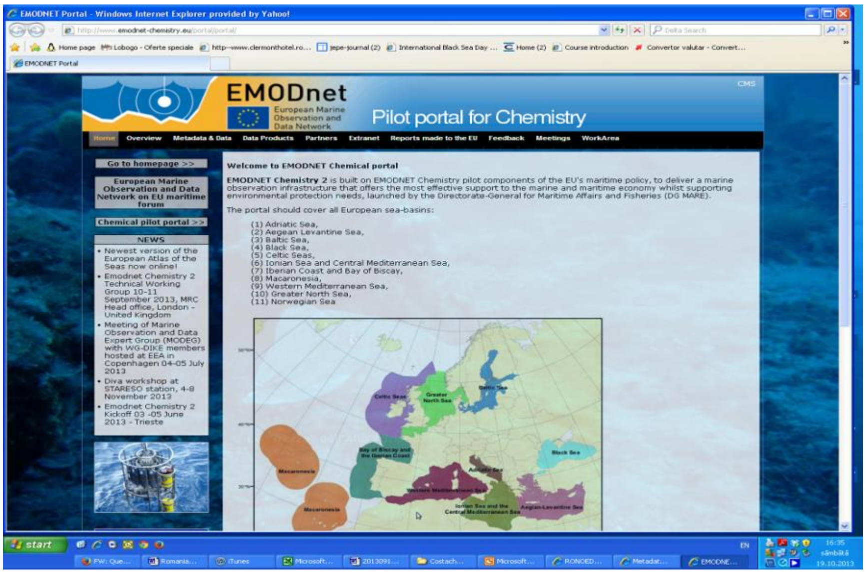


Fig. 2.8 Emodnet project website *(Source: [http://www.emodnet-chemistry.eu/portal/portal/)](http://www.emodnet-chemistry.eu/portal/portal/)*

EC/DG ENVIRONMENT: MSFD Guiding Improvements in the Black Sea Integrated Monitoring System (MISIS) (2012-2014)

http://www.misisproject.eu/?task=home

The overall goal of the MISIS project was to support efforts to protect and restore the environmental quality and sustainability of the Black Sea. The additional specific objectives were: to improve availability and quality of chemical and biological data to provide for integrated assessments of the Black Sea state of environment, including pressures and impacts (in line with

Annex I and III of the MSFD); to increase number and size of protected areas in the Black Sea as well as to increase their degree of protection; to enhance stakeholders participation and public awareness on environmental issues.

EC/FP 7: Pan-European infrastructure for Ocean & Marine Data Management SeaDataNet II (2011 - 2015) (SeaDataNet II)

The second phase of the project SeaDataNet started on October 2011 for another 4 years project with the aim to upgrade the SeaDataNet infrastructure built during previous years. The numbers of the project are quite impressive: 59 institutions from 35 different countries are involved. In particular, 45 data centers are sharing human and financial resources in a common effort to sustain an operationally robust and state-of-the-art Pan-European infrastructure for providing up-to-date and high quality access to ocean and marine metadata, data and data products.

Project objectives:

- to improve operations and to progress towards an efficient data management infrastructure able to handle the diversity and large volume of data collected via the Pan-European oceanographic fleet and the new observation systems, both in real-time and delayed mode. The infrastructure is based on a semi-distributed system that incorporates and enhance the existing RNODCs network.

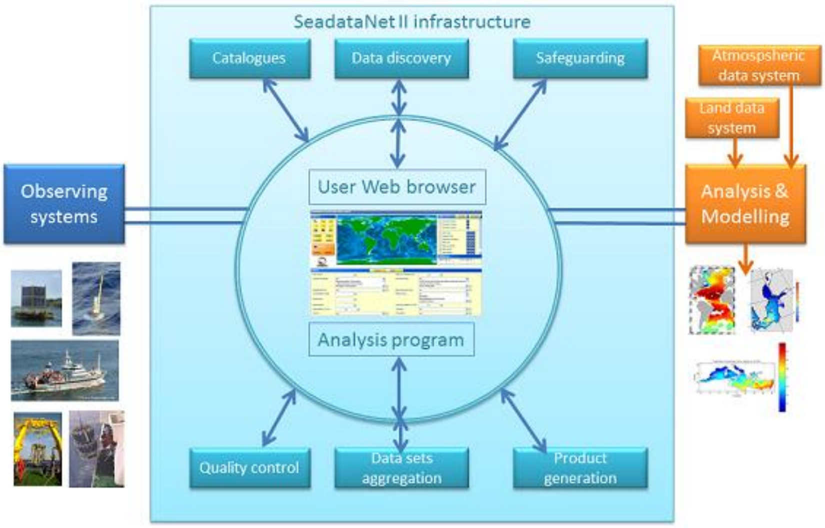


Fig. 2.9 SeaDataNet II project website *(Source: http://www.seadatanet.org)*

EC/FP 7: Policy-oriented marine Environmental Research in the Southern EUropean Seas (2011 - 2015) (PERSEUS)

PERSEUS Policy-oriented marine Environmental Research in the Southern EUropean Seas. It is a policy-oriented, marine research project aimed at supporting regional policymakers for the Southern European Seas. The PERSEUS project is about gathering new knowledge on our eco-systems, analyzing the data with new tools and developing recommendations to support policymakers to make new laws based on solid scientific evidence.

Characterized by innovation and a global perspective, the PERSEUS research project represents the combined expertise of both marine and socioeconomic scientists from Europe and beyond. This distinguished community of experts, 54 partners, from 22 countries, is working together towards a common goal: Good Environmental Status (GES) of the Mediterranean and Black Seas.

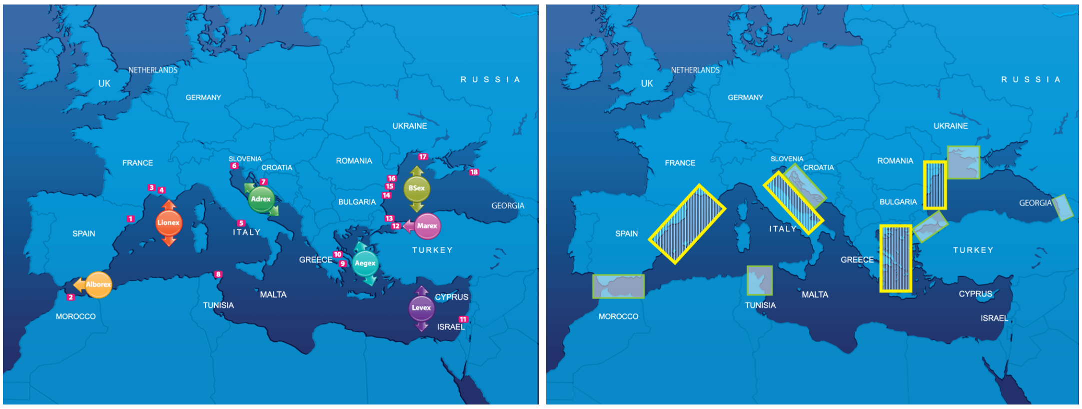


Fig. 2.10 Perseus project website *(Source: http://www.perseus-net.eu/)*

Project objectives: aim far and wide, beginning with a wide-scale study area from basin to coast in these two historical seas, to identify the changing patterns in marine ecosystems. The toxic effects of land/sea pollution on marine life are a well-known fact. However, for the first time, PERSEUS is investigating the interactions between human-induced and natural pressures determined to assess their combined impact on marine ecosystems and what we can expect in socioeconomic terms, if we don't take action. Innovative tools including satellite observations and a prototype vessel for very shallow waters represent a breakthrough approach for acquiring data. The research results will provide the solid, scientific foundation to develop new tools for the policymaker, including scenario-based management schemes, as well as a framework of adaptive policies for implementation by countries in the region to meet the objectives of the Marine Strategy Framework Directive.

EC/FP7: Towards COast to COast NETworks of marine protected areas (from the shore to the high and deep sea), coupled with sea-based wind energy potential (CoCoNET)

The main objectives of CoCoNet (2012-2016) are to:

- Identify prospective networks of existing or potential Marine Protected Areas (MPAs) in the Mediterranean and the Black Seas, shifting from a local perspective to the regional level (network of MPAs) and finally the basin scale (network of networks). The identification of the physical and biological connections among MPAs will elucidate the patterns and processes of biodiversity distribution. Measures to improve protection schemes will be suggested based on maintaining effective exchanges (biological and hydrological) between protected areas.
- Explore where OWF might be established, producing an enriched wind atlas both for the Mediterranean and the Black Seas. OWF locations will avoid too sensitive habitats but the possibility for them to act as stepping-stones through MPAs, without interfering much with human activities, will be evaluated.

Fig. 2.10a CoCoNET project website *(Source: http://www.coconet-fp7.eu/)*

EC/FP7: Co-creating Ecosystem-based Fisheries Management Solutions (MareFrame)

MAREFRAME (2014-2017) will develop new assessment methods and a decision support framework for the management of marine resources. Enhancing the capacity to provide integrated assessment, advice and decision support for an ecosystem based approach to fisheries (EAF) will support the implementation of the Marine Strategy Framework Directive (MSFD). The project partner SMEs, together with RTD institutions and stakeholders, will develop and demonstrate the use of innovative monitoring systems and decision support tools for fisheries advice through training actions, role-play and workshops. Indicators of Good Environmental Status (GES) will be developed along with models for ecosystem-based management.

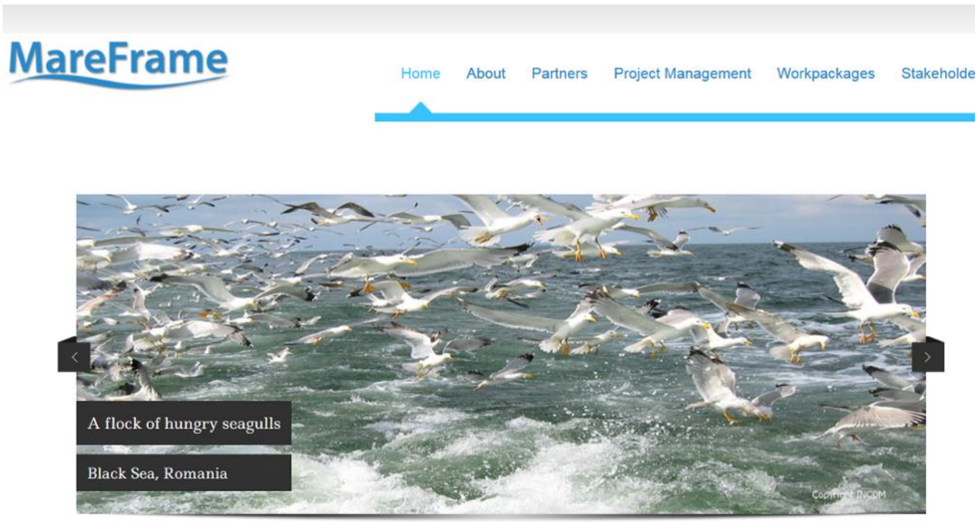


Fig. 2.11 MareFrame project website *(Source: http://www.mareframe.org)*

Constanta Space Technologies Competence Center Dedicated to the Romanian Marine and Coastal Regions Sustainable Development (COSMOMAR)

The COSMOMAR project is funded within the STAR (Space Technology and Advanced Research) Research, Development and Innovation Programme 2012-2019, through the Romanian Space Agency (ROSA), and is coordinated by NIMRD "Grigore Antipa" Constanta.

The Centre's structure comprises three main components: Research Infrastructure, Networking/Cooperation Platform, Interdisciplinary Collective of specialists for Consultancy, Expertise and Dissemination Activities.

The overall goal of the project is the development of a Competence Centre in spatial technologies for the South-East Region of Romania, with the aim of: having the use of space technologies and remote sensing data as main application area, towards monitoring and rapid assessment of the marine and coastal environment state, developing environmentally friendly bio-technologies and materials with applicability in spatial programmes, as well as supporting local and regional small, medium and big enterprises development in accessing opportunities of the EU spatial programmes.

COSMOMAR's strategic objectives include collecting, archiving and preserving oceanographic data, in order to maximize their use; increasing the availability of oceanographic data for a wide group of users; promoting the exchange of information at national and international level; transferring data to different users; transferring data from different oceanographic data sources; providing data to implement EU policies in the marine area.

Fig. 2.12 Cosmomar project website *(Source: http://www.cosmomar.ro/)*

EU INNITIATIVES

Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 Establishing a Framework for Maritime Spatial Planning

On 12 March 2013 the European Commission (EC) adopted a Proposal for a Directive of the European Parliament and of the Council establishing a framework for Maritime Spatial Planning and Integrated Coastal Management. One year later (March 2014), the three institutions, European Commission, European Parliament, and the European Fisheries Council, agreed to a MSP Directive.

On 17 April 2014 the European Parliament amended and endorsed a Directive for Maritime Spatial Planning ("MSP"), aimed at achieving a more coordinated maritime planning process within the European Union. On 23 July 2014 the amended Directive was adopted by the Council (http://eur-lex.europa.eu/legal-content).

The new Directive will require Member States to establish and implement Maritime Spatial Plans for their marine areas, according to a set of minimum common requirements. Member States are expected to establish plans "*as soon as possible"* and by 2021 at the latest. As a framework Directive, the MSP Directive only establishes procedural obligations. Member States retain the power to define the structure, content and detail of these plans.

Maritime Spatial Planning (MSP) is a cornerstone of the Commission's Blue Growth strategy and of the EU Integrated Maritime Policy. It allows improved understanding of the distribution of marine resources and offers investors greater certainty about potential economic development. With MSP, operators will know what, where and for how long an activity can take place. Maritime Spatial Planning will also reduce existing over-regulation and administrative complexity. For instance, in some countries up to nine executive agencies need to be contacted before securing a permit for an offshore aquaculture site. Better coordination will speed up procedures which will generate economic gains. For instance by accelerating investments in offshore aquaculture or renewables by 1, 2 or 3 years, economic gains from €60 million to over €600 million could be generated by 2020.

Maritime Spatial Planning will also contribute to a more efficient implementation of EU environmental legislation in marine waters and will help Member States reach good environmental status of their waters by 2020. It should help establish coherent networks of Marine Protected Areas, for which cooperation on planning across borders is essential, and ensure the participation of all stakeholders in planning processes.

Member States must transpose the Directive into their national legislation by 2016 and nominate the Competent Authority in charge of the implementation of MSP. Member States must also draw up their national maritime spatial plans by 2021. They are free to tailor the content of the plans and strategies to their specific economic, social and environmental priorities, and their national sectorial policy objectives and legal traditions, but must respect the minimum requirements of the Directive (http://europa.eu/rapid/press-release_IP-14-459_en.htm).

Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008, establishing a Framework for Community Action in the Field of Marine Environmental Policy (Marine Strategy Framework Directive)

The Marine Directive was adopted on 17 June 2008, after several years of preparation and extensive consultation of all the relevant actors and the public, and came into force on 15 June 2008. It was due to be transposed into national legislation by 15 July 2010.

The Commission also produced in 2010 a set of detailed criteria and indicators to help Member States implement the Marine Directive. More information on this Commission Decision on the page on Good Environmental Status (http://eur-lex.europa.eu/legal-content).

The Marine Directive aims to achieve Good Environmental Status (GES) of the EU's marine waters by 2020 and to protect the resource base upon which marine-related economic and social activities depend. It is the first EU legislative instrument related to the protection of marine biodiversity, as it contains the explicit regulatory objective that "biodiversity is maintained by 2020", as the cornerstone for achieving GES.

The Directive enshrines in a legislative framework the ecosystem approach to the management of human activities having an impact on the marine environment, integrating the concepts of environmental protection and sustainable use.

In order to achieve its goal, the Directive establishes European marine regions and sub-regions on the basis of geographical and environmental criteria. The Directive lists four European marine regions - the Baltic Sea, the North-east Atlantic Ocean, the Mediterranean Sea and the Black Sea - located within the geographical boundaries of the existing Regional Sea Conventions. Cooperation between the Member States of one marine region and with neighboring countries which share the same marine waters, is already taking place through these Regional Sea Conventions.

In order to achieve GES by 2020, each Member State is required to develop a strategy for its marine waters (or Marine Strategy). In addition, because the Directive follows an adaptive management approach, the Marine Strategies must be kept up-to-date and reviewed every 6 years.

The marine strategy includes the following steps:

- The initial assessment of the current environmental status of national marine waters and the environmental impact and socio-economic analysis of human activities in these waters (by 15 July 2012) - implemented;
- The determination of what GES means for national marine waters (by 15 July 2012) - implemented;
- The establishment of environmental targets and associated indicators to achieve GES by 2020 (by 15 July 2012) - implemented;
- The establishment of a monitoring programme for the ongoing assessment and the regular update of targets (by 15 July 2014) - implemented;
- The development of a programme of measures designed to achieve or maintain GES by 2020 (by 2015);
- The review and preparation of the second cycle (2018 - 2021).

Fig. 2.13 Marine Strategy Framework implementation scheme
(Source: http://ec.europa.eu/environment)

Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora

The Habitats Directive (together with the Birds Directive) forms the cornerstone of Europe's nature conservation policy. It is built around two pillars: the Natura 2000 network of protected sites and the strict system of species protection. All in all the directive protects over 1,000 animals and plant species and over 200 so called "habitat types" (E.g. special types of forests, meadows, wetlands, etc.), which are of European importance. (http://eur-lex.europa.eu/legal-content).

The enlargement of the European Union with 10 new member states (Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Slovenia and Slovakia) in 2004 meant that EU nature conservation legislation had to be applied to a much larger territory than before. The amazing richness in nature and wildlife was one of the environmental assets the new member states bring to the EU. These countries still host species and habitat types that have nearly vanished from Western Europe. But not only that: they hold nature values that do not occur at all in the old European Union of the 15. This is why the Birds and the Habitats Directives had to be adapted to cover these unique assets.

The enlargement of the European Union with two additional new member states (Bulgaria and Romania) in 2007 has brought amendments of the EU nature conservation legislation. The exercise of negotiating amendments to the lists of habitat types and species of the above directives originally started simultaneously for all 12 candidate countries, and has now been completed for the two most recent Member States. Unlike the 2004 enlargement, the consolidated annexes have not been included in the Treaty of Accession to the European Union of 2005. Based on the political agreement referred to in the Accession Treaty (Accession BG and RO), the Council adopted a directive effecting the changes: Directive 2006/105/EC of 20 November 2006 adapting Directives 73/239/EEC, 74/557/EEC and 2002/83/EC in the field of environment, by reason of the accession of Bulgaria and Romania. As in the case of the 2004 enlargement, most changes concern the annexes of the directive. In the first place new typical and endangered species and habitats in the new Member States have been added to the annexes, with a limited number of geographic exceptions granted. In addition, a small number of earlier typographical errors were corrected. For the Habitats Directive, also two new biogeographic regions were added to the existing seven (Continental, Mediterranean, Alpine, Atlantic, Macaronesian, Boreal, Pannonian): the Black Sea and the Steppic Regions.

The enlargement of the European Union with Croatia in 2013 has brought the most recent amendments of the EU nature conservation legislation - the "Birds Directive" (2009/147/EC) and the "Habitats Directive" (92/43/EEC).

Directive 2009/147/EE of the European Parliament and of the Council of 30 November 2009 on the Conservation Of Wild Birds (Codified Version of Directive 79/409/EEC)

Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (this is the codified version of *Directive 79/409/EEC* as amended) is the EU's oldest piece of nature legislation and one of the most important, creating a comprehensive scheme of protection for all wild bird species naturally occurring in the Union. It was adopted unanimously by the Members States in 1979 as a response to increasing concern about the declines in Europe's wild bird populations resulting from pollution, loss of habitats as well as unsustainable use. It was also in recognition that wild birds, many of which are migratory, are a shared heritage of the Member States and that their effective conservation required international co-operation. (http://eur-lex.europa.eu/legal-content).

The directive recognizes that habitat loss and degradation are the most serious threats to the conservation of wild birds. It therefore places great emphasis on the protection of habitats for endangered as well as migratory species (listed in Annex I), especially through the establishment of a coherent network of Special Protection Areas (SPAs) comprising all the most suitable territories for these species. Since 1994 all SPAs form an integral part of the NATURA 2000 ecological network.

The Birds Directive bans activities that directly threaten birds, such as the deliberate killing or capture of birds, the destruction of their nests and taking of their eggs, and associated activities such as trading in live or dead birds, with a few exceptions (listed in Annex III - III/1 allows taking in all Member States; III/2 allows taking in Member States in agreement with European Commission). The Directive recognizes hunting as a legitimate activity and provides a comprehensive system for the management of hunting (limited to species listed in Annex II - II/1 allows hunting in all Member States; II/2 allows hunting in listed Member States) to ensure that this practice is sustainable. This includes a requirement to ensure that birds are not hunted during the periods of their greatest vulnerability, such as the return migration to the nesting areas, reproduction and the raising of chicks. It requires Member States to outlaw all forms of non-selective and large scale killing of birds, (especially the methods listed in its Annex IV). It promotes research to underpin the protection, management and use of all species of birds covered by the Directive (Annex V).

The Annexes to the Birds Directive have been adapted on a number of occasions in response to scientific and technical progress and to the successive enlargements of the European Union. The most recent adaption is in response to the Accession of Bulgaria and Romania to the European Union on 1 January 2007, and Croatia in 2013.

Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy

On 23 October 2000, the Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy or, in short, the EU Water Framework Directive (or even shorter the WFD) was finally adopted. The Directive aims for "good status" for all ground and surface waters (rivers, lakes, transitional waters, and coastal waters) in the EU (http://eur-lex.europa.eu/legal-content).

The ecological and chemical status of surface waters are assessed according to the following criteria:

- Biological quality (fish, benthic invertebrates, aquatic flora);
- Hydromorphological quality such as river bank structure, river continuity or substrate of the river bed;
- Physical-chemical quality such as temperature, oxygenation and nutrient conditions
- Chemical quality that refers to environmental quality standards for river basin specific pollutants. These standards specify maximum concentrations for specific water pollutants. If even one such concentration is exceeded, the water body will not be classed as having a "good ecological status".

The Water Framework Directive stipulates that groundwater must achieve "good quantitative status" and "good chemical status" (i.e. not polluted) by 2015. Groundwater bodies are classified as either "good" or "poor".

Article 14 of the directive requires member states "to encourage the active involvement of interested parties" in the implementation of the directive. This is generally acknowledged to be an assimilation of the Aarhus Convention.

One important aspect of the Water Framework Directive is the introduction of River Basin Districts. These areas have been designated, not according to administrative or political boundaries, but rather according to the river basin (the spatial catchment area of the river) as a natural geographical and hydrological unit. As rivers often cross national borders, representatives from several Member States have to cooperate and work together for the management of the basin (so-called transboundary basins). They are managed according to River Basin Management Plans, which should provide a clear indication of the way the objectives set for the river basin are to be reached within the required timescale. They should be updated every six years.

Directive 2006/113/EC of the European Parliament and of the Council of 12 December 2006 on the quality required of shellfish waters

The European Community Shellfish Waters Directive 2006/113/EC was adopted to protect and, where necessary, improve the quality of waters where shellfish grow and to contribute to the high quality of directly edible shellfish products. It supersedes the original Shellfish Waters Directive 79/923/EEC (http://eur-lex.europa.eu/legal-content).

The Directive concerns the quality of shellfish growing waters. All Member States have designated those coastal and brackish waters needing protection or improvement in order to support shellfish (bivalve and gastropod mollusks) life and growth and to contribute to the high quality of directly edible shellfish products.

It is the Member States' responsibility to designate shellfish waters. The list of designated waters may be amended to take into consideration factors not foreseen at the time of designation. If waters immediately adjacent to borders with neighboring Member States are designated as shellfish waters, these States must be consulted.

The Directive establishes parameters applicable to designated shellfish waters, indicative values, mandatory values, reference methods of analysis and the minimum frequency for taking samples and measures. The parameters applicable to shellfish waters are set for pH, temperature, coloration, suspended solids, salinity, dissolved oxygen and the presence or concentration of certain substances (hydrocarbons, metals, organochlorine substances).

On the basis of these criteria, Member States establish the values with which the designated shellfish waters must comply. These limit values may be stricter than those set by this Directive. For metals or organochlorine substances, these values must respect the emission rules established in line with Directive 2006/11/EC on the discharge of certain substances into the aquatic environment.

Member States must establish programmes allowing them to comply with the limit values they have set within six years of designation.

The competent authorities for each Member State must take samples from the waters to verify their conformity with the criteria set by the Directive. The following proportions of samples must conform to the established values:

- 100 % of the samples for the parameters 'organohalogenated substances' and 'metals';
- 95 % of the samples for the parameters 'salinity' and 'dissolved oxygen';
- 75 % of the samples for the other parameters.

Common Fisheries Policy (CFP)

Regulation (EU) No. 1380/2013 of the European Parliament and of the Council of 11 December 2013 on the Common Fisheries Policy, amending Council Regulations (EC) No. 1954/2003 and (EC) No. 1224/2009 and repealing Council Regulations (EC) No. 2371/2002 and (EC) No. 639/2004 and Council Decision 2004/585/EC

The new Common Fisheries Policy (CFP) has been agreed by Council and Parliament and is effective from 1 January 2014. On 13 July 2011, the European Commission presented its proposals for the reform of the EU common fisheries policy and, on 2 December 2011, it proposed a new fund for the EU's maritime and fisheries policies for the period 2014-2020: the European maritime and fisheries fund (EMFF) (http://ec.europa.eu/fisheries/)

In 2009, the Commission launched a wide-ranging public debate on the way EU fisheries were managed. Its *Green paper on reform of the common fisheries policy* (CFP) outlined the challenges facing Europe's fisheries. The public consultation elicited very interesting responses from EU citizens, organisations and governments. We analyzed these and summarized them in a synthesis report on CFP-reform consultation.

The CFP is a set of rules for managing European fishing fleets and for conserving fish stocks. Designed to manage a common resource, it gives all European fishing fleets equal access to EU waters and fishing grounds and allows fishermen to compete fairly.

Stocks may be renewable, but they are finite. Some of these fishing stocks, however, are being overfished. As a result, EU countries have taken action to ensure the European fishing industry is sustainable and does not threaten the fish population size and productivity over the long term. The CFP was first introduced in the 1970s and went through successive updates, the most recent of which took effect on 1 January 2014.

The CFP aims to ensure that fishing and aquaculture are environmentally, economically and socially sustainable and that they provide a source of healthy food for EU citizens. Its goal is to foster a dynamic fishing industry and ensure a fair standard of living for fishing communities. Although it is important to maximize catches, there must be limits. We need to make sure that fishing practices do not harm the ability of fish populations to reproduce. The current policy stipulates that between 2015 and 2020 catch limits should be set that are sustainable and maintain fish stocks in the long term.

To this day, the impact of fishing on the fragile marine environment is not fully understood. For this reason, the CFP adopts a cautious approach which recognizes the impact of human activity on all components of the ecosystem. It seeks to make fishing fleets more selective in what they catch, and to phase out the practice of discarding unwanted fish.

Fig. 2.14 CFP aims to ensure that fishing and aquaculture are environmentally, economically and socially sustainable

The CFP currently has four components (Khalilian et al., 2014):

- Regulation of production, quality, grading, packaging and labeling;
- Encouraging producers organisations intended to protect fishermen from sudden market changes;
- Setting minimum fish prices and financing buying up of unsold fish.
- Set rules for trade with non-EU countries

Total allowable catch (TAC)

The CFP sets quotas for how much of each species can be caught (in a certain area). Each country is given a quota based upon the total available (Total Allowable Catch, TAC) and their traditional share (percentage). TACs are fixed annually by the Council of Ministers. They consider proposals drawn up by the European Commission, which consults its own scientific advisers (Scientific, Technical and Economic Committee of Fisheries, STECF). STECF generally provides its advice to the European Commission taking account of the work conducted by the International Council for the Exploration of the Sea (ICES). The Council of Ministers furthermore (when relevant) takes account of the views of non EU fishing nations and the advice coming directly from

ICES, which is independent of EU institutions. After quotas are fixed by the Council of Ministers, each EU member state is responsible for policing its own quota. Different countries distribute their quota among fishermen using different systems.

The Basic Regulation sets the common principles for the EU management, under which each Member State can use different management approaches as licenses, limited entry or individual fishing quota. Catches and landings must be recorded. Regulations cover the kind of fishing gear that may be used. Areas may be closed from fishing to allow stocks to recover.

A minimum size for catch led to fishermen dumping dead fish that were too small to land legally, so a minimum mesh size was introduced, which let small fish escape to replenish stocks. Choice of mesh is complicated, because mature fish of different species are naturally different sizes and require different nets.

In 1977 an aid programme was introduced to improve the fish processing industries. This includes such things as fish filleting, salting, drying, smoking, cooking, freezing and canning. It was intended to indirectly assist the catching industry. There has been an attempt to introduce new technologies to the sector, improve hygiene conditions, and also fund conversions of fish processing factories to other uses.

Each country is given a target for the size of their fleet. Funding is available to assist modernization of boats and installations, but also to buy out fishermen to reduce the fleet size. Money is available for advertising campaigns to encourage consumption of fish species that are not over fished, or are unfamiliar to the public. Also, grants are available to assist the industry in improving product quality and managing quotas.

***

All these European regulatory acts apply only to the two Members States at the Black Sea, Bulgaria and Romania.

3.1. General features of the Black Sea region

The Black Sea is one of the most remarkable regional seas in the world, being almost completely separated from the rest of the world's oceans and embodying an abyssal basin with maximum depth of 2300 m adjoining a very wide continental shelf area. Its waters are permanently stratified under the influence of fresh water supplied by large rivers (Fig. 3.1) and the inflow of Mediterranean water through the Bosphorus and Dardanelles Straits.

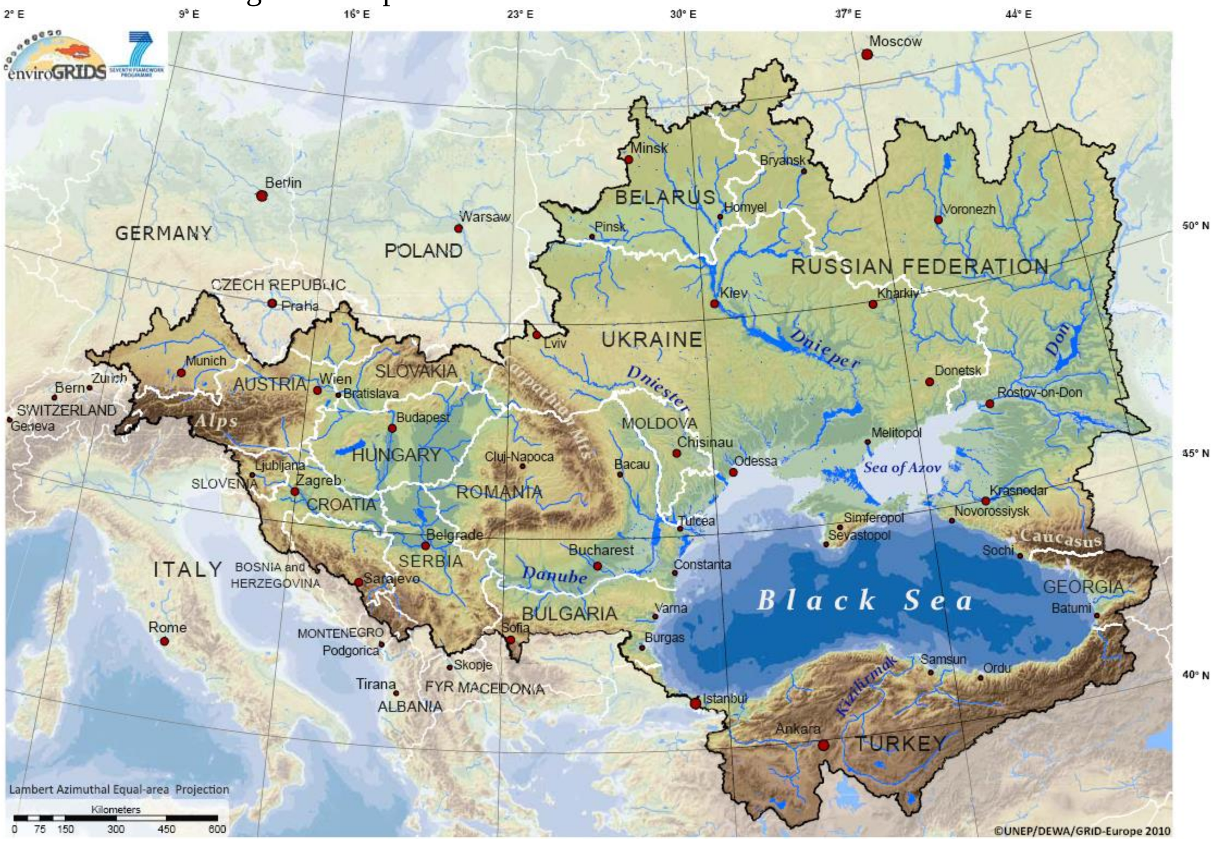


Fig. 3.1 The catchment area of the Black Sea *(Source: http://envirogrids.net)*

The Black Sea is considered to be a hugh laboratory naturally hosting oxic, hypoxic and anoxic water masses permanently existing due to strong vertical stratification. While strong vertical stratification supports isopycnal distribution of various biogeochemical species, the wide range of redox conditions supports specific processes rendering the Black Sea a unique place to study the Earth System responses to climate changes and anthropogenic forcing. Since a large part of the basin (i.e. approx. deeper than 100 m) is anoxic, life forms in the Black Sea display limited diversity and almost all pelagic and benthic fauna and flora dwell in the shallower upper oxic water layers.

Over the past 20 years the Black Sea region has faced numerous socio-economics changes. Based on The Blue Growth report the most important economic functions in the Black Sea are shortsea shipping, offshore oil and gas exploration and coastal tourism (ESaTDOR, 2013).

Other additional sectors are: fishing, land based industry, military uses and infrastructure. Aquaculture is developing in all Black Sea countries, but it has grown rapidly into an important activity in Turkey and Bulgaria (BSC, 2007, Deniz, 2001).

According to Eurostat 2010, 6.4% of shortsea shipping occurred in the Black Sea, based on the gross weight of goods transported. Offshore oil and (mainly) gas production in the Black Sea is located in production fields such as Ayazli off the Turkish coast, Galata near the Bulgarian coast, and the Ana and Doina fields off Romania.

Tourism on the Black Sea is increasing. International tourism makes up only a small percentage of total tourism on the Black Sea (about 14 % in 2006 for Bulgaria, Russia, Turkey and the Ukraine combined); most tourists come from within the region. It is estimated that about 4 million visitors come to the Black Sea coastline each summer (BSC, 2008). The Black Sea region tries to copy the approach of the Mediterranean region, hoping to attract international tourists. It focuses on the natural and cultural heritage of the regions, offering sandy beaches, ancient monuments and modern resorts. In Bulgaria, the number of tourism establishments increased by 14 % on average per year between 2000 and 2005. Bulgaria offers seaside resorts, large hotels, motels and other tourist properties focused in the cities of Varna and Bourgas. Romania, with 14 hours of sunshine per day in the summer and warm water and air temperatures, is also experiencing growth in the tourism sector. It offers modern facilities, historical sites and monuments, spas, traditional villages, and vineyards (European Parliament, 2008).

The integration of this thematic information into composite maps gives a general overview on the economic, transport and environmental situation of Europe's seas. A sum of percentages was calculated of every economic sector related to maritime activities in each NUTS 2 region (percentage of the total employment representing the maritime cluster). These sums have been classified by quintiles as follows in Table 3.1 and the results shown in Fig. 3.2.

Table 3.1 Composite classification of maritime economic use

Total Percentage	Total Employees	Category name
5.42 - 15.52	8,005 - 51,861	Very Low
15.52 - 17.60	51,861 - 109,775	Low
17.60 - 21.06	109,775 - 162,63	Medium
21.06 - 24.69	162,923 - 263,461	High
24.69 - 36.35	263,461 - 674,442	Very High

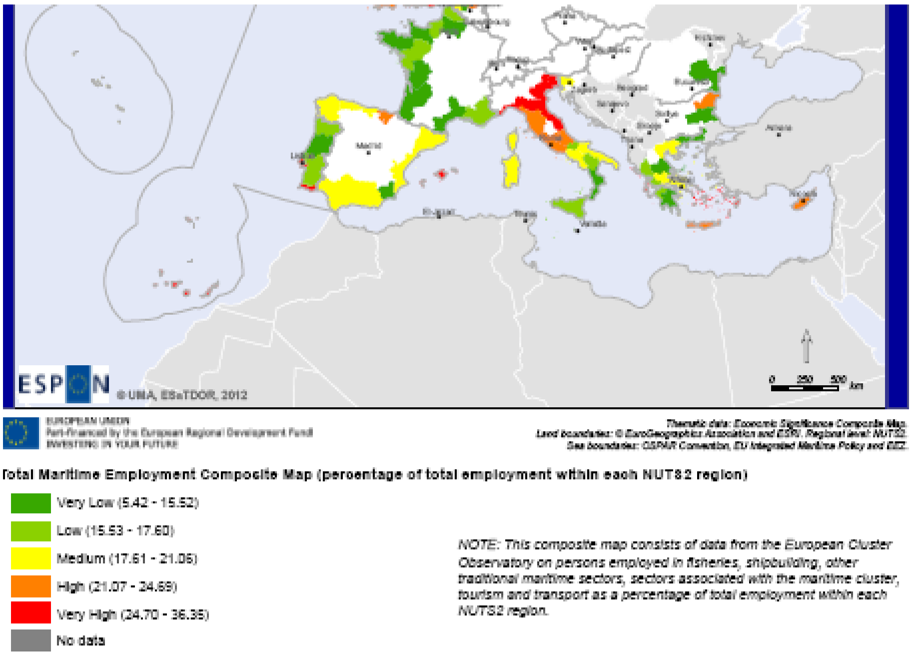


Fig. 3.2 Composite map of maritime employment (as a percentage of total employment), 2009

A similar approach generated composite maps for maritime transport patterns and flows (Fig. 3.3) and environmental pressures (Fig. 3.4). The environmental pressures composite map was obtained by calculating the average (equal weight basis) of layers with information about invasive species as well as organic and inorganic inputs. Their values were reclassified into five groups (based on quintiles) as follows:

Table 3.2 Composite classification of environmental impacts

Organic Inputs	Invasive Species	Inorganic Inputs	Category name
-	0*	-	-
1 - 60	1 - 60	0.1 - 320	Very Low
60 -120	60 -120	320 - 640	Low
120 - 180	120 - 180	640 - 960	Medium
180 - 240	180 - 240	960 - 1,280	High
240 - 7,662	240 - 3,030	1,280 -10,186	Very High

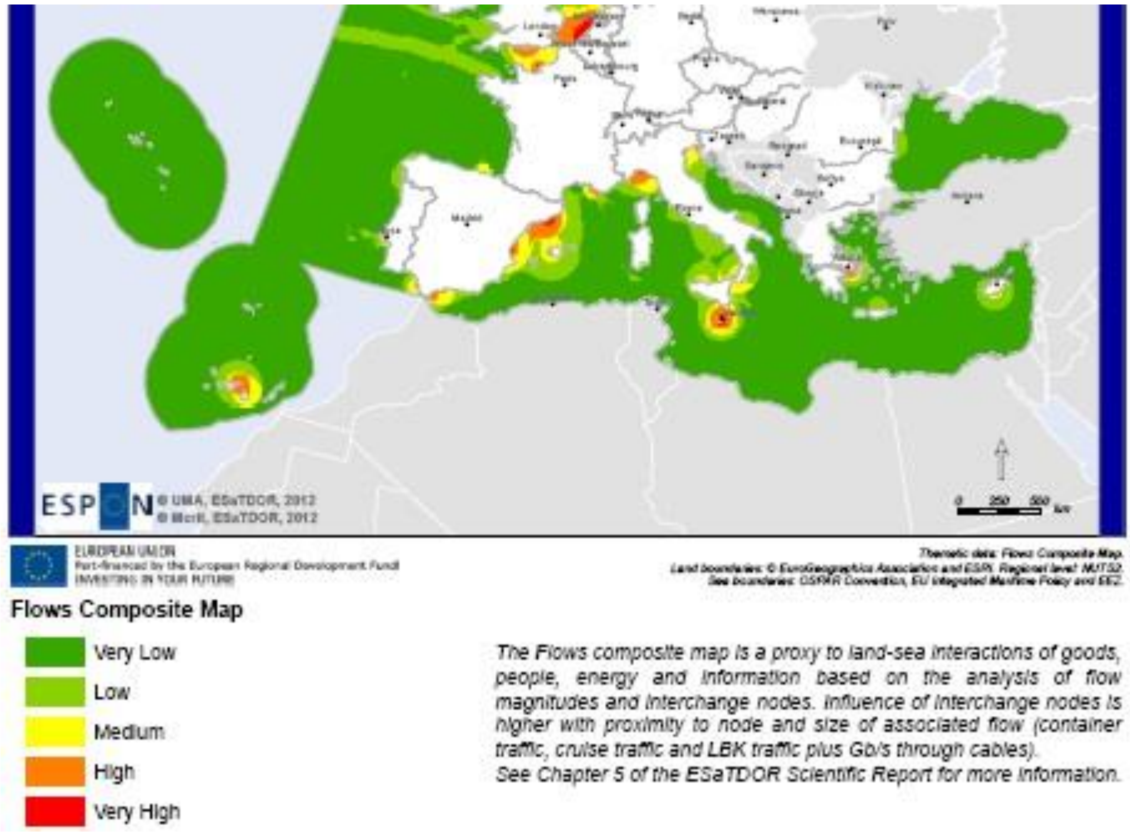


Fig. 3.3 Composite map of maritime flows

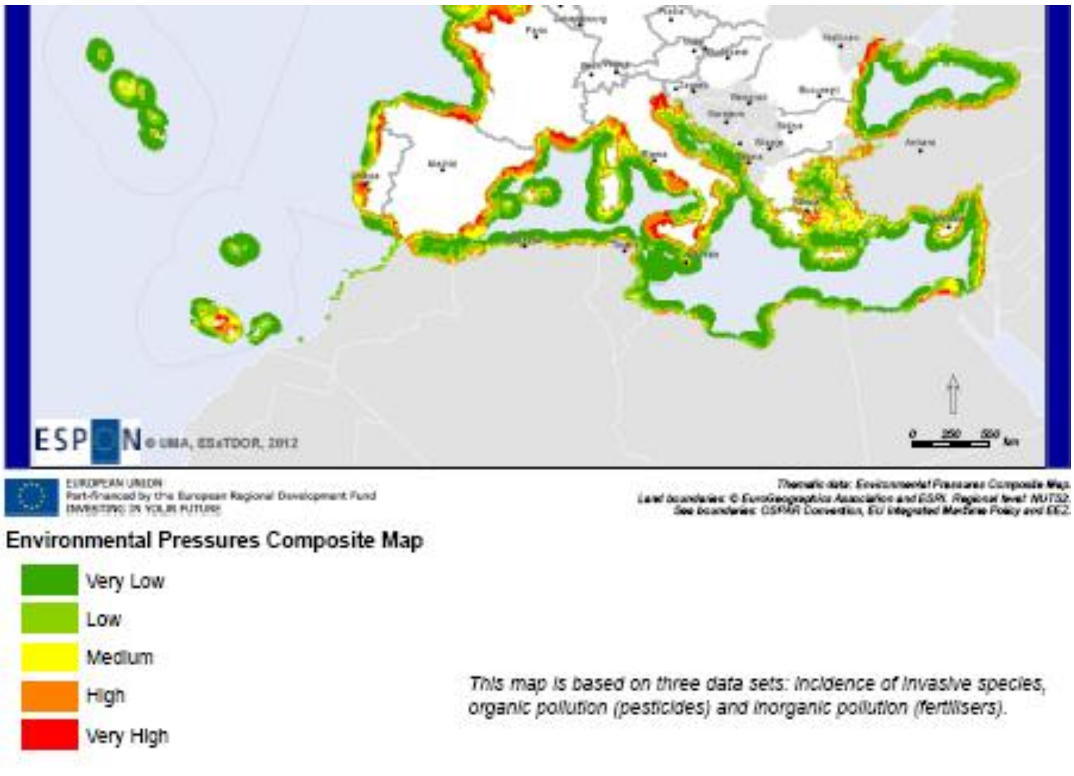


Fig. 3.4 Composite map of environmental pressures

This gives an emerging picture for the European part of the Black Sea as follows. There is a generally low level of maritime jobs, though with a locally higher level around Constanta, reflecting the maritime cluster referred to above, and indicating the potential for growth. Transport is similarly at a low level overall, but again with a higher level of activity offshore from Constanta, reflecting its port activity.

Environmentally, the Black Sea shows a similar pattern as in other European seas of problems closer to the coast, but with an area of particular concern in the shallower north-western waters.

3.2. Delineation of the Black Sea coastal zone

There are four maritime zones recognized under UNCLOS, as follows (UNCLOS, 1982):

- The *territorial sea* which is a belt of sea of 12 NM in breadth adjacent to the territory of a coastal State, including land territory and internal waters and, in the case of an archipelagic State, its archipelagic waters; the sovereignty of a coastal State extends to its territorial sea.

- The *contiguous zone* which is an area extending up to 24 NM from the territorial sea baseline, where a coastal State may exercise the control necessary to prevent and punish infringements of its customs, fiscal, immigration or sanitary laws and regulations within its territory or territorial sea. UNCLOS does not provide for delimitation of the contiguous zone and so will not be discussed in this chapter.

- The *continental shelf*, which comprises the seabed and subsoil of the submarine areas that extend beyond the territorial sea to a distance of up to 350 NM where the natural prolongation of the land territory extends up to or beyond that distance, or to 200 NM where the natural prolongation of the land territory does not extend to that distance. A coastal State exercises sovereign rights over the continental shelf for the purpose of exploring it and exploiting its natural resources. A coastal State's rights over its continental shelf exist ipso facto and ab initio without there being any question of having to make a good claim to the areas concerned. Claims to a continental shelf beyond 200 NM are to be submitted to, and considered by, the Commission on the Limits of the Continental Shelf set up under Art. 76(8) of UNCLOS. To date, however, the jurisprudence of the Court has been limited to delimitation claims up to 200 NM.

– The *exclusive economic zone or EEZ*, which is an area beyond and adjacent to the territorial sea but may not extend beyond 200 NM from the territorial sea baselines. In the EEZ, a State has sovereign rights to explore, exploit, conserve and manage the natural resources of the waters superjacent to the seabed and of the seabed and its subsoil; sovereign rights with regard to other activities for the economic exploitation and exploration of the zone, such as the production of energy from the water, currents and winds; and jurisdiction over artificial islands, installations and structures.

Beyond the EEZ/continental shelf lie the high seas which are open for use by all States, except in respect of resources of the seabed of the ocean floor and subsoil thereof, exploitation of which is to be managed by the International Seabed Authority, set up under UNCLOS for the common benefit of mankind.

The current situation of maritime delimitations in the Black Sea is the following:

- **Bulgaria - Romania**. Not delimited.
- **Bulgaria - Turkey**. Delimitation of all maritime boundaries: a treaty was signed in Sofia on 4 December 1997 and entered into force on 4 November 1998 (http://www.un.org/depts/los/LEGISLATIONANDTREATIES/STATEFILES/TUR.htm).
- Georgia - Russian Federation. Not delimited.
- Georgia - **Turkey**. Delimitation of the territorial sea: treaty signed in Ankara on 17 April 1973 and entered into force on 27 March 1975; delimitation of the continental shelf: treaty signed in Moscow on 23 June 1978 and entered into force on 15 May 1981; delimitation of the exclusive economic zone: treaty concluded through exchange of notes, the first of which signed on 23 December 1986 by Turkey and entered into force as binding between the parties on 6 February 1987 upon note of exchange signed by the Soviet Union (http://www.un.org/depts/los/LEGISLATIONANDTREATIES/STATEFILES/TUR.htm).
- **Romania - Ukraine**. Delimitation of the territorial sea: treaty signed in Cernauti on 17 June 2003 and entered into force on 27 May 2004; delimitation of the exclusive economic zone and continental shelf: judgment of the International Court of Justice on the Case Concerning Maritime Delimitation in the Black Sea (Romania/Ukraine) of 3 February 2009 (ICJ Report, 2009).
- Russian Federation - **Turkey.** Delimitation of the continental shelf: treaty signed in Moscow on 23 June 1978 and entered into force on 15 May 1981; delimitation of the exclusive economic zone: treaty concluded through exchange of notes, the first of which signed on 23 December 1986 by Turkey and entered into force as binding between the parties on 6 February 1987 upon note of exchange signed by the Soviet Union (http://www.un.org/depts/los/LEGISLATIONANDTREATIES/STATEFILES/TUR.htm).
- Russian Federation - **Ukraine**. Not delimited.
- **Turkey - Ukraine**. Delimitation of the continental shelf: treaty signed in Moscow on 23 June 1978 and entered into force on 15 May 1981; delimitation of the exclusive economic zone: treaty concluded through exchange of notes, the first of which signed on 23 December 1986 by Turkey and entered into force as binding between the parties on 6 February 1987 upon note of exchange signed by the Soviet Union (http://www.un.org/depts/los/LEGISLATIONANDTREATIES/STATEFILES/TUR.htm).

Bulgaria

As an EU country, Bulgaria has to conform to the EU environmental legislation in addition to the Regional Black Sea Convention for Black Sea protection against pollution (Bucharest Convention) and the four annexed Protocols and the Strategic Action Plan (SAP 2009). The Water Framework Directive (WFD) Directive 2000/60/EC, establishing a framework for Community action in the field of water policy as for management the coastal zone within 1 mile distance from the coastline offshore, while the Marine Strategy Framework Directive (MSFD) Directive 2008/56/EC is the legislative instrument for management of member states territorial marine waters including the EEZ. According to the WFD all member states should reach good ecological status (GES) of their coastal environment by 2015, while MSFD postulate achieving of Good Environmental Status (GEnS) for the European regional Seas by 2020.

The management unit within the WFD are coastal "*water bodies*", while the MSFD requires each member state to delineate relevant pelagic and b enthic habitats (E.g the abiotic environment and strata + biota) within their territorial marine waters including the EEZ. In the WFD key components for assessment of coastal waters are the Biological quality elements - phytoplankton, macrophytobenthos and macrozoobenthos and hydromorphological elements supporting the biological elements, while MSFD is based on 11 Descriptors, each with listed criteria and indicators for assessment (Commission Decision of 1 September 2010 on criteria and methodological standards on good environmental status of marine waters (notified under document C(2010) 5956)/(2010/477/EU) (Table 3.3).

Table 3.3 Water body types in the Bulgarian Black Sea

Water body code	Station	Characteristics	Latitude	Longitude	Depth,m
BG2BS000C001	Krapetz	exposed and shallow waters with mixed substratum	43°35.250'N	28°35.500'E	16
BG2BS000C002	Shabla	exposed and shallow waters with muddy substratum	43°32.000'N	28°36.400'E	37
BG2BS000C003	Rusalka	exposed and shallow waters with sandy substratum	43°25.460'N	28°33.202'E	27
BG2BS000C004	Kaliakra	moderately exp. shallow waters, mixed substratum	43°22.000'N	28°25.000'E	16
	Balchik		43°22.750'N	28°12.000'E	17
BG2BS000C013	Albena	moderately exp. shallow waters, mixed substratum	43°19.500'N	28°05.800'E	17
	Galata		43°10.000'N	28°00.000'E	24
BG2BS000C005	Varna Bay1	moderately exp. shallow waters, mixed substratum	43°12.100'N	27°57.300'E	17
	Varna Bay2		43°11.100'N	27°56.200'E	15
BG2BS000C006	Kamchia	moderately exp. shallow waters, mixed substratum	43°01.500'N	27°54.550'E	19
BG2BS000C007	Dvoinitza	moderately exposed shallow waters,sandy substratum	42°46.100'N	27°55.560'E	30
BG2BS000C008	Nesebar	moderately exp. shallow waters, mixed substratum	42°40.800'N	27°46.700'E	22
	Sarafovo		42°30.380'N	27°40.330'E	28
	Rosenetz		42°27.800'N	27°31.000'E	15
BG2BS000C009	Koketrais	moderately exposed shallow waters,sandy substratum	42°38.800'N	27°53.200'E	19
BG2BS000C010	Burgas bay	moderately exp.intermediate waters,muddy substra	42°30.019'N	27°48.000'E	36
	cape Maslen		42°20.170'N	27°49.150'E	47
BG2BS000C011	Sozopol	moderately exposed shallow waters,sandy substratum	42°26.000'N	27°43.350'E	38
BG2BS000C012	Varvara	exposed and shallow waters with mixed substratum	42°09.000'N	27°54.750'E	47
	Veleka		42°05.000'N	28°00.000'E	53

Source BSBD, MOEW

The coastal zone is subdivided into 5 regions (from north to south) c. Sivriburun- c. Kaliakra c. Kaliakra- c. Galata, c. Galata - c. Emine, c. Emine - c. Sozopol and c. Sozopol - Rezovska river (Fig. 3.5)

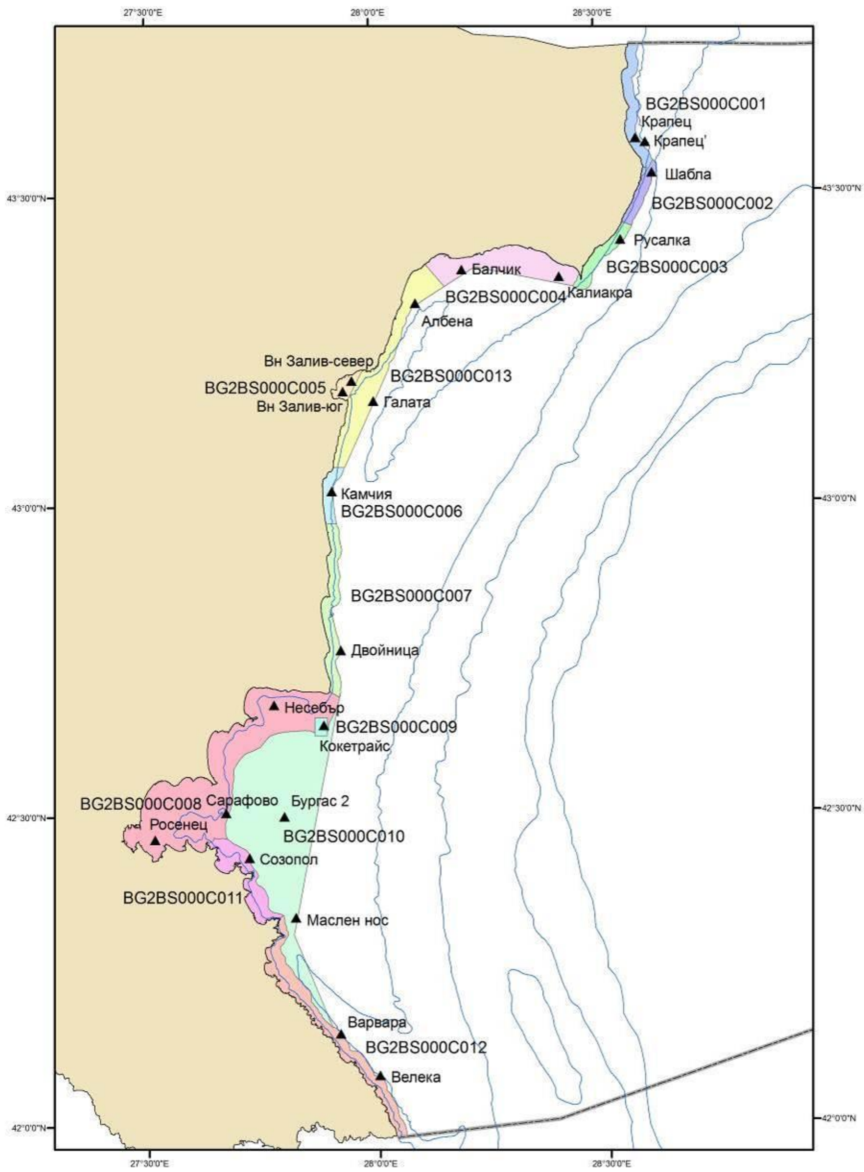


Fig. 3.5 Map of water bodies and monitoring stations sensu WFD/source BSBD, MOEW

Moldova

Moldova is located in the south-eastern part of Europe at the intersection of Central Europe with Eastern and Southern Europe. The territory of the country is crossed in the middle by the meridian 28°50' E and the parallel 47° N. Moldova is a country situated in the Black Sea and Danube River basins, as its southern border stretches down close to the Black Sea, the outlet to the sea opening through the Dniester liman and the Danube River.

Moldova has access to the Danube for only about 480 meters (1,570 ft), and Giurgiulesti is the only Moldovian port on the Danube. The building of an oil terminal started there in 1996, and was finished in 2006 (http://www.traveltill.com).

The largest part of the country lies between two rivers, the Dniester and the Prut. The country's main water arteries are transboundary and can be divided into three main river basins of regional and international importance:

- The Dniester (called Nistru) basin covers about 57% of the country. The Dniester rises in Ukraine and forms the border between Ukraine and Moldova in parts of N-NE and SE before flowing back into Ukraine, where it continues for some 20 km before reaching the Black Sea.

- The Danube (Prut) basin covers about 35% of the country. The Prut River is tributary of the Danube, rises in Ukraine and forms the border between Moldova and Romania, before flowing into the Danube, just after crossing the border into Ukraine. There are a number of small seasonal tributaries of the Danube in southern of Moldova that flow into the Danube after having crossed the border to Ukraine.

- The southern basins cover 8% of the country. Between the Dniester and the Danube basins, several other rivers rise and flow across the border into Ukraine and then into the Black Sea.

The elaboration of the Prut River Basin District Management Plan has as the legal support Water Law nr. 272 of 23.12.2011 which entered into force on 26.10.2013 and the Regulation on the procedure for the management plan drafting and revising, approved by the Republic of Moldova Government Decision no. 866 of 01.11.2013. One of the key objectives of the Water Law, stipulated in its first article, is to prevent further deterioration, protects and improvement of aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands directly depending on the aquatic ecosystems. Water Law and normative documents drawn up in accordance with it serve as support in reforming the system of management of water resources including:

- Developing management plans for water resources in the river basin districts;
- Achieving and maintaining good status of surface water and groundwater;
- Defining five classes of surface water quality taking into account a wide set of chemical, microbiological and hydrobiological parameters;
- Establishment of protection zones located within the river basin district;
- Establishment of environmental objectives;
- Realization of economic analysis of water use taking into account the principle of recovery of costs of water services;
- Taking measures to gradually reduce wastewater discharges, emissions and losses of priority hazardous substances etc.

Management Plan of the Prut river basin district included the following methodology: WFD (Art. 5, Annex 2/1.4), WFD Guidance documents No. 3 (Analysis of pressures and impacts), No. 4 (Identification and Designation of Heavily Modified and Artificial Water Bodies), No. 13 (Overall approach to the classification of ecological status and ecological potential), as well as the Provisions of Water law nr.272 form 23.12.2012 and secondary legislation as well methodology for identification, delineation and classification of SWB, approved by regulation nr.881 from 07.11.2013 Normative Acts of the Republic of Moldova.

In line with Water Law, Dniester District and Prut-Danube and Black Sea District were established (Fig. 3.6) and approved by Government Decision 775/04.10.2013. For each district a committee with consultative role in the elaboration of the Management Plans was established (Government Decision 867/01.11.2013).

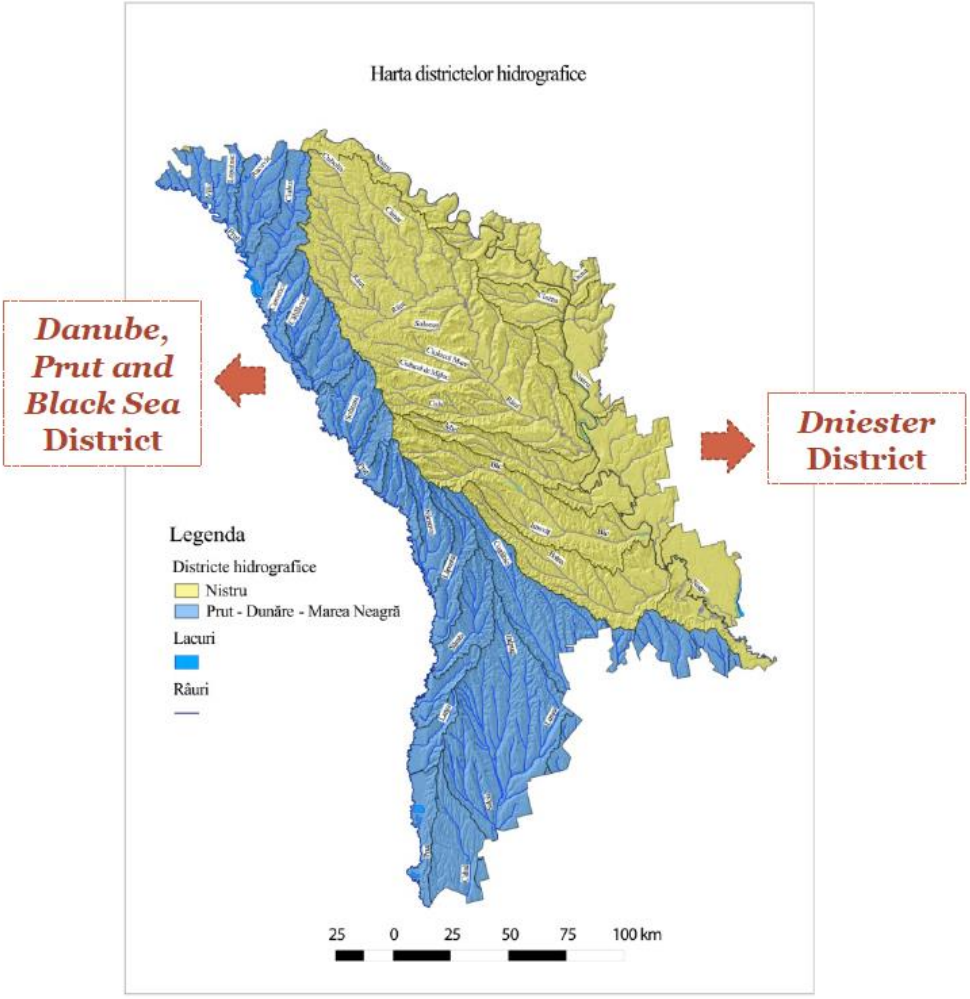


Fig. 3.6 The map hydrographic districts of Moldova

Romania

In Romania, the delineation is made according to the Governmental Emergency Ordinance no. 202/2002 regarding coastal zone management approved with further modification and amendments through the Law no. 280/2003, and in complaince with the methodology concerning the public domain delineation of the state in the coastal zone, since 7 April 2004. One of the first questions that is affiliated with the process management of the integrated coast is: - “How far in to the inland and how far from the shore to the sea must the coastal zone expand”. Even if in Romania it is officially defined, for planning and scientific reasons, in Europe the coastal zone is considered to stretch 12 nautical miles in the territorial sea and a strip of 10 km inland, so it may include the most of the large coastal cities (Fig. 3.7).

The talk about region in the national and international political documents as being “the coastal zone” may be characterized and determined utilizing following criteria: physico-geographic, geologic, social, cultural, ecosystem, economic, administrative and legislative.

Even if in comparison with other countries of the European Union, Romania has only a 244 km of coastal strip, due to its socio-economic importance, as having MPAs and a good strategic position on the east boarder side of Europe, this coastal zone had great importance for Romania.

If till now this delineation hasn't been done, in the present the aim is to have a more stable precision on the principles regarding the delineation and definition of the coastal zone and the assertion measurements for its integrity assurance.

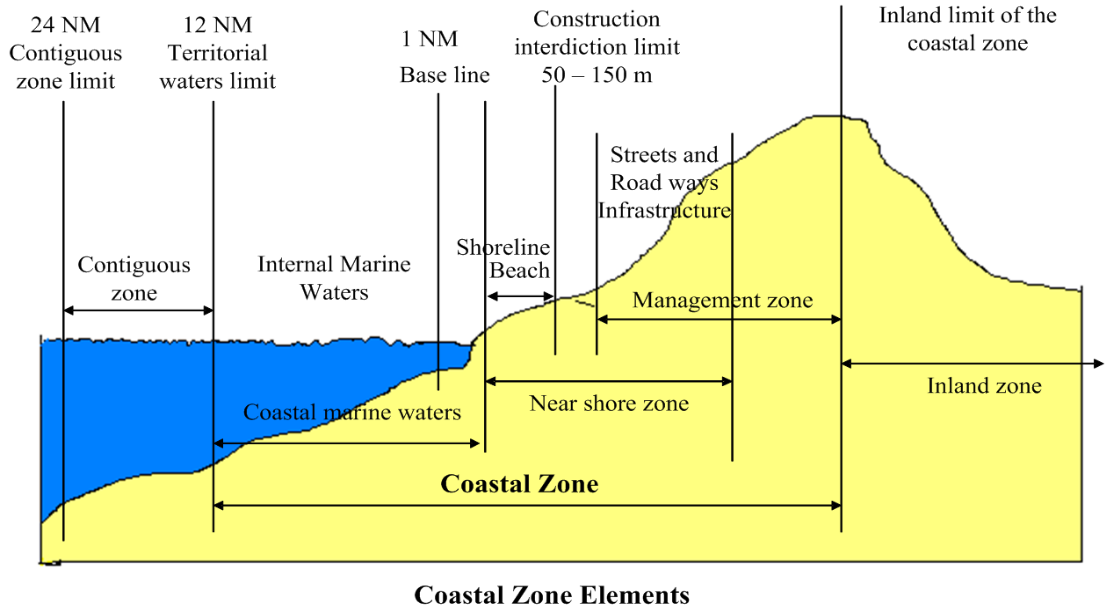


Fig. 3.7 The coastal zone elements *(original)*

The present Study follows the same objective, which intends to support the durable exploitation of the coastal zone, the efforts to integrate environmental requirements in the sector development policies, especially the reconstruction and conservation of this zone, through the delineation of the public and private domain, existing in this space of the Romanian coastal zone.

Based on these conditions and on the legislative implementation requirements concerning the integrated management of the coastal zone, the Dobrogea-Littoral Water Basin Administration has initialized to carry out a study that has as aim the delineation of the public state domain in the coastal zone. Thus, to determine the conditions and rules to ensure the sustainable management of the zone it is necessary to determine the methodology/step of the delineation, unequivocal, of the geographical delineations of the coastal zone specific of the present conditions found at the Romanian shore. The existent institutional frame will expand and emphasize the delineation criteria especially at the interaction between land and sea.

The natural vulnerability of a coastal sector is outlined especially by the intensity/magnitude of the coastal processes. This natural vulnerability is reflected in the variability of the coast line, specifically on the two geomorphologic units of the Romanian coast: the North Sector, delineated by the Chilia Arm and Cape Midia, which includes the Danube Delta Biosphere Reserve, and the South Sector, delineated by Cape Midia and Vama Veche.

Additionally, the coastal system vulnerability is specifically determined on coastline sectors where the intervention of human activities is or is not felt directly: the littoral that is evolving in a natural regime and the littoral that is constructed. Here constructions have been developed in time. The hydro-technical coastal structures and installations are for the economic activities: ports, similar structures or adjacent and for the development and protection of the coastal zone: seawall, revetment, bulkhead and consolidation.

In both cases, the shoreline is considered to be the most important key in the determination process. In this case, it is mentioned in Article 9 of the Methodology/07.04.2004 the following: "From a technical point of view, the delineation of the public domain of the state in the coastal zone will be made on the grounds of position measurements configuration and surface measurements, situated on both sides of the shoreline". On the basis of the above mentioned, the following functional zones that include the areas of interest can be declared:

1. Coastal dry land:

1.30.1. Protected DDBR zones;

1.30.2. Historical monuments: ancient castles;

1.30.3. Industrial/harbor zones: Midia, Constanta South-Agigea, Mangalia;

1.30.4. Tourist zones: Mamaia, Mangalia resorts;

1.30.5. Agricultural/forest zones: Agigea, Eforie South, Tuzla, Costinesti, 23 August, Comorova Forest, Limanu;

1.30.6. Residential arias: Coastal municipal incorporated space;

1.30.7. Military zones: Corbu and Mamaia Sat firing ranges

2. Coastal marine zones

2.30.1. Reserves: Vama Veche Underwater Reserve;

2.30.2. Oil extractions and underwater pipes: Midia continental shelf;

2.30.3. Transport sea routes: for the 3 ports;

2.30.4. Industrial fishing zones: on the whole coast - some have passive fishing, others active;

2.30.5. Tourist navigation: Tomis, Belona, Costinesti and Mangalia ports;

2.30.6. Military navigation: Mangalia and Constanta ports;

2.30.7. Zones with an economical potential that have a series of explicit conflicts of interest, in the economic activities and in the coastline ecosystem component;

2.30.8. Harvesting grounds for mollusks: Shellfish Directive.

Likewise, based on the criteria of use and management, the coastal zone will be classified in the following functional zones, that can be relatively delineated to the coastline position (Article 9 of the Methodology/07.04.2004):

a) In the northern sector - Terrestrial zone

- Strictly protected areas;
- Buffer areas;
- Economic zones;

b) In the southern sector - Terrestrial zone

- Tourist beaches;
- Undeveloped beaches that include dunes and sand vegetation;
- Cliff zones;
- Natural reserves;

c) In the southern sector - Land-sea interface zones

- Ports and related constructions;
- Hydrotechnical constructions - submerged and emerged for the coastline protection;
- Work consolidating cliffs;

d) In the northern and southern sector - Marine zone

- Waterways and harbors;
- Military sector for specific mission - exercises for vessels;
- Shellfish farms.

The maximum limit of public land domain in the sectors mentioned above will be determined taking into account the delineation of functional areas, the need to ensure free public access to the sea/shore line, respecting the law, as well as the specific sector components available:

- Geophysical: crustal movement, subsidence;
- Geological: structural genesis, soil types, mineralogical composition;
- Geomorphologic: erosion/sedimentation, coastline variability;
- Geodynamic: retract/accumulation patterns;
- Hydrodynamic: springs, aquifers;
- Hydrological: precipitation regime, wave-current regime, sea level rise;
- Biological: ecosystems and biotope: Natura 2000 sites, reserves and protected areas;
- Anthropogenic development: Coastal development for navigation and protection.

Although the criteria for delineation of public domain are generally the same as those set out in the legislation in force, only the ones that refer to the sea-land interface have been developed, so the implementation of the legislation phase hasn't started.

In the past project Matra 2004 ”Implementation of the WFD and ICZM in transitional and coastal waters in Romania”, the proposed coastal zone definition and demarcation was made. The proposed coastal zone model in 4 subzones fits well in the ICZM and Water Framework Directive context of Dobrogea-Danube-Black Sea. The applied typology of Impact-Planning-Management-Impact zones promotes linkages and harmonization between sectorial activities. It provides only a start of the combined ICZM and Water Framework Directive approach in Romania. Romanian shoreline and coastal watershed line were produced by using remote sensing images, Romanian register atlas of the rivers (Fig. 3.8) and Topographic maps scale 1 : 100 000 and 1: 50 000. The ***all_polygon*** shape file (Fig. 3.9) was produced by overlapping all the lines shape files (shore, watershed and 50 m elevation).

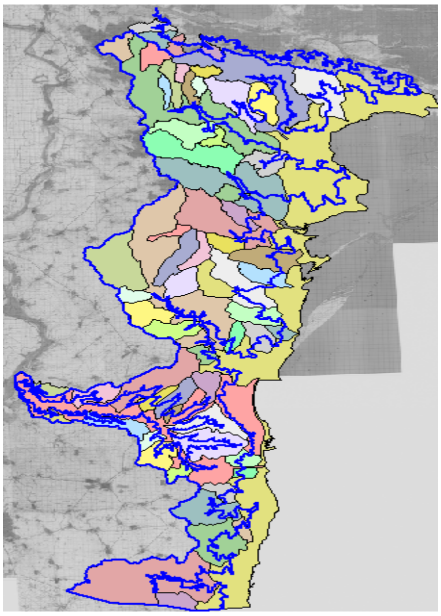


Fig. 3.8 Romanian coastal watersheds *(original)*

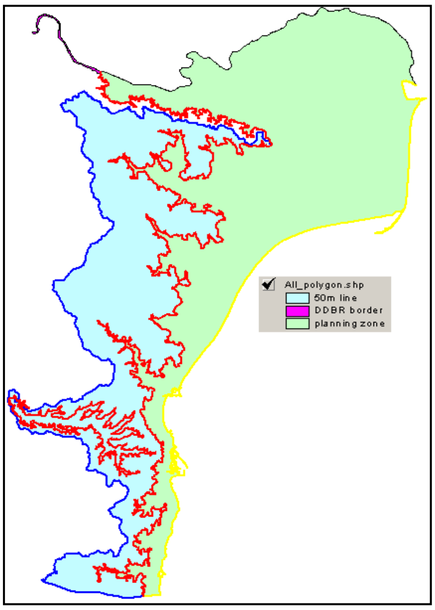


Fig. 3.9. All_polygon shape file *(original)*

Turkey

The Northern Turkish land borders to the Black Sea represent 20.4 % of the total coastline, 1,701 kilometers in total length without islands perimeter (Fig. 3.10).

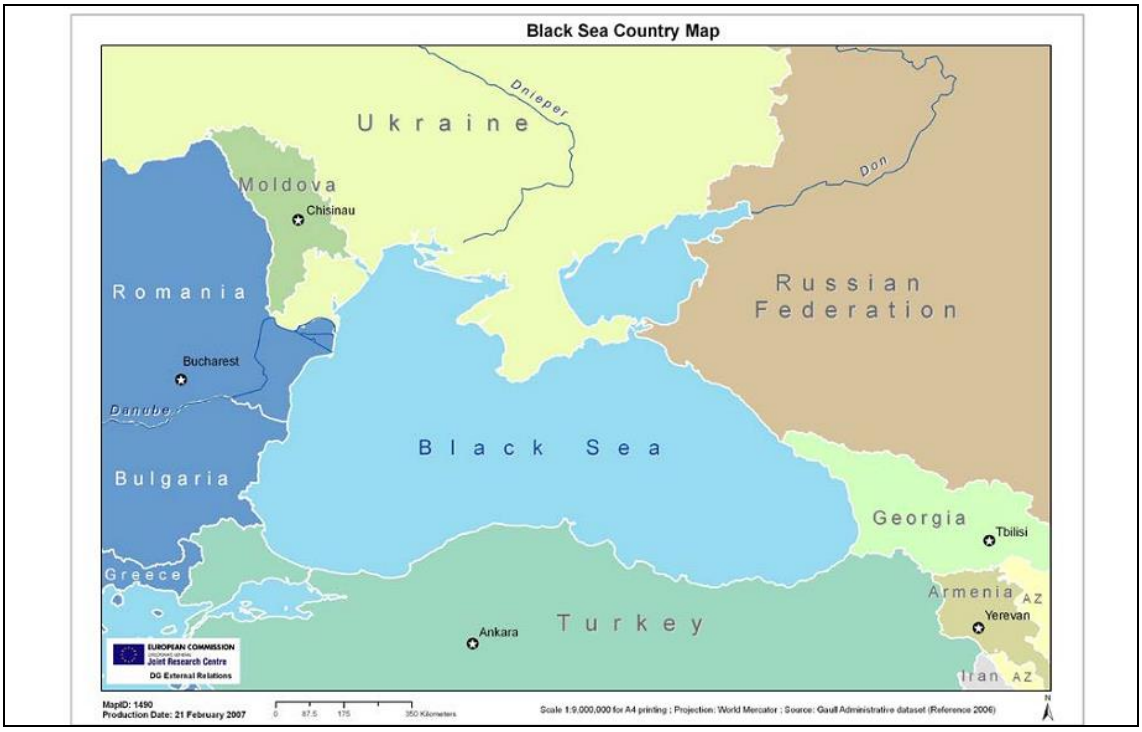


Fig. 3.10 Black Sea country map

Turkey is divided to seven "*geographic regions*" and four of these are named after the sea that they border such as the Black Sea (Karadeniz) Region is often referred to in two parts: the eastern and the western Black Sea regions. This region has very large areas and at a lower level they are the provinces that are basically political (administrative) units. The coastal provinces at the Black Sea region are: Artvin, Rize, Trabzon, Giresun, Ordu, Samsun, Sinop, Kastamonu, Bartın, Zonguldak, Düzce, Sakarya, Kocaeli, İstanbul, Tekirdağ and Kırklareli (Fig. 3.11).

Fig. 3.11 Black Sea coast of Turkey *(source: http://geology.com/world/turkey-satellite-image)*

The boundaries of the provinces have been drawn based on administrative features. The coastal provinces in all cases occupy both coastal and inland land areas. A further administrative division exists within provinces, districts. The boundaries of coastal districts would correlate better with the accepted coastal area definitions. However, most of the information that is important for coastal management is available at the provincial level. Therefore, the use of the coastal management in Turkey, although preferable due to its closer correspondence to the “coastal area” definition, is unfortunately impractical.

The ICZM’s first component included by the BSEP is Delineation of the national coastal zone boundaries or ***delineation of the Black Sea coastal zone of Turkey.***

Ukraine

The Ukrainian coast belongs to two seas: the Black Sea and the Azov Sea, which are very closely linked and should be studied together. The coasts of the Black Sea and the Sea of Azov form the natural boundary of the Ukrainian territories in the south. The Black Sea is the only natural boundary of Ukraine (Fig. 3.12). The coastline of the Black Sea is quite even, except for the Crimean Peninsula, which juts out from the northern coast towards the south and divides the sea into a western and an eastern section. The northwestern coast of the Crimea and the southern shore of the continent enclose the only large bay - Karkinit Bay. The other bays are Kalamitska Bay, on the southwestern coast of the Crimea, and Teodosiia Bay, on the southeastern coast of the Crimea.

A shallow branch of the Black Sea, the Azov Sea is connected to it by the Kerch Strait. It covers a part of the Black Sea Depression lying between the Donets Ridge and the Azov Upland in the north and the foothills of the Crimean Mountains and the Caucasus Mountains in the south. The Sea of Azov is located between mainland Ukraine in the north, the Crimea in the west, and the Kuban region in the east. In the northeast it is bordered by the Don region. The large rivers that flow into the Sea of Azov - the Don River and the Kuban River - connect it with the continental heartland. The Sea of Azov now lies within the borders of Ukraine and the Russian Federation.

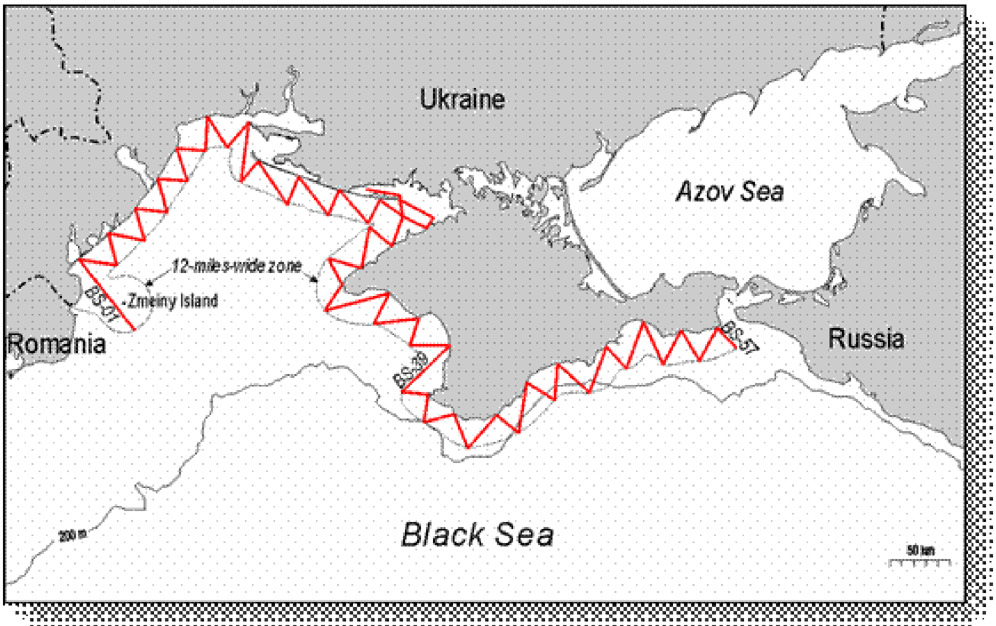


Fig. 3.12 Black Sea coast of Ukraine *(source: http://www.blacksea-commission.org)*

Conclusions. In conclusion, it can be stated that among the BS riverine countries, despite of it diversity of the costal geographical features and cultural visions on the criteria of delineation, the coastal zone delineations should be the subject of a regional debate, and certain of the international practices can be assimilated, based mainly on geomorphological characteristics .

3.3. Natural conditions

3.3.1. Geography

The Black Sea is a continental sea of the Atlantic Ocean. The Bosphorus connects it with the Sea of Marmara, which in its turn is connected with the Mediterranean by the Dardanelles. In the North the Kerch Straits connects the Black Sea with the Sea of Azov (considered a shallow bay of Black Sea). The area of the Black Sea is 420.325 sq.km (462.000 sq.km with the Sea of Azov). The northern most point is the Berezan Liman (46°33’ N) close to Ochakov, the eastern most between Batumi and Poti (41° 42’ E), the southernmost is at Giresun (40° 56’) to the west of Trabzon, and the western most in Bourgas Bay (27°, 27’ E). The maximum length of the Black Sea along the 42° 30’ parallel between Bourgas and Caucasians coast is 1149 km. The depth of the Black Sea increases to the south and reaches its maximum of 2245 m, the average depth being 1271. The Black Sea holds 537.000 c.km of water.

The submarine relief of the Black Sea consists of three concentric rings: the continental shelf, the continental slope, and the basin's core.

The **continental shelf** is the outer, coastal ring, less than 200 m in depth. It slopes gently away from the coast and is covered with terrigenous deposits. It covers about one-quarter of the sea's area and is widest in the northwest and at the Kerch Strait.

The **continental slope** is the ring separating the continental shelf and the basin's core. The incline of the slope usually varies between 5° and 6°. At a depth of about 2,000 m the incline of the slope suddenly decreases, and the slope merges with the basin bottom. The surface of the slope is usually very uneven and is covered with a layer of sticky mud, black on top and light gray underneath. The color is due to ferrous sulfide, which is deposited in the form of very fine grains or thin needles.

The **deep water depression (basin’s core)**, the deepest part of the sea, covers about one-third of the sea's area. It is a flat and featureless plain that descends very gradually to its lowest point of 2,245m in depth. It is constructed of Precambrian deposits interlaid with layers of basalts and granites and covered with a thin layer of very fine silts.

The shoreline of the Black Sea is rather smooth, only the north-western and northern coasts being rugged. The Crimean Peninsula, on the northern coast divides the sea into a western and an eastern section and also 2 major bays - Oddesky and Karkinitsky. The largest bay of the Caucasian coast is Novorossitsk bay; Sinop Bay, Samsun Harbour and Vona Bay are the largest along the Turkish coast. The Bulgarian coast has two major bays - Bourgas and Varna, and Romania - Mamaia Bay.

Islands are rare, the largest ones being Snake’s Island (Zmeiny, Fidinisi in the Sulina inlet of the Danube), Berezan (in the liman of the same name) and Kefken (92 km to the East of Bosphorus and to the North of Kefken Cape).

The coast is divided between Turkey, Bulgaria, Romania, Russia, Ukraine and Georgia (Fig. 3.13).

Fig. 3.13 Black Sea natural conditions and geography *(original map)*

Bulgaria

The length of the Bulgarian Black Sea coastline is 378 km. The altitude of the coast is low - from 0 to 600 m. Dominating are the lower parts which are up to 100 m. They comprise the eastern parts of Coastal Dobrudja, the firths of rivers Provadiyska (Varna-Beloslav), Batova, Kamchiya, Bourgas Valley. The relief in the most northern part is flat and is part of the Danubian Plain. On the territory of Shabla Municipality, the lakes of Durankulak and Shabla are situated with swampy surrounding lands/Ramsar wetlands of international importance. To the south - in Municipalities of Kavarna and Balchik, the steep sea coast of Dobrudja plateau and the Valley of Batova follow. Large part of the plateau is built of solid limestone rocks, forming rock ledges in the coastal zone (mostly north and south of Cape Kaliakra).

In the coast area of Aksakovo, Varna and Avren higher parts follow - Franga and Momino plateau with altitude of 100 to 300 m. South of Franga plateau the Beloslav-Varna fault depression is located. There are two lakes - Beloslav and Varna, which are part of the 30 km long firth. Between Beloslav - Varna depression and Kamchiya River the Momino (Avren) plateau is located. To south the Kamchiya sector of Black Sea coast is located. This sector starts from Avren plateau and reaches the estuary of Fandakliyska River. Here the largest firth valley is developed with the longest sandy beach in Bulgaria - Shkorpilovtzi (11 km). Both firth lowlands - of River Batova (Baltata) and River Kamchiya (Longosa) are occupied by vast forests (protected areas - reserves) and wide sandy beaches.

The Balkan Mountains cross the country reaching to the edge of the Black Sea at Cape Emine, dividing the coastline into a southern and northern part. Parts of Bulgaria's northern Black Sea Coast feature rocky headlands where the sea abuts cliffs up to 70 meters in height. The southern coast is known for its wide sandy beaches. In the Bulgarian territorial waters are five Black Sea Island: St. Anastasia St. Joan, St. Peter, St. Kirik, Jalita and St. Toma.

Moldova

The Republic of Moldova is part of the Black Sea basin countries, as its southern border stretches down close to the Black Sea, the outlet to the sea opening through the Dniester liman and the Danube River. The Republic of Moldova is located in the south-eastern part of Europe at the intersection of Central Europe with Eastern and Southern Europe.

The territory of the country is crossed in the middle by the meridian 28°50' E and the parallel 47° N. The Republic of Moldova is a country situated in the Black Sea and Danube River basins, and neighbored by Ukraine and Romania. The number of population of the Republic of Moldova on January 01, 2013, was 3,559,500 inhabitants.

The territory of the Republic of Moldova is organized in villages (1576), cities (65), districts (32), and two autonomous territorial units - the Gagauzia Autonomous Unit and the Administrative Territorial Unit on the left side of the Dniester.

The Republic of Moldova has modest water reserves. The rivers are part of the Black Sea Basin. The small rivers prevail. The biggest rivers are: Dniester, Prut, Raut, Bic, Botna, Ialpug and others. A few natural lakes are found in the territory of the country. The Moldavian sector of the Danube is approximately 480 m long (http://en.wikipedia.org/wiki/Moldova).

Romania

The Romania Black Sea coastline extends for 244 km and can be divided into two main geographical and geomorphological sectors:

The northern sector (165 km in length) lies between the Musura Bay and Cape Midia and forms a limitrophe shore to the Danube Delta, including the lateral lagoon complex Razim-Sinoe and consisting of alluvial sediments with extensive lowlands marshes and lagoons, and beaches formed of Danube sediments; the contour of the seaward delta front is smooth and nearly linear except for mouths of Sf. Gheorghe and Sulina branches of the Danube.

The southern sector (about 75 km in length) lies between Cape Midia and Vama Veche, subdivided in two sub-sectors: Cape Midia - Cape Singol (characterized by the appearance of the first promontories with active, high cliffs until 35-40 m, separated by large zones with accumulative beaches) and Cape Singol-Vama Veche, where active or inactive cliffs are predominant and only interrupted by beaches at the mouth of the Black Sea tributaries. The south section specific features are dominance of wave-cut relief consists of abrasive and accumulative forms: cliffs, benches, beaches and sandy barriers in front of littoral lakes (Techirgiol, Costinesti, Tatlageac). The cliff comprises Sarmatian and Pontic limestones. It has been transformed as a result of intensive development: ports, coastal protecting structures, urban and touristic infrastructures.

Turkey

The Black Sea region has a steep, rocky coast with rivers that cascade through the gorges of the coastal ranges. A few larger rivers, those cutting back through the Pontic Mountains , have tributaries that flow in broad, elevated basins. Access inland from the coast is limited to a few narrow valleys because mountain ridges, with elevations of 1,525 to 1,800 meters in the west and 3,000 to 4,000 meters in the east in Kaçkar Mountains, form an almost unbroken wall separating the coast from the interior. The higher slopes facing northwest tend to be densely forested. Because of these natural conditions, the Black Sea coast historically has been isolated from Anatolia.

Mountain ranges run parallel to the coast along the Black Sea coast, especially in the eastern part, limiting the size of the coastal area to extreme minimums on one hand and bringing a marked influence on the climatology of the region on the other. As the winds over the Black Sea prevail dominantly from the northern sectors, the Turkish coast is often the down-wind side. The humidity brought by the marine winds consolidates over the mountainous slopes and fall as precipitation, making the Black Sea coast (especially the eastern part) the most humid region of Turkey.

The North Anatolian Mountains in the north are interrupted chain of folded highlands that generally run parallel to the Black Sea coast. In the west, the mountains tend to be low, with elevations rarely exceeding 1,500 meters, but they rise in east direction to heights greater than 3,000 meters south of Rize. Lengthy, through-like valleys and basins characterize the mountains. Rivers flow from the mountains toward the Black Sea. The southern slopes - facing the Anatolian Plateau - are mostly unwooded, but the northern slopes contain dense growths of both deciduous and evergreen trees.

In the western part of the Black Sea in Turkey are Strandja Mountains where the provinces of Kırklareli and Tekirdağ are located. The Strandja Mountains run parallel along the Back Sea Coast. Mahya Mountain is the peak with 1,031 m in Kırklareli. Rivers within the Ergene basin are born from these mountains. The Strandja Mountains are also known for their flood-plain forests that have unique, rich and diverse flora and fauna. Igneada Longoz floodplains have a national park status in Turkey.

Ukraine

The Black Sea shoreline within Ukraine is 1,628 km long, and the shelf area is 55,750 km^2 (Shuisky, 1989). So, the Ukrainian shoreline makes 37% and the shelf - about 57% of the entire Black Sea (Zaitsev, 1992). The total length of the state border of Ukraine from the Danube estuary to the Taganrog inlet coast in the Sea of Azov equals 1,355 km, which makes one fifth part of the entire state border of Ukraine, specifically: in the Black Sea - 1,056.5 km; in the Sea of Azov – 249.5 km; in the Kerch Strait - 49 km. According to its structure, 46% of the Ukrainian coast is represented by plain-type coasts; 41% of the coast is of accumulative type; and 13% - are mountainous coasts – the Crimea peninsula (Shuisky, 1990). In Ukraine there are 14 main limans and estuaries of the total area 1,952 km^2, and 8 inlets of 6,350 km^2 water areas (Yemelyanov et al., 2004). One of the physical and geographical features of the Ukrainian shelf is its rugged coasts which form a number of shallow inlets: Jebrian, Odessa, Yegorlyk, Tendra, Jarylgach, Karkinit, Kalamit and Feodosiya inlets in the Black Sea, and Obitochna, Berdiansk, Belosaray and Taganrog inlets in the Sea of Azov.

The coastline of the Black Sea is quite even, except for the Crimean Peninsula, which juts out from the northern coast towards the south and divides the sea into a western and an eastern section. The northwestern coast of the Crimea and the southern shore of the continent enclose the only large bay - Karkinit Bay. The other bays are Kalamitska Bay, on the southwestern coast of the Crimea, and Teodosiia Bay, on the southeastern coast of the Crimea. The northwestern coast of the Black Sea is low and intersected by rivers, the largest of which are the Danube River, Dnister River, Boh River, and Dnieper River. The Danube Delta is low and muddy. Steep cliffs of the Black Sea Lowland, intersected by ravines and limans, stretch north from the Danube to the mouth of the Dnieper. The largest limans are those of the Dniester, Boh, and Dnieper rivers, and they are connected with the sea. Smaller limans lose so much water by evaporation that they form closed saline lakes. East of the Dnieper Estuary the cliffs gradually diminish and turn into gently sloping sand beaches. On this part of the coast the largest spit—Tendriv Spit - is located. The northwestern coast of the Crimea is low and abounds in lakes and lagoons. The southwestern coast of the Crimea runs perpendicular to the Crimean Mountains. It is partly submerged and forms a picturesque riss shore. The southeastern coast of the Crimea runs parallel to the mountains, which fall steeply into the sea. A narrow beach stretches between the mountains and the sea and widens out somewhat at the mouths of mountain streams. The eastern coast of the Black Sea is at first low and flat along the Taman Peninsula and then becomes mountainous towards the south.

3.3.2. Climate

The major air factors are air temperature, humidity, precipitation and wind regime, all together determining the characteristics of local climate and affecting the coastal development. The Black Sea region is situated in the transit area between moderate temperate and subtropical zones. The southern slopes of Crimean mountains, southern coast of Bulgaria and the Rumelian coast of Turkey are in dry subtropics of the Mediterranean type, the Anatolian coast lie within humid subtropics, the western part of Black Sea coast has temperate moderate climate, the eastern part of Ukrainian coast- temperate continental climate.

Annually the sea receives about 100 kilocalories of solar heat per 1 cm^2, irregularly distributed between north and south part.

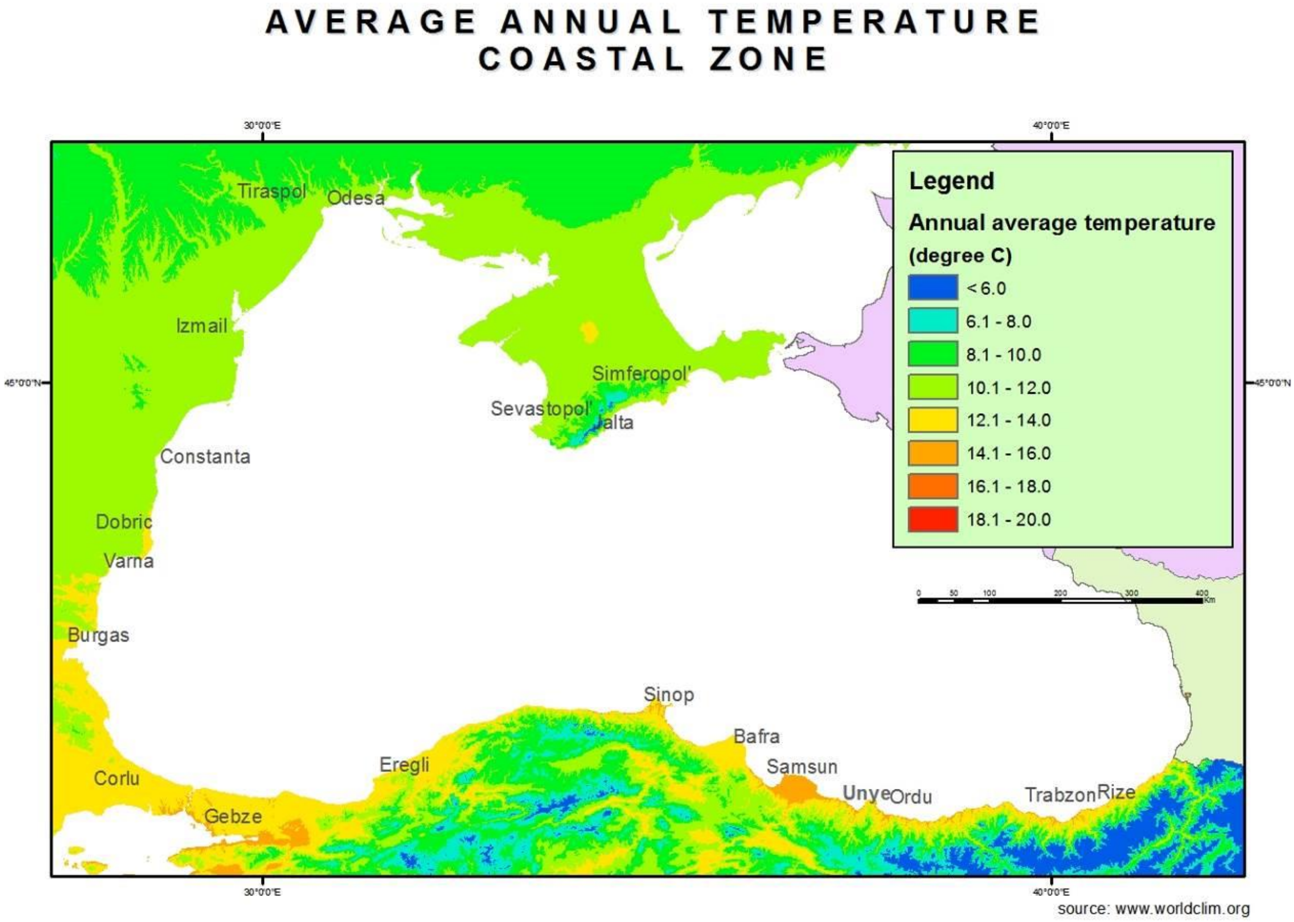


Fig. 3.14 Average annual temperature in the Black Sea coastal zone *(original map)*

Average air temperatures generally grow from North-West to South East from ~ 10°C at Ochakov to ~ 14.5-15°C at Giresum Station and Rize, Samsun (Turkey). The absolute maximum was observed in the Danube Delta in the north part + 36°C, the absolute minimum being -28°C; the correspondent temperatures on south-eastern coasts (Turkey) are 40°C and -8°C. The warmest month is July (average over a multi-year period grows from north to south from -2° to 8°C) and the coldest January (average over a multi-year period grows from north to south from 22° to 24°C) (Fig. 3.14). The yearly-average values of relative air humidity above the sea level and the coast are 70-80%.

Precipitation falling on the Black Sea surface is distributed unevenly. Maximal precipitation occurs in the South east - up to 2500 mm/yearly in Rize (Turkey), decrease westwards - along the Anatolian coast of Minor Asia and further to the north along the western coast of the Black Sea: 1374 mm/year in Giresun, 754 mm/year in Sinop, 680 mm/year in Istanbul (Turkey), 502 mm/year in Varna (Bulgaria) and 365 mm/year in Sulina (Romania).

In accordance with the general circulation pattern over Europe the dominate winds are from North West, North and North-East with summary recurrence over 50%. From Danube Delta to south to the Bosphorus Strait, the North and East winds are most common. In winter the Anatolian coast are affected by South-Western and South-Eastern winds. The yearly average wind velocity does not exceed 7 m/s in the coastal zone, the maximal multi-year average values being registered in the Danube Delta and Tarkhankut Cape, in the Kerch Strait, along the Romanian and Bulgarian shore. The direction of strongest winds (over 15 m/s) generally coincides with that of dominating winds. Maximal winds velocity have been registered in the area of Tendra Spit (41 m/s), Sevastopol, Novorossiiysk, Poti, Sinop, Eregli, Constanta and Varna (over 40 m/s).

3.3.3. Ecosystems

Its size, geographical, geological and ecological peculiarities render the Black Sea the character of Large Marine Ecosystem (LME).

The Black Sea ecosystem is highly productive and offers many goods and services for recreation, food, pharmaceuticals, mining and navigation. This impact of uses on the ecosystem, and especially the impact of fisheries, is the key-task for the sustainable development of the marine environment. On a larger time scale, the ecosystem is affected by global climate changes, which will probably influence many aspects of fish distribution, dynamics and abundance of fisheries resources. The majority of fish species having economic value are shared in the Exclusive Economic Zone (EEZ) of several states (sprat, whiting, dogfish, turbot etc.) or are migratory (anchovy, horse mackerel, bluefish, bonito etc.), having spawning, foraging and wintering areas located in different areas of the Black Sea.

At the same time, the recent history of the Black Sea showed, probably more than elsewhere, a tight inter-dependence between fish stocks, eutrophication, pollution, climate changes, habitat changes and opportunistic settlers

During the last three decades eutrophication has been identified as a key ecological problem for the coastal Black Sea regions and especially for its northwestern part where strong anthropogenic nutrient and pollution loads resulted in dramatic alterations in chemical and biological regimes. Eutrophication refers to undesirable disturbances in ecosystem functioning due to anthropogenic enrichment by nutrients and subsequent accelerated growth of algae and higher life forms. Rapidly intensifying eutrophication in the 1970s and 1980s transformed the formally diverse ecosystem with a rich variety of marine life into a degraded system with marked changes in composition and abundance at species level, and species communities and their interactions at the ecosystem level. In addition to eutrophication, other high priority transboundary ecological problems are the decline in living resources (mostly fish stocks), chemical pollution, biodiversity change, habitat destruction, alien species invasions, climate-change impacts, and mesoscale variability of the circulation system (Oguz et al., 2007).

Phytoplankton. The annual-mean phytoplankton biomass over the Ukrainian, Romanian and Bulgarian shelf waters (Fig. 3.15) experienced a decreasing trend from ~10 gm-3 during the late 1980s and the early 1990s to less than 4 g m^{-3} during the 2000s. Relatively high values greater than 20 g m^{-3}, however, occasionally measured in hot spot regions along the entire coast, an example of which is shown in Fig. 3.15 near Batumi (Georgia) in 2005. A decreasing trend of phytoplankton biomass from 20 g m^{-2} to 4 g m^{-2} was also observed in interior basin up to 2002 followed by an increase to more than 10 g m^{-2} in the subsequent years (Fig. 3.16). Assuming that phytoplankton biomass in western coastal waters is homogeneous over 10-15 m layer, its integrated biomass of 40-60 g m^{-2} is roughly five-folds higher than the interior waters biomass that imply extensive ongoing phytoplankton production within the inner shelf waters of the western basin. On the other hand, a two-fold increase in species diversity from roughly 20 to 40 (Fig. 3.17), decreasing phytoplankton: zooplankton biomass ratio (Fig. 3.18) together with diminishing bloom frequency and tendency of shift of annual maximum algal development from summer to the classical spring and autumn forms during the present decade indicate a tendency of algal community towards its normal status. In fact, the shifts in phytoplankton taxonomic composition have become more and more evident since 2000. The blooms of non-traditional species (*Dactylosolen fragilissimum*, *Pseudosolenia calcar-avis*, *Akashiwo sanguinea*, *Emiliana huxleyi*, microflagellates) are more frequently observed and a high number of new species have successfully adapted to the Black Sea environment, some of them however potentially toxic.

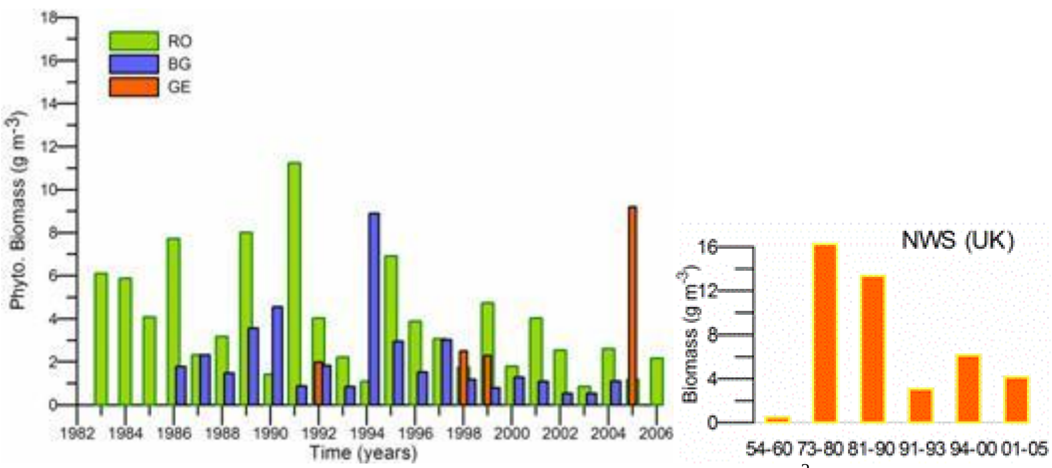


Fig. 3.15 Long-term variations of annual-mean phytoplankton biomass (g m^{-3}) averaged over all stations in the Romanian (RO), Bulgarian (BG), Georgian (GE) shelves as well as the coastal northwestern sector of the Ukrainian shelf *(NWS-UA, after Nesterova, 1987)*

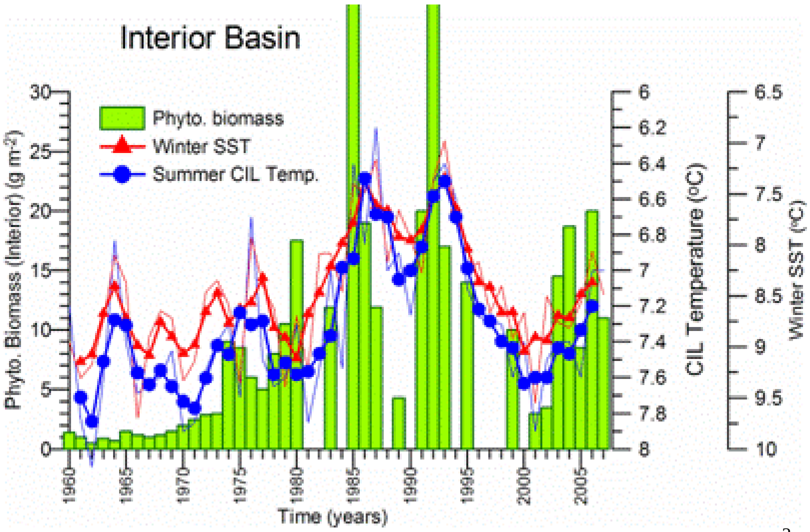


Fig. 3.16 Long-term variations of summer-autumn mean phytoplankton biomass (g m^{-2}) *(vertical bars; after Mikaelyan, 2005)*, the mean CIL temperature (^{o}C) *(blue dots; after Belikopitov, 2005)* averaged over all stations within interior basin and mean winter (December-March) sea surface temperature (SST) as an average of Hadley, NCEP-Reynolds and Pathfinder data sets. The phytoplankton biomass is expressed in terms of euphotic zone integrated values.

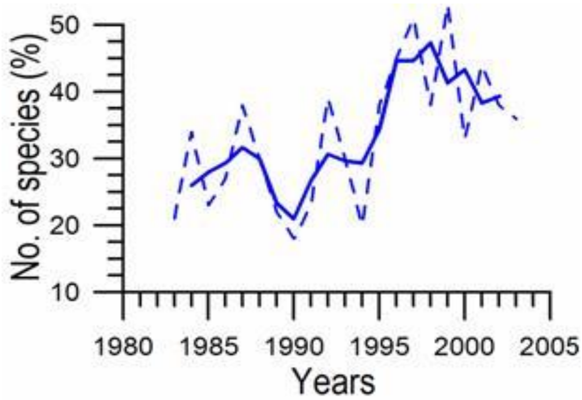


Fig. 3.17 Long-term changes in species number contributing to annual phytoplankton biomass along the Bulgarian coastal waters *(after Moncheva, 2005)*

Diatom/dinoflagellate biomass ratio is normally considered as an indicator for the change in phytoplankton taxonomic structure. Its classical spring-summer value of 10:1 for an undisturbed system was used to be maintained in the Romanian coastal waters during the 1960s and 1970s by 92% and 75% contribution of diatoms, respectively. This ratio then altered in favor of dinoflagellates during the 1980s when its biomass constituted almost 60-70% of total phytoplankton (Fig. 3.17). The diatom constituted more than 50% of the total phytoplankton during the 1990s whereas dinoflagellates became the dominant group again during the recent decade. Similar changes were also observed in the Bulgarian coastal waters and within the interior basin.

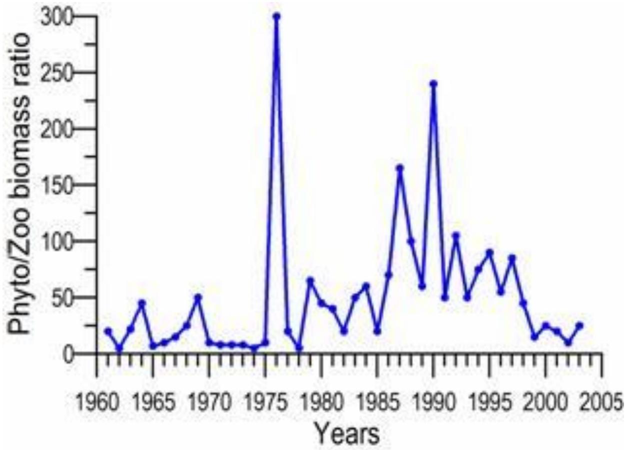


Fig. 3.18 Long-term changes annual-mean phytoplankton to edible zooplankton biomass ratio along the Bulgarian coastal waters *(after Moncheva, 2005)*

The shift in phytoplankton species composition from diatom (siliceous) to dinoflagellates (non-siliceous) during the 1980s is consistent with the decreasing silicate concentration and thus reduction in Si:N ratio of the Danube nutrient load during the 1980s. As the Danube SiO_4 load increased in the 1990s, diatoms were no longer limited and started dominating the community structure against dinoflagellates. In the present decade, decreasing SiO_4 load (except 2005) led to domination of the community structure by dinoflagellates again. Furthermore, cooler (warmer) spring-summer conditions in the 1980s (1990s) provide growth advantage for dinoflagellates (diatoms). The phytoplankton data from the interior basin indicate domination of phytoflagellates and coccolithophores in the annual bloom structure during the present decade. The species shift towards carbonate-producing coccolithophores in coastal waters during May-June has significantly affected sea water chemistry in terms of alkalinity and pH. Predominance of small-sized flagellates during the recent years may be a major reason for the proliferation of gelatinous zooplankton (E.g. *Noctiluca scintillans*) at the expense of edible mesozooplankton and fish eggs and larvae.

Trends in phytoplankton biomass may not always be a firm indicator for the state of eutrophication due to strong modulation of bloom intensity and species structure by climate-induced changes (Fig. 3.19). For example, anthropogenic-based nutrients that were accumulated into the subsurface waters of the interior basin and/or sediments of the shelf waters are brought into the surface layer more effectively in cold winters that then promote more intense new production-based spring blooms and subsequently stronger regenerated production in summer months. This is clearly shown by the correlation between increasing and decreasing trends of interior basin phytoplankton biomass and the cooling and warming phases of the mean May-November CIL temperature during the 1980s and 1990s, respectively. The subsequent increase of phytoplankton biomass in 2003-2007 may also be explained by the recent climatic cooling trend. Moreover, the phosphorus limitation constitutes as an additional factor for the decrease of phytoplankton biomass along the western coastal zone during the 1990s and the present decade. Even if the phytoplankton biomass has been improved recently, it does not indicate a stable structure; instead it implies a transitional phase with fragile ecological conditions under relatively high nutrient concentrations.

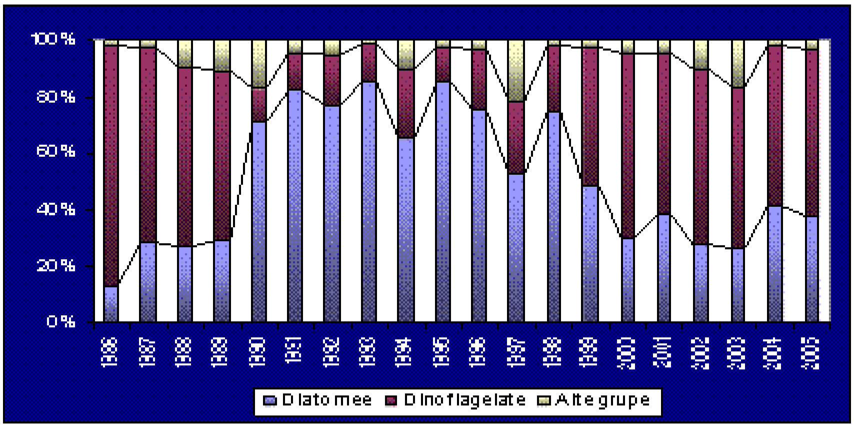


Fig. 3.19 Long-term change in percentage of biomass of main algal groups in Constanta monitoring station during 1986-2005 *(after Boicenco)*

Bacterioplankton. The annual-mean bacterioplankton abundance within the northwestern shelf during 1979-2008 (Fig. 3.20) resembles closely the long-term changes in phytoplankton biomass. It reveals an increasing abundance from the average value of 1.2 million cells ml^{-1} during the late 1970s and the early 1980s (the range: 0.3-2.6 million cells ml^{-1}) to 3.3 million cells ml^{-1} (the range 1.0-7.3 million cells ml^{-1}) in 1990-1991. It was followed by an abrupt drop to ~2.5 million cells ml^{-1} in 1993-1994 and a steady decreasing trend to 1.5 million cells ml^{-1} up to 2008. The average bacterioplankton abundance was therefore reduced during 2003-2008 by more than twice with respect to 1990-1992. This reduction was most likely caused by the decrease in total concentration of autochthonous and allochthonous organic matter that are more easily assimilated by bacteria; thus implying a reduction in organic pollution in the northwestern Black Sea. This should be connected to the decrease in the intensity of algal blooms and lower mortality rates in bottom fauna. Higher abundance was particularly observed in the vicinity of Danube delta. The measurements in the Bulgarian coastal zone also showed a stable annual abundance remained around 1.0 million cells ml^{-1} since 1994. The NWS bacterioplankton abundance (Fig. 3.21) attains lowest values in winter (January-February) and highest in summer under high organic matter accumulation in water column. During the intense eutrophication phase (1983-1997), abundance greater than 2 million cells ml^{-1} prevailed from March to October with the highest population close to 3 million cells ml^{-1} in August. During 2004-2007, maximum abundance reduced to 1.5 million cells ml^{-1} and summer abundances varied around 1 million cells ml^{-1} from April-to-September.

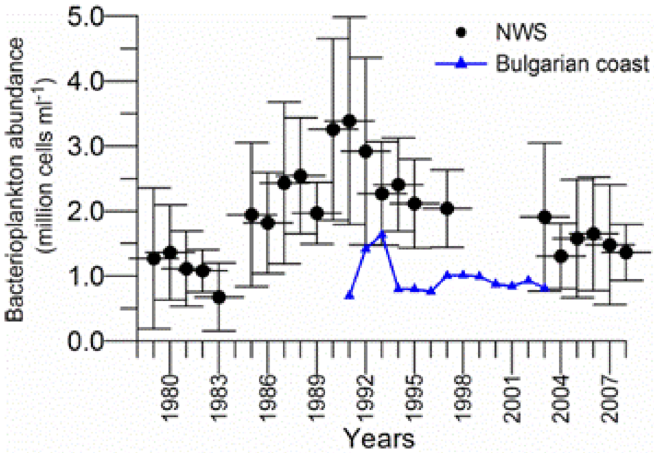


Fig. 3.20 Long term annual-mean changes of bacterioplankton abundance in the surface layer of northwestern and Bulgarian coastal waters *(redrawn from Kovalova et al., 2008)*

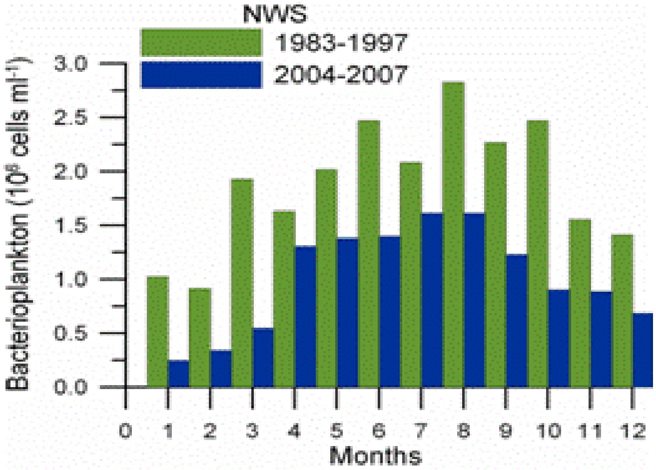


Fig. 3.21 Long term monthly-mean changes of bacterioplankton abundance in the surface layer of northwestern coastal waters in the Black Sea *(redrawn from Kovalova et al., 2008)*

Fodder Zooplankton. The annual-mean fodder zooplankton biomass formed by averaging of the Ukrainian, Romanian and Bulgarian data sets exhibited a declining trend from ~300 mg m^{-3} in 1960 to 20 mg m^{-3} in 1990, persisted this level up to 1995, and then fluctuated interannually within 50-200 mg m-3 range during 1996-2004 (Fig. 3.23). These fluctuations were mostly provided by the intermittent recovery of edible zooplankton (up to ~300 mg m^{-3}) within the Romanian shelf contrary to only a slight improvement (~100 mg m^{-3}) in the Ukrainian NWS and the Bulgarian shelf. According to this amalgamated data, the highest biomass registered within 1996-2004 was almost half of the biomass attained prior to the 1970s.

On the other hand, fodder zooplankton biomass followed a different track of changes in the northeastern basin; it fluctuated around 10.5 g m^{-2} during 1960-1990, maintained its minimum level (2.0 g m^{-2}) during 1991-1993, and then experienced a pronounced rising trend to 20 g m^{-2} in 2000-2004 and 25.0 g m^{-2} in 2005-2008 (Fig. 3.22). Its values during the present decade were the highest ever registered since the 1960s. Assuming that zooplankton population is uniformly distributed within the upper 50 m layer, integrated biomass of the western coast during 1996-2004 varied between 2.5 and 7.5 g m-2 that were comparable with the Cape Sinop, but substantially lower than the northeastern basin (Fig. 3.23).

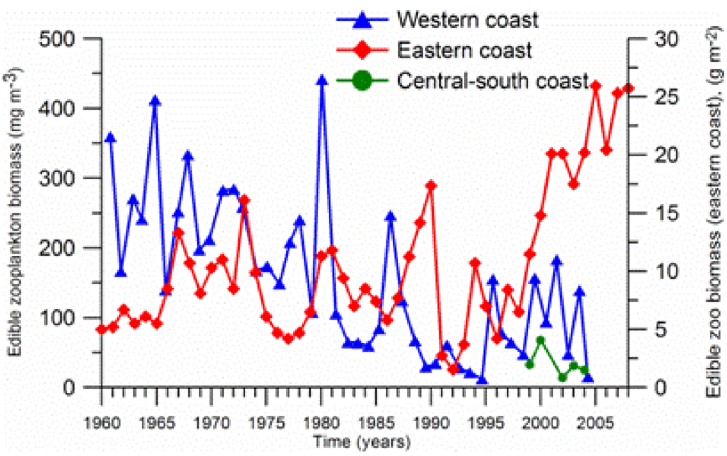


Fig. 3.22 Long-term variations of the annual-mean fodder zooplankton biomass in the northeastern basin (g m^{-2}) and the western coast (mg m^{-3}) obtained by averaging the Romanian, Bulgarian, and the northwestern Ukrainian data sets. Also included for comparison is the edible zooplankton biomass (g m^{-2}) measured near the Cape Sinop in central part of the Turkish coast *(after Shiganova et al.).*

Although fodder zooplankton biomass has not yet increased to a level observed in the 1970s in the NWS and western coastal waters, its community was partially recovered in terms of species diversity. The community structure was re-organized by an increase in abundance and biomass of copepods and cladocerans, such as *A. tonsa*, *P. mediterranea*, *C. euxinus* and *A. patersoni* which were almost absent during 1980s-1990s. The extinct species *P. mediterranea*, being an indicator of non-eutrophic waters, has re-appeared since 2000 as a sign of positive ecosystem changes. Similar changes were also noted within the northeastern basin.

Fig. 3.23 depicts the distribution of the summer edible zooplankton biomass over the basin based on the compilation of all the available data during 1954-1995. It reveals considerable patchiness in accord with the meso-scale circulation structure. Biomass variations follow closely meanders of the Rim Current with higher biomass within coastal anticyclonic eddies at onshore side of meanders. Its most distinctive example is shown near the southeastern corner of the sea occupied by the well-known quasi-permanent Batumi gyre.

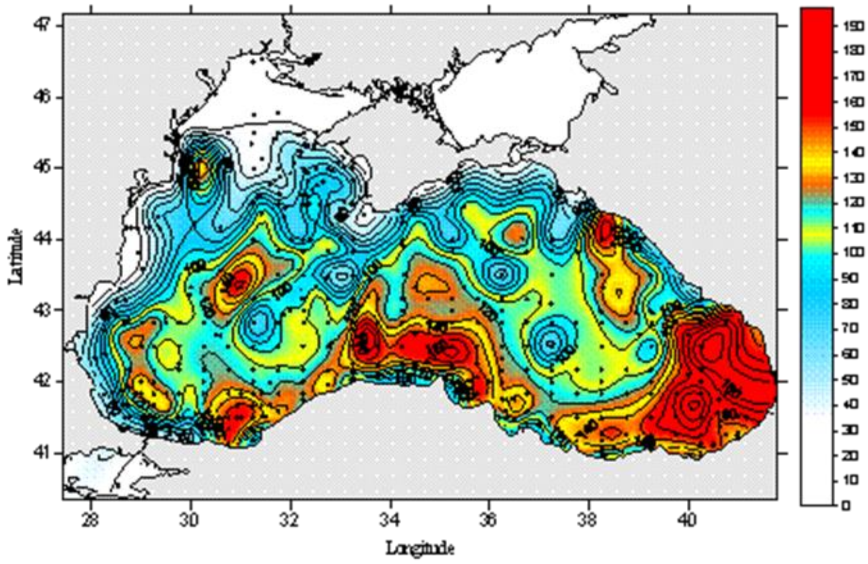


Fig. 3.23 Distribution of summer edible zooplankton biomass (mg m-3) during 1954-1995 *(after Temnykh, 2006)*

Gelatinous zooplankton. According to recent observations (1998-2004), *Mnemiopsis* biomass had a decreasing trend following its population control by *Beroe* after 1998. Nonetheless, *M. leidyi* can occasionally be abundant in the northwestern and western coastal waters (Fig. 3.24), in contrast to deeper part of the western shelf and the northeastern basin where the share of *Aurelia aurita* was increased due to its competitive advantage under low *Mnemiopsis* populations. As one of the worst cases, edible zooplankton biomass in the Danube delta region constituted only 10% of the total zooplankton structure during 2003-2007; the rest was dominated by the combination of *Mnemiopsis, Aurelia* and the opportunistic species *N. scintillans*. On the premise of low fodder zooplankton and high gelatinous and opportunistic species, the western-northwestern inner shelf waters therefore do not show a stable zooplankton structure within the present decade, but a sign of recovery of mesozooplankton community structure is well-marked within the northeastern basin.

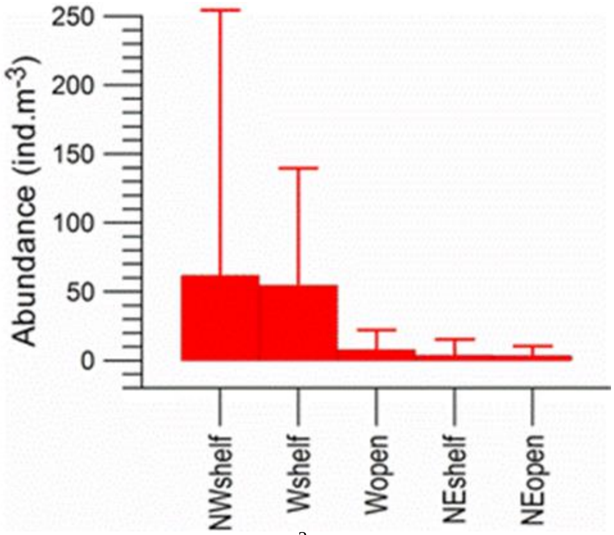


Fig. 3.24 Mean *Mnemiopsis leidyi* abundance (ind.m^{-3}) in the Northeastern (NE), North-Western (NW), and Western (W) Black Sea inshore and offshore waters during the summer 1998-2004
(redrawn from Kamburska et al. 2006)

As for the long-term variations of phytoplankton, zooplankton biomass and community structure also appear to be strongly regulated by climatic variations. Relatively mild years with warmer winter temperatures favor more efficient *Mnemiopsis* and fodder zooplankton growth, whereas severe years with colder winter temperatures limit edible zooplankton production albeit producing stronger spring phytoplankton blooms and promote more favorable *N. scintillans* and *A. aurita* development. The spring temperature conditions are particularly critical for the intensity and species succession of zooplankton production. *Mnemiopsis* attained higher biomass when August surface temperature was relatively high as in the case of 2000-2001 and 2005 or lower biomass as in the case of relatively cold August temperatures during 1996-1998 and 2003-2004.

Macrophytobenthos. The red algae *Phyllophora* field in the northwestern shelf was known to be one of the most extensive macrophytobenthos habitats in the world. It was not only an important generator of oxygen but also the nucleus of benthic community involving more than 100 species of invertebrates and more than 40 species of fish. Following the deterioration of environmental conditions since the early 1970s as a combination of reduced transparency, lifting of mud particles in the water column during bottom trawling and hypoxia, the settlement size and stock of the *Phyllophora* field reduced from about 9 million tons to 8 thousand tons in 2000. *Phyllophora* harvesting therefore ceased practically after 1996. The recent observations indicated a sign of their re-establishment within the outer shelf whereas no apparent recovery has yet been evident close to the mouths of Danube and Dniester Rivers in particular and shallow coastal zone of the NWS in general. Its total harvesting of 0.5 thousand tons during the recent years had no significant commercial value, but suggests their ongoing degradation. A similar deterioration of *Phyllophora* biomass also continues along the northeastern coastal zone. For example, its biomass of 1.4 kg m^{-2} along 20 m isobath during the 1970s reduced to 0.5 kg m^{-2} during 1998 and disappeared during 2005 (Fig. 3.25). The same also holds in shallower regions.

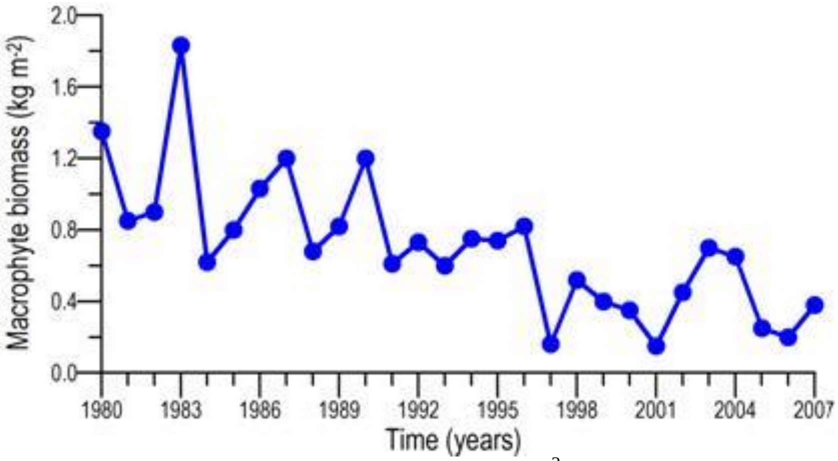


Fig. 3.25 Long-term change of total macrophyte biomass (kg m^{-2}) in the northwestern shelf dominated by small, opportunistic species *(after Minicheva)*

Due to intense eutrophication, the *Cystoseireta* phytal zone has been reduced to a narrow inshore strip shallower than 10 m due to the lack of sufficient light for photosynthesis in deeper regions. Beyond 10 m depth zone, large perennial macrophytes with a thick talus and longer life cycle were replaced with a few small branchy, filamentous, opportunistic-type algae species having rapid growth but relatively short life cycle. Nevertheless, the overall biomass of opportunistic species group had a declining trend by the beginning of 1990s and their present level suggested a three-fold reduction (Fig. 3.25). Similarly, along the northeastern coast, *Cystoseira* fields that were used to stretch up to 20-30 m in the 1970s with biomass >3.0 kg m-2 were limited into the innermost 5 m zone during the 1980s (Fig. 3.26). The present status shows a slight recovery at depths shallower than 10m zone. Floristic diversity of macrophyte communities in Zernov's *Phyllophora* field started increasing even though the tendency of increase in *Ochrophyta* species is minor with respect to ongoing intensive development of ecologically active filamentous algae in relation to the increase of transparency and availability of high nutrient content in the bottom sediments (Fig. 3.27). In spite of such positive signs, it is still difficult to assert an appreciable basin scale restoration. Full recovery of historical *Phyllphora* field is still not evident. Its coverage both in winter and summer is less than 10% with respect to the pristine state, and its role as habitat was taken over by filamentous algae.

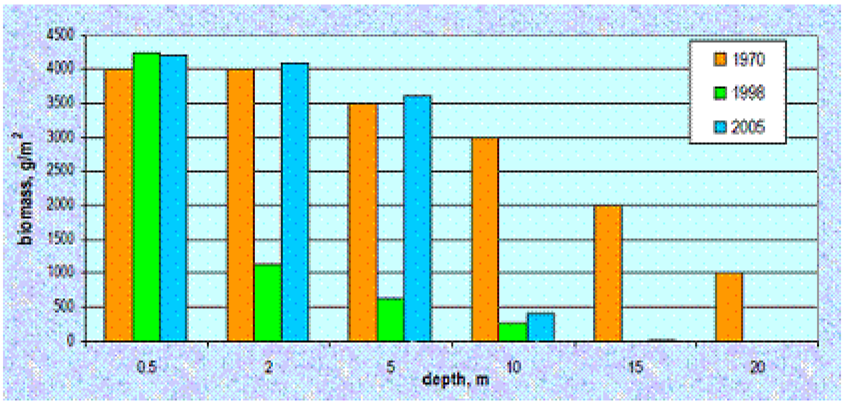


Fig. 3.26 *Cystoseira* spp. biomass at different depths along the northeastern coastal zone during 1970, 1988 and 2005 *(after Kucheruk, 2006)*

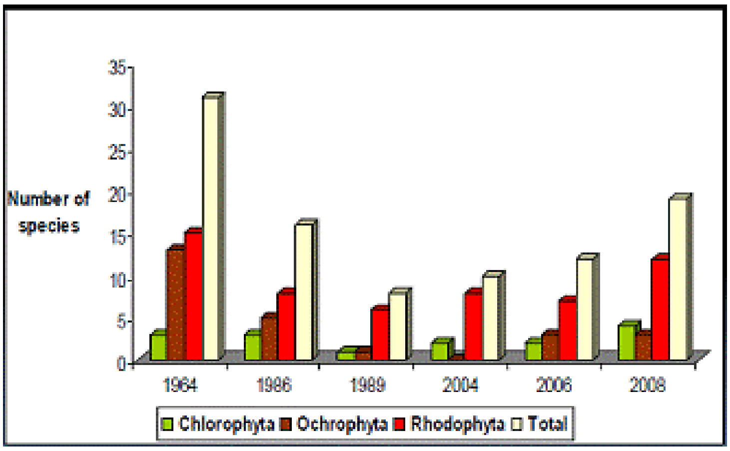


Fig. 3.27 Changes in floristic diversity of macrophyte communities in Zernov's *Phyllophora* field *(after Friedrich et al., 2008)*

Macrozoobenthos. The most notable changes in zoobenthos community of the 1980s and 1990s in response to intensifying eutrophication and sustained organic enrichment of sediments were lower species diversity, reduced abundance and biomass of benthic populations, and thus a more simplified community structure dominated mostly by opportunistic and invasive species with high total abundance but low total biomass, increasing role of hypoxia-tolerant groups (bivalve mollusks), high fluctuations of populations. Despite such severe changes, observational studies since the mid-1990s were limited and were based on random samplings with irregular periodicity. The measurements suffered from deficiencies in sampling quality and processing, organism identification, lack of general consensus on benthic biodiversity methodology, and insufficient experts. Therefore, the current state of knowledge on the existing state of zoobenthos structure involves many uncertainties to make a reliable assessment.

Available data for the western shelf suggest a slight improvement of zoobenthos community structure in terms of species number during the last 10 years (Fig. 3.28).

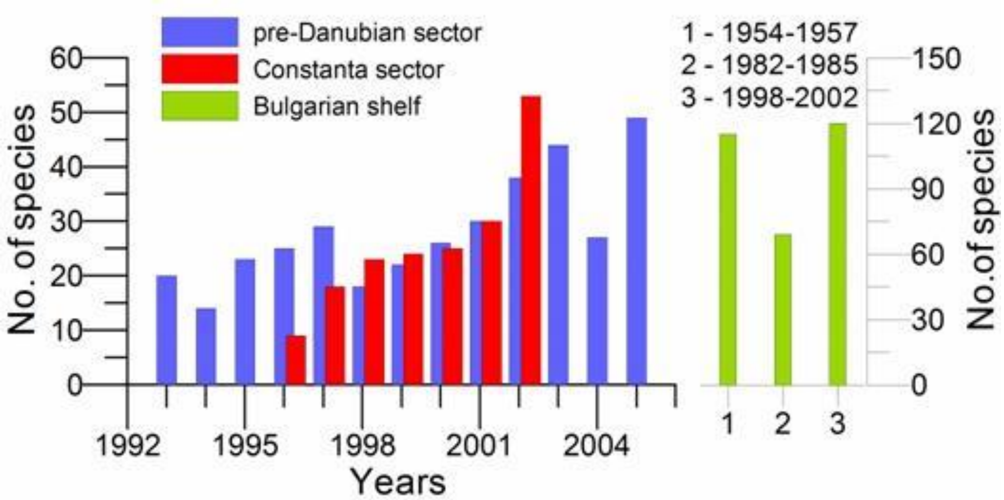


Fig. 3.28 Temporal changes in species diversity of total macrozoobenthos community in the Romanian pre-Danubian and Constanta sectors (left) and the Bulgarian shelf (right) *(after Abaza, Todorova et al.)*

Some species sensitive to hypoxia which became almost extinct started re-appearing. But, the recovery of the crustaceans is incomplete despite their population increase. The mussel *Mytilus galloprovincialis* population seems to grow under more favourable conditions as they can sustain more than one year life cycle. The current abundance level of opportunistic mollusks species, the predatory gastropod *Rapana venosa*, the bivalves *Anadara inequivalvis* and *Mya arenaria*, however continue to dominate the macroobenthos system due to rich trophic resources and their hypoxia tolerance.

As these modifications signaled beginning of the rehabilitation trend, the general state of this biotic component of the marine ecosystem is still fragile over large areas of the Ukrainian and Romanian shelves and represents clear symptoms of undesirable disturbances, such as patchiness, domination of the zoobenthos system by opportunistic and hypoxia tolerant species as indicators of organic pollution. Shallow, coastal regions remain to be vulnerable to anthropogenic disturbances as compared to offshore areas deeper than 30-50 m. The muddy bottom biocoenoses of *Modilus phaseolinus* at deeper than 50 m has not yet recovered due to impact of hypoxia, opportunistic species, and degradation of bottom by dredging and trawling. Therefore, there are great deals of uncertainty to claim the recovery. On the other hand, the classification algorithm based on the empirical AMBI model (Fig. 3.29) suggests a rather optimistic view that even the Danube delta region has rather moderate pollution level and most part of the NWS is in ecologically good conditions. The conditions gradually progress to the south along the western coast and to the east away from the source region of the pollution and eutrophication.

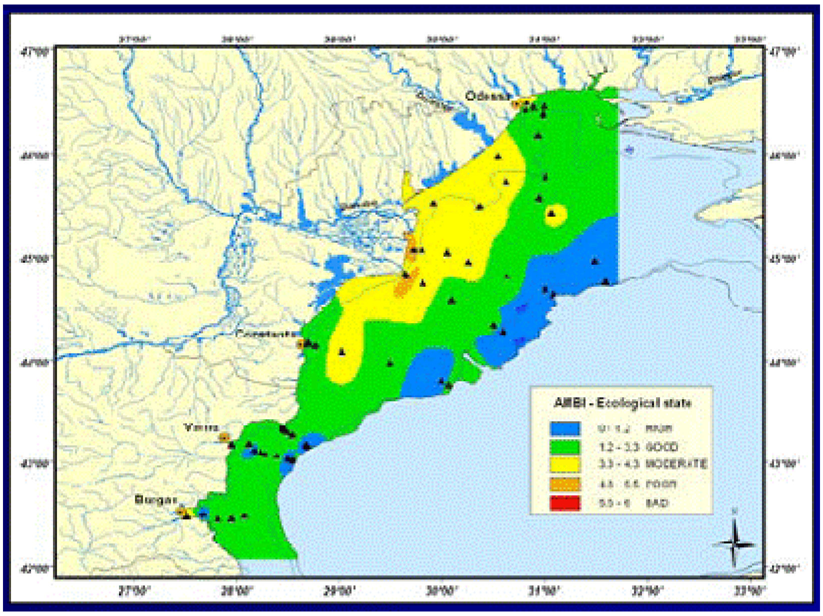


Fig. 3.29 Recent ecological state of the northwestern and western shelves according to the AMBI classification. Yellow and green colors signify moderate and good ecological state, whereas the brown spots are degraded regions of macrozoobenthos (after GEF-UNDP Project Report, 2006)

The introduction of *Beroe* and its predation on *Mnemiopsis* introduced a major transition in macrozoobentic populations. As shown in Fig. 3.30 for the northeastern coastal zone, over-consumption of bivalve larvae and the subsequent reduction in the settlement of young bivalves observed during the 1990s were ended after the weakening of *Mnemiopsis* population. This led to mass settlement of opportunistic alien Bivalvia species *Anadara inequivalvis* larvae that is a major competitor of the native species *Chamelea gallina*. Simultaneously, the niche emptied by

Mnemiopsis was immediately occupied by the opportunistic invasive predator Gastropod species *Rapana venosa*. Starvation due to food shortage for such high populations and their predation by *Rapana venosa* concomitantly led to their population decline which was followed by the population decline of *Rapana* due to food shortage. The opportunistic polychaeta group took advantage of these conditions in the absence of *Rapana* and increased at a significant level. It is not clear whether this transient system observed during 2000-2005 is gradually stabilizing in recent years or still continuing to persist.

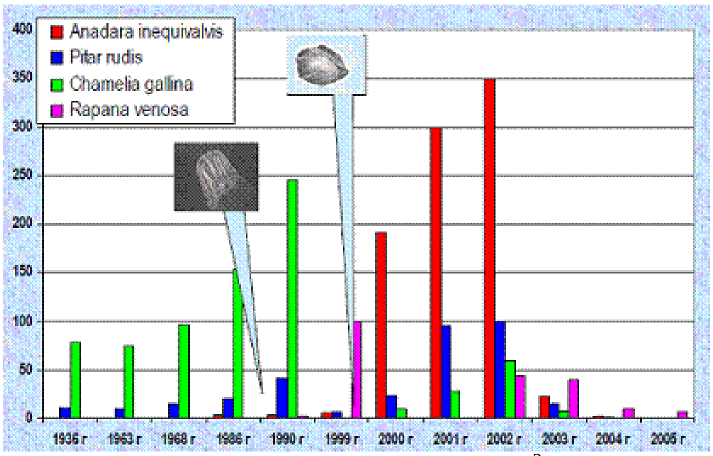


Fig. 3.30 Changes in dominant zoobenthos species biomass (g m^{-2}) at the 10-30 m depth range of the northeastern Black Sea coast during 1936-2005 period *(after Kuchreruk, 2006)*

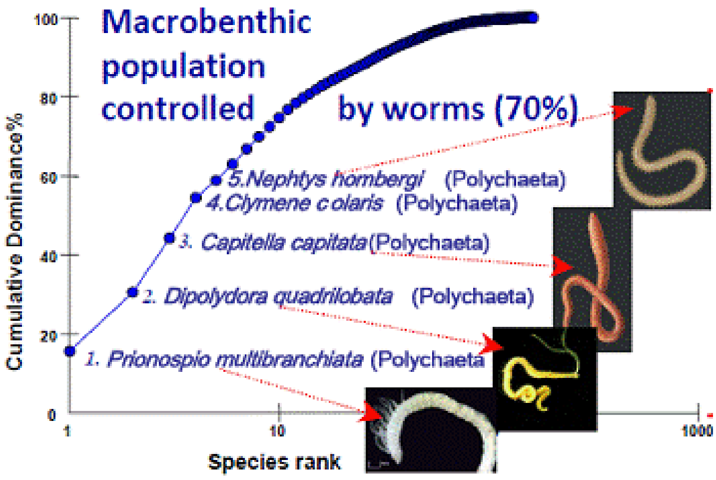


Fig. 3.31 Species rank of macrozoobenthic population indicating its overwhelming domination by worms in the northwestern shelf *(after Friedrich et al., 2008)*

The 2008 Poseidon cruise in the NWS indicated a similar spectacular population development of Polychaeta species on soft sedimentary and hard substrate (Friedrich et al., 2008). As they formed 70% of the benthic population, filter feeders constituted only 9% that is a typical indication for eutrophication (Fig. 3.31). The overall findings of the cruise were a small recovery of macrozoobenthos community, strong biomass perturbations, high ecological pressure in coastal areas especially the vicinity of Danube and Dniestr discharge regions, ongoing high pressure from *Mya arenaria, Anadara inaequivalvis, Rapana venosa* survivors, and domination of the macrozoobenthos community by Polychaeta species.

Status of marine living resources. Pelagic fish in general and their small-sized plankton-eating types in particular are the most abundant species in the Black Sea ichthyocoenosis. The total catch main target species European anchovy (*Engraulis encrasicolus*) constituted 31-75% of the total Marine Living Resources (MLR) during the last 15 years. European sprat (*Sprattus sprattus*), Mediterranean horse mackerel (*Trachurus mediterraneus*), Atlantic bonito (*Sarda sarda*) and bluefish (*Pomatomus saltatrix*) are the other pelagic fish in terms of fishing value. The latter three species are large-sized predators which migrate into the Black Sea from the Marmara and Aegean Seas for feeding and spawning in spring and return their native places for wintering in late autumn. The catch around 350,000 - 100,000 tons suggest partial recovery of major pelagic species after the fishery collapse at 1991 (Fig. 3.32). From the fisheries perspective, the most important demersal fish species in the Black Sea are whiting (*Merlangius merlangus*), picked dogfish (*Squalus acanthias*), turbot (*Psetta maxima*), striped and red mullets (*Mullus barbatus, M. surmuletus*), four species of the family Mugilidae, including so-iuy mullet (*Mugil soiuy*). The total catch of these demersal fish species had a tendency of reduction after 2000. Its present catch size is approximately half of the 1990s.

Among fish by capture volume, the anadromous fish species pontic shad (*Alosa pontica*) and three sturgeon species *Acipenser gueldenstaedtii, Acipenser stellatus, Huso huso* take the last place, but their high consuming and economical value determines their specific role in the structure of the MLR. Stocks of anadromous fish are formed mainly by the Danube populations. The catch data (Fig. 3.32) suggested their order of magnitude decline from about 5000 tons in 1994 to 500 tons in 1999-2001. A slight increasing trend of their annual catch after 2000 was due particularly to the recovery of Pontic shad.

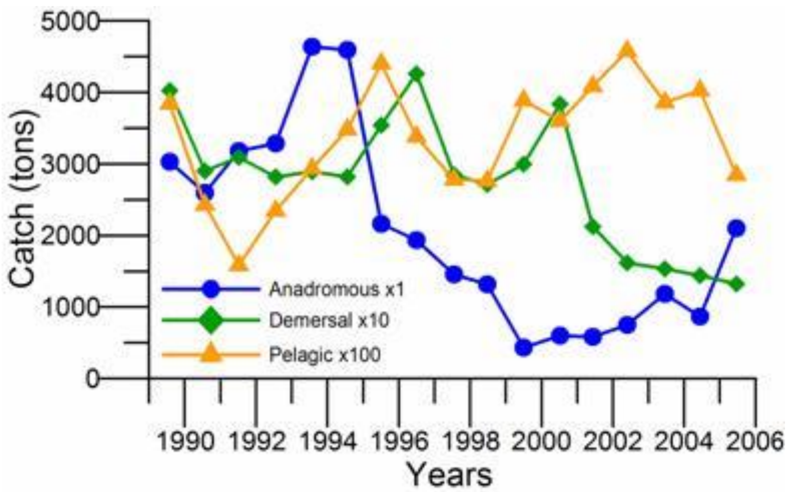


Fig. 3.32 Total catches of main anadromous, demersal and small pelagic fish in the Black Sea during 1989-2005. The demersal and pelagic fish catch values need to be multiplied by 10 and 100 to get the observed magnitudes, respectively *(after Shlyakhov and Daskalov)*

During 2000-2005, the most significant threats for fish resources appear to be the illegal fishing and use of destructive harvest techniques as well as the lack of regional cooperative management of fisheries, in addition to eutrophication-induced instability in the food web structure. At present, no recovery of sturgeons spawning and nursery habitat occurred, restocking size of the Dnieper sturgeon populations reduced considerably and the state of sturgeon stocks deteriorated definitely after 1999 with the possibility of collapse not being excluded. The state of Danube shad stocks did not improve; nevertheless the situation is less disastrous as compared to sturgeons. The sprat, anchovy, picked dogfish, and mullet stocks partially recovered in 1995-2005, but the current level of relatively high fishing efforts and catches impose a risk of deterioration of their stocks. The horse mackerel stock continues to be in a depressed state with low stock size and there is no sign of its recovery. The whiting and turbot stocks are exploited rather intensively and declining.

Starting with 2002, the total catches registered a slight but continuous decline from 486,500 t until 361,000 in 2005. 2007 represented an exception from the general rule, a maximum catch of 555,500 to being registered, and 387.000 t in 2013. After 2007, a sharp decline (28%) of the total catches occurred again by 2009 (395,000 t). In 2010 a slight increase of total fish catches to 421,000 was registered, followed by 340,000 to/2012. In fact, excluding 2007, this decline became continuous since 2002. The most important reduction of about 96% occurred for anchovy landings, from 378,000 t in 2007, to 192,000 t in 2009. The data for 2012 indicated the continuation of anchovy landings reduction, to the level below 200,000 t and a slight increase to 253,000 t in 2013 (Nicolaev, 2014). For compensation of these significant reductions in total landings, some fleets, as the Turkish and Ukrainian, increased the catches of other species, mainly the sprat, whose catch increased by 120%, from 40,900 t (2007) to about 91,000 t (2010). In 2011, only in TR and UA, the total landings of sprat counted 110,000 t. In 2012 and 2013, the total reported landings of sprat decreased drastically below the level of 30,000 t. This is an alarming scenario for the Black Sea ecosystem, situation whose impact must be carefully analysed.

During the past 6 years, anchovy and sprat accounted for more than 80% of the total catch, horse mackerel 5-8%, whiting 3-5%, Atlantic bonito 3-7% (Nicolaev, 2014).

Among the mollusks, the clams (*Chamelea gallina*, *Tapes* spp.), the Mediterranean mussel (*Mytilus galloprovincialis*), and the sea snail (*Rapana venosa*) have the greatest commercial value. The former two species are harvested only by Turkey and the latter species by all countries of the region except Romania. In 2000-2005, mussel harvesting has had a decreasing trend in the Ukrainian sector but as a whole the state of mussels improved in the Black Sea (Fig. 3.33).

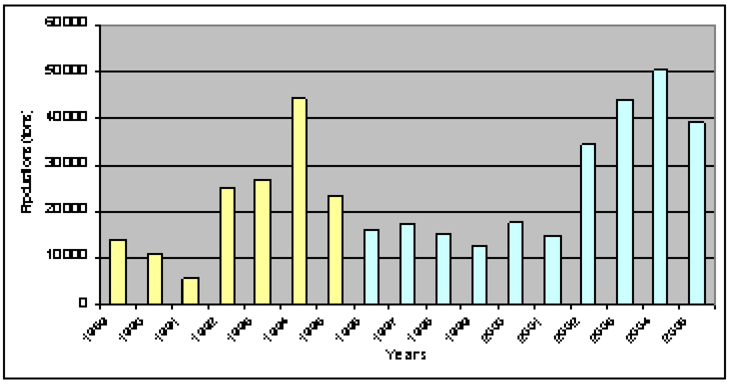


Fig. 3.33 Total catch of main mollusks in the Black Sea in 1989 -2005 *(after Shlyakhov and Daskalov)*

The current status (2000-2005) of the MLRs, in general, suggests an improvement with respect to the collapse period (1989-1992), but the overall situation is inferior when compared with the baseline state (1970-1988). The highly variable stock dynamics and lack of effective control measures may quite likely lead to sharp stocks decline in the future. In order to avoid this risk and to achieve sustainable fishery development, implementation of a regional management strategy is essential.

The harbor porpoises (*Phocoena phocoena relicta*), common dolphins (*Delphinus delphis ponticus*) and bottlenose dolphins (*Tursiops truncatus ponticus*) are the top predators without any natural enemies in the Black Sea except humans. Their populations were badly damaged during the last four decades due to anthropogenic-induced habitat degradation, depletion of food resources and commercial and intentional killing until the early 1980s. They are supposedly protected by the international agreements, but in practice their conservation status has not been adequately assured yet.

Conclusions. Briefly, the recent assessments indicate a tendency of improvement and rehabilitation of coastal ecosystems of the Black Sea after 1995 under constraints for implementation of environment politics and restructured economic activities. The trends of improvement are visible both for water quality parameters and structural and functional properties of biota, when compared with conditions observed from the mid-1970s to the early 1990s.

The pelagic ecosystem of western Black Sea coastal waters improved noticeably due to weakening of anthropogenic pressures. It is inferred by reduced nutrient inputs and fewer algal blooms, lower algal biomass, recovery of some algal populations, increasing plankton biodiversity, decreasing opportunistic and gelatinous pressures, and re-appearance of some native fodder zooplankton and fish species and increasing edible zooplankton biomass. The current relatively low nutrient inputs, especially phosphorus, were mainly due to the economic recession after the collapse of the former Soviet Union. The phosphorus limitation prevails most notably along the coastal zone whereas the nitrogen limitation dominates within the outer shelf and deep basin. The climatic warming during the 1990s and the early 2000s also played an important role for the limitation of primary production. Its relative contribution to the overall improvement of the pelagic system of the western coastal and shelf waters remains to be substantiated by the modeling studies. A switch to the cold climatic conditions in the future (as in the 1980s) may promote more intense phytoplankton production and thus disturb the present quasi-stable pelagic ecosystem structure.

The prominent changes were encountered in the structure of benthic communities of the Romanian and Ukrainian coastal waters. However, recovery of the benthic ecosystem appears to be less certain although an improvement on regeneration of macrophytobenthos and macrozoobenthos is suggested by the available data. In the western Black Sea, large areas of the seabed that had been suffering from anaerobic conditions a clear symptom of eutrophication started now returning to conditions prior to the 1970s. Hypoxic events are now less severe and less frequent than they were used to be in the past. The available data also show some unavoidable indications that the present status of benthic ecosystem is highly fragile and susceptible to further anthropogenic and environmental impacts. The regions shallower than 30-40 m depths still show symptoms of some undesirable disturbances, the most important of which is exerted by the alien opportunistic species such as bivalve species *Mya arenaria*, soft-clam species *Anadara inequivalvis*, gastropod species *Rapana*. Once again, higher organic load to the benthic community which likely develops during cold-climatic conditions may further disturb the benthic structure.

Fish stocks over the basin are still out of balance, mainly as a result of overfishing but also due to eutrophication. For example, eutrophication-induced unfavorable conditions reduced sharply catches of demersal fish with high commercial value such as flounder and turbot and replaced them with large quantities of small pelagics such as sprat in the western shelf. As a consequence, the Ukrainian and Romanian fishing fleet in the Black Sea almost collapsed. The additional impact of overfishing exacerbated the decline of high trophic level fish relative to low trophic level fish and multispecies fishery is unsustainable during the present decade. Anchovy remains to be the top predator species of the Black Sea ecosystem together with sprat along the western coast. Illegal fishing and destructive harvest techniques, lack of regional cooperative fishery management, eutrophication-induced instability of the food web structure constitute ongoing major threats for fish resources.

The most significant ***threats for Black Sea Marine Living Resources*** remain (Nicolaev, 2014):

● **Overfishing:** the drastic drop of total landings during the past 5 years by over 40% may be a result of significant changes in the structure and functionality of the marine ecosystem, but, to a similar extent, the result of an extremely high rate of fishing effort. The reduction in the number of fishing vessels registered in Turkey, Bulgaria and Romania is insignificant (367 vessels decommissioning, 7% compared to 2007), the fishing effort at regional level being high.

● **Climate changes**, resulting in abnormalities in water mass stratification, circulation and temperature, have determined in certain areas the change of the fish behavior (mainly anchovy, sprat, dogfish) and the complete extinction of certain species (E.g. sprat, dogfish and whiting in traditional fishing areas in Georgia). The massive jellyfish agglomerations in certain areas prevent performing trawling hauls during sprat fishing.

● **Illegal and unregulated fisheries** (IUU): It is a general issue in all BS countries. A Roadmap for reducing IUU fisheries was elaborated. In some cases, such as turbot fisheries, the level of IUU catches exceeded 5 times the official data.

● **Lack in regional cooperation**: No progress in the adoption of a legally binding document (LBD) for fisheries has been achieved so far.

● The recent assessment of General Fisheries Commission for the Mediterranean (GFCM) together with the Scientific, Technical and Economic Committee for Fisheries (STECF), presented during the 38th session of GFCM, is the following:

- Turbot and spiny/picked dogfish are both overfished and subject to overfishing;
- Sprat, whiting and anchovy - uncertain; however, all stocks are believed to be either partially or fully overfished;
- For turbot, there might be different entities (overall status = status of different stock entities)

The present ecosystem structure is still different from that documented during the 1960s, and most likely it will never revert back to the pristine state. A more likely scenario is adaptation of the system to new conditions where it will eventually be stabilized. However, it is too soon to assert its stabilization today due to prevailing relatively high nitrogen concentration in the water column and sediment. The complexity and inherent nonlinear response of the ecosystem to external drivers and their internal feedbacks make unclear how the pelagic and benthic systems will respond to further stresses that may likely be introduced by climate changes, future agricultural and industrial development as economies of the riparian states recover. Its stabilization partly depends on natural evolution of the system under the concurrent impacts of climate change; eutrophication level, invasive species populations, and sustainable consumption of fishery resources. But it may partly be controlled by a carefully designed and implemented integrated and adaptive management strategy that ultimately needs to take firm decisions by policy-makers in the riparian countries.

The restoration of ecosystems is generally a long-lasting process that depends on the accomplishment of the conservation, protection and management measures both at national and regional level. In this respect, stress reduction interventions should be implemented in order to achieve improvement of environmental conditions in the coastal zone of the Black Sea and the sea itself. The most critical ones are the reduction of the terrestrial nutrient load from the catchment basin by investing in high technology waste-reduction projects and intensive agricultural practices, firm control on commercial fishery by effective regulation of trawls and dredges.

Moreover, the present assessment study indicates some gaps in our knowledge due to the absence of sufficiently comprehensive monitoring data. For the success of ecosystem restoration, routine monitoring of the key ecosystem indicators, e.g. set by EEA within the DSPIR framework, should be effectively implemented. This approach will further set a basis for the policy-relevant assessment of the state of the Black Sea environment in the EU context. The DSPIR protocol, however, may require some adaptations to the Black Sea conditions in terms of network of coastal stations, sampling frequency, and sampling depths in order to allow detection of temporal trends and inter- comparison of different areas. To this end, measurements of nutrients, oxygen, chlorophyll concentrations, as well as phytoplankton and zooplankton biomass, abundance and diversity need to be measured on monthly basis at some selected critical sites around of the basin. Also of critical importance is to monitor them not only in surface waters but also below the seasonal thermocline, and close to the bottom. Because majority of processes governing the pelagic ecosystem take place at time scales less than a month either in the surface layer or different parts of sub-surface layer, such high temporal resolution in observational strategy is indeed necessary. Either temporally, spatially and/or vertically coarse resolution measurements may be adequate for a stable ecosystem but will indeed carry a high risk of false assessments for the unstable Black Sea ecosystem.

For more detailed information on the Black Sea ecosystem, use the ADDITIONAL USEFUL REFERENCES FOR THE BLACK SEA ECOSYSTEM (page 359).

3.3.4. Geomorphology

Bulgaria

Morphological-hydrographic and coastal morphological-metric characteristics

The morphological-and-hydrographical appearance of the Northern Black Sea coast is dependent on its constituent basic geological, morphological and structural units - Moesian plate, Lower Kamchiya morphological-and-hydrographical depression, seaside part of Balkan mega structure. It includes two main geo-morphological areas: Dobrudja-Franga covering 30.4% of the length of the coastline and Lower-Kamchiya - 8.9% (“Morphological-and-hydrographic analysis of the coastal zone of the Bulgarian Black Sea coast”, Stoyan D. Keremidchiev, Institute of Oceanology, BAS, Varna). The types of banks that occur along the northern coast are: abrasive type /most widespread/, also called cliff coast; abrasion-accumulative (mainly near Shabla); accumulative and non-flooded presented with extensive sandy beaches near Shkorpilovtzi, Golden Sands and Albena; accumulative-flooded (fragmented with small sandy beach along the whole coast length) and technogenic coast with built dams and groins in the region of Varna and Balchik. Active cliff coast covers over 37% of the length of the coastline of Varna, Balchik and Kavarna coast.

Along the entire Northern Sea coast extensive landslide complexes are developed. High activity of surface erosion and permanent river runoff is observed within them. Causes of landslides are their lithological-and-stratigraphic structure, strong features of fault tectonic processes and abundant shallow aquifers. The catchment area of the river - valley network of the Bulgarian Black Sea coast, actively nourishing the coastal zone with erosive and sedimentary material is 14,644.65 km^2 with average altitude of 139.8 m and average gradient 6.1°.

The largest catchment network is that of river Kamchiya constituting 36.2% of the entire Black Sea catchment area. The catchment areas of rivers Provadiyska and Batova occupy 71.7% of the area of Dobrudja-Franga region. North of Varna the erosion and hydrographic segmentation is weak due to the plateau-like geological and morphological structures built by lithological-and-stratigraphic rock formations permeable or resistant to deep erosion. The values of the horizontal segmentation vary from 0.30 to 1.40 km/ km^2 and that of the vertical segmentation - from 0.00 to 37.50 m/ km^2. The density of the river-valley network is from 0.00 to 0.59 m/km^2.

Underwater morphology

The morphology of the underwater coastal slope of the Northern Black Sea coastal zone is closely associated with faults and tectonic processes, lithological-and-stratigraphic structure and extensive landslides. The faults of Franga, Balchik and Kavarna as well as the fault zone north of the mouth of the river Kamchiya form underwater slope with significant gradients in the active part of the coastal zone. The lithological-and-stratigraphic structure is presented almost horizontally by overlying Neogene rock complexes and is the cause of terrace-type structure of the relief.

The underwater coastline morphology near Varna, Balchik and Shabla is a reflection of landslides and active wave abrasion. Abrasion-landslide-tiered relief is formed. A landslide tongue of Holocene age is formed - underwater sand “Aladzha bank” outlined of 10 m isobaths. The surface is heavily crinkled and covered with blocks and boulders.

The geomorphologic subdivision of the continental shelf is presented on the figure below:

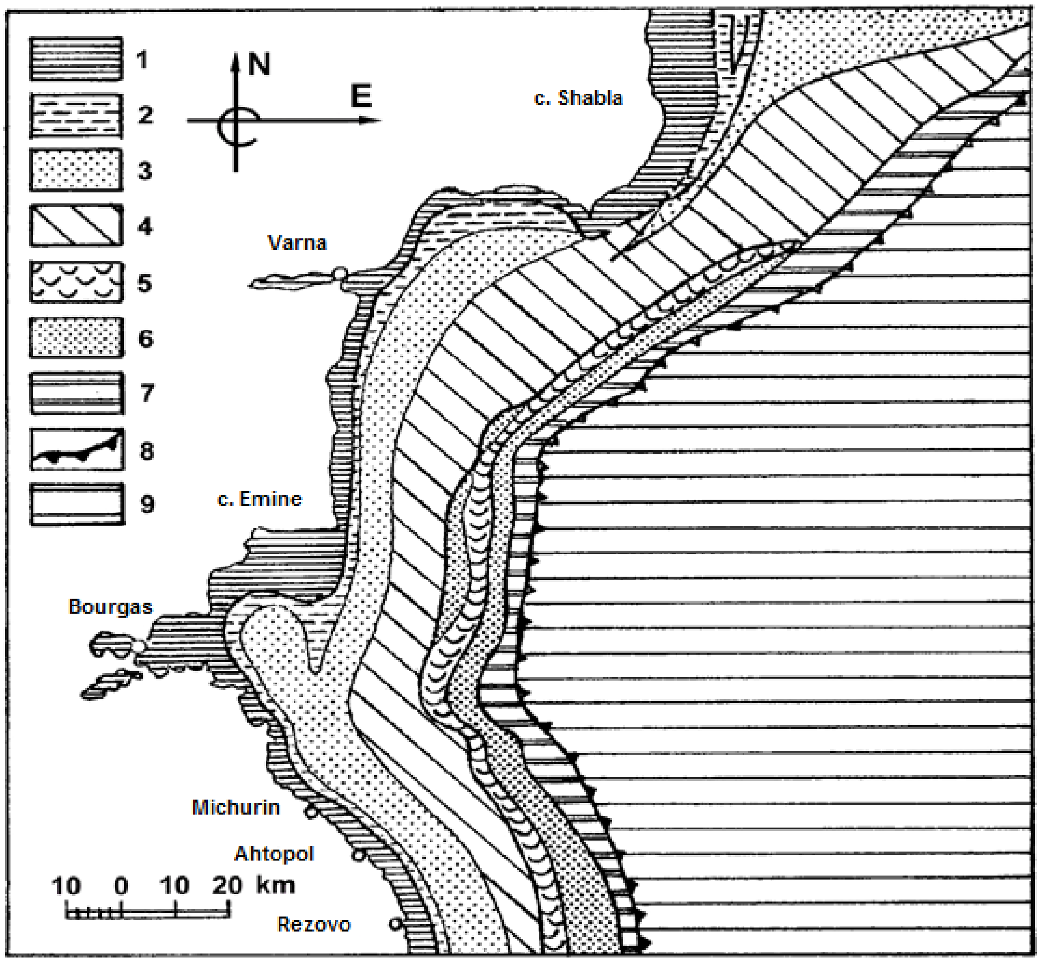


Fig. 3.34 Map of Geomorphologic Subdivision of the Shelf Zone Legend: 1 - Coastal Zone; 2 - Inner (Coastal) Depression) 3 - Swell Zone (Kaliakra And Emine Acumulative Swells); 4 - Shelf Inclination; 5 - Shelf Periphery; 6 - Outer Depression (Likely the Bottom of Relict Lagune); 7 - Underwater Swells at the Shelf Edge; 8 - Boundary Shelf-Continental Slope; 9 - Continental Slope And Abyssal Plane.
(Source: BG IAR, 2013)

Sensitive coastal areas

The most sensitive to pressure from urbanization and pollution from maritime activities along the northern coast are:

- The rock cliffs near Cape Kaliakra and north of it including Kamen Bryag coast;
- Wetlands - Ramsar sites: Durankulak Lake - in the list since 1984, with current area of 350 hectares and Shabla Lake - in the list since 1996, with current area 404 hectares;
- Reserves Batova and Kamchiya located at the mouth of the eponymous rivers;
- Bourgas wetlands.

Moldova

Most of Moldova’s territory is a moderate hilly plateau cut deeply by many streams and rivers. Geologically, Moldova lies primarily on deep sedimentary rock that gives way to harder crystalline outcroppings only in the north. Moldova's hills are part of the Moldavian Plateau, which geologically originate from the Carpathian Mountains.

Drainage in Moldova is to the south, toward the Black Sea lowlands, and eventually into the Black Sea, but only eight rivers and creeks extend more than 100 kilometers. Moldova’s main river, the Dniester, is navigable throughout almost the entire country, and in warmer winters it does not freeze over. The Prut river is a tributary of the Danube, which it joins at the far southwestern tip of the country (Fig. 3.35). The Danube catchment area covers around 35% of the Moldovan territory (Drumea et al., 2002).

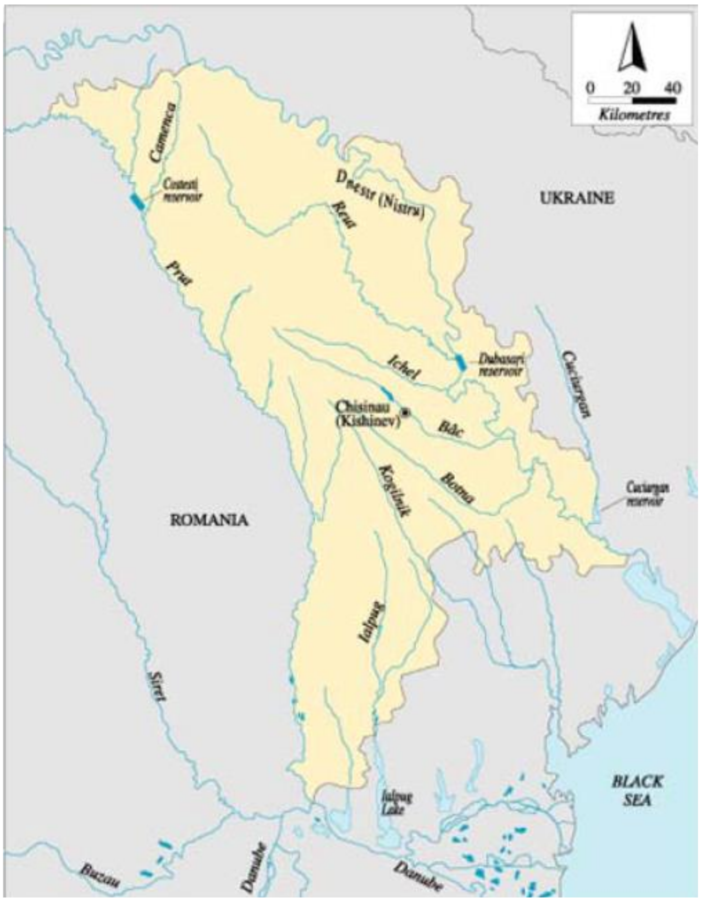


Fig. 3.35 Moldova’s main waters arteries

The Prut River basin is situated in the Moldavian Highlands. Based on aspects of the morphology and absolute elevation of the terrain, several second-order forms stand out: hills and plains.

The absolute elevation is 424 m a.s.l. maximum in the Codri Hills, and 2,4 m a.s.l. minimum at the Prut mouth. Based on absolute elevation, the basin can be divided into three topographic classes:

• high elevation terrain: height over 250–300 m a.s.l. (up to 400–420 m a.s.l. in Codri Hills and up to 300 m a.s.l. in North Moldavian Highland and Tigheci Hills);

• medium elevation terrain: height 200–250 m a.s.l. (Middle Prut, Sarat and Lower Prut plains);

• low elevation terrain: height 60 m a.s.l. or less (floodplains).

Relative elevation – i.e. the depth of river channel downcutting – is an important feature of river basins. Based on relative elevation/depth of downcutting, the Prut River basin has three regions:

• northern region – North Moldavian Highland: prominence 110-120 m (basins of Racovat, Ciuhur, Vilia and Lopatna) and 130-140 m (basins of Sovat, Caldarusa and Camenca);

• central region – Codri Hills: prominence up to 190-220 m (basins of Lapusna, Nerova, Delia, etc.);

• lower region – Tigheci Hills: prominence up to 150 m (Tigheci basin) and 160 m (Larga valley).

The morphology of river valleys in the basin is largely determined by the geological structure. Based on aspects of basin morphology and morphometry, river valleys are of two main types.

• Narrow valleys/gorges – typical of the Prut River tributaries in the North Moldavian Highland: Larga, Vilia, Racovat, Draghiste, Ciuhur, etc. These are entrenched into Neogene limestone in the zone of Toltry (or Medobory). These valleys have very steep slopes and transition into riverbed directly, forming numerous rapids and small waterfalls.

• Broad terraced floodplain valleys – predominant, including the Prut valley and the valleys of its tributaries from Codri Hills in the middle of the basin to the Prut River mouth. The morphology and structure of these valleys are determined by the geological structure and terrain.

The gradient and aspect of slopes of hydrographic basins and sub-basins are important indicators of terrain morphometry.

Four genetic types of slopes form in the Prut catchment area in Moldova: diluvial, landslide, talus (rock fall/scree) and complex. These form under various gravitational and erosional-denudational geodynamic processes.

Talus slopes form as a result of collapse (sometimes catastrophic) of large masses or blocks of rock formations, as well as systematic fall of separate, relatively small debris. Such slopes are related to surface outcrops of rock formations. Typically, the slope gradient is 20–35^{o}. Talus slopes are characteristic of the valleys of the Prut tributaries Vilia, Larga, Lopatnic, Draghiste, Racovac, Ciuhur, Ciuhuret, and Camenca.

Landslide slopes form as large rock masses move downward slopes, composed of intercalated sandstones and claystones. Movement (slide, flow, slump) is provoked by change in the stress-deformation state of the slope as resisting forces (shear resistance) becomes greater than driving forces (shear force). Such change in the force ratio may result from slope base undercutting or overloading of the slope peak, or increase in hydrostatic and hydrodynamic pressure due to seismic processes. Characteristically, landslides slopes have gradient between 5–6^{o} and 18–25^{o}. In geological age, they are recent or ancient.

Landslide slopes dominate in the valleys of the left tributaries of the Prut River, from Camenca River in the north and to Delia River in the south. Landslide slopes are found on both the right and left sides of the Delia. From Nerova River to Larga River, landslides develop mainly on the left, steeper slopes. Diluvial slopes with slope gradient of 5–10^{o} form as a result of diffuse sheetwash of rainfall and snowmelt.

Complex slopes form when processes of slope genesis accrue in space and time. Their slope gradient has the widest range (4–40^{o}) and they occupy the largest area.

The lithological composition of the slopes of valleys of the Prut and its tributaries south of Costesti includes sand-clay formations. Due to intensive river erosion, in places these formations lose stability and contribute to the development of potent rotational landslides over large areas. The largest section of such landslides, 20 km^2, is near Branesti.

Accumulative terraced deposits on valley slopes do not typically contribute to extensive development of translational slides, particularly earthflows and debris flows. Most common here are rather large rotational slides (slumps) and complex landslides, which are characteristic of high valley slopes (above 120–150 m). Most intensively landslide processes develop on valley slopes of Prut River tributaries within Codri Hills, Tigheci Hills and the Middle Prut plains.

Romania

Among the processes which occur in the littoral zone, the coastal geomorphodynamic aspects take a special place, for their socio-economic implications, as well as for their impact on the coastal ecosystem. The geomorphologic characteristic zones of Romanian shore are grouped in two sectors:

- Northern Sector, Danube Delta and Razim-Sinoe lagoon, with a length of approximately 170 km, stretching from the Ukrainian border to Cape Midia, consisting of deltas, lagoons and banks/levees, being constituted by riverine/marine accretions, new organogenous sands, and disposed under low beach and littoral belts shapes, generally less than 2.0 m.
- Southern Sector, from Cape Midia to Vama Veche (Bulgarian border), with an approximate length of 74 km, is a relative high shore, with cliffs of 35 m maximum height, mainly active.

The Danube Delta Littoral can be divided, taking in consideration the shoreline orientation from the predominant wave direction (NE) beyond the distance from the Danubian sediment sources, in three main sub-sector: northern subsector (between Sulina and Sf. Gheorghe arms), central (Ciotic - Periteasca) and southern subsector (Portita - Cap Midia) (Fig. 3.36).

The shoreline orientation is crucial for the *northern sector*, where predominant winds coming from Siberia generate big waves with strong geomorphological effect due to the sediment transport disturbed by the Sulina channel jetties, which induces a strong erosion rate/shoreline retreat in the median part of this sub-sector, with a maximum of 20-25m/year,

The *central subsector* has an E-W exposure, which makes it protected of the wave action, and induces a stable behavior to the coast line, with little accretion. The southern sub-sector, with shoreline orientation of NE-SW, is characterized by a small Danubian detritus input, which is compensated by an intense input of organogenous sediment. The wave action is stronger than in the central subsector and it results in a moderate erosion phenomenon.

Fig. 3.36 Romanian northern coast subsectors between Sf. Gheorghe Branch and Midia Cape *(original)*

In the northern part a special sub-sector is Musura Bay, where, after the extension of the Sulina channel jetties, the sedimentation processes were intensified mainly because sediment drift and the sediment from Chilia arm were blocked by dikes. The present tendency of the bay is of warping and in the future it will be transformed into a lagoon by closing with a sand spit. Important sedimentation processes are highlighted in Musura Bay. The maximum width of sedimentary deposits between 1975 and 2006 is 520 m, this being the most active area, and under Sulina bar the width of deposits is up to 400 m. The appearance of the island in front of the Musura Bay involves different considerations of the border with Ukraine, also related to the Bistroe channel impact.

Also, a large sedimentation area is the Sachalin Island, which started to evolve in 1961 from the Sf .Gheorghe Arm. But, in present time, it was found that the extension of the island is unstable during the storms, and since 2012 it was broken and displaced by land with 3 km.

The Southern Sector (Cape Midia - Vama Veche) has an active character of constant retreat on the cliffs area. In this sector the structural and lithological variations of the cliffs determine the general feature of the coast, being governed by sharp promontories and large bays sequences. Also, on this shore sector are included several accumulative shores, beaches, and anthropogenic/built shores (ports, coastal facilities constructions and shore defense works). Promontories are the most significant geomorphologic elements which characterize the shore, from north to south, the main promontories being: Turk's Cape, Tuzla Cape and Aurora Cape. Accumulative shores form barrier-beaches in the places of old marine lagoons: Techirghiol, Costinesti, Tatlageac, Neptun, Mangalia.

Fig. 3.37 Romanian southern coast subsectors between Midia Cape and Vama Veche *(original)*

Even though the evolution of this area was set aside between small limits of changing, in several erosion-prone regimes, because of the submerged structural relief, in certain parts negative effects were recorded, very well emphasized by the significant surface losses (Eforie Beach, Mangalia Beach). The southern littoral protected cells by coastal constructions are relatively stable, and the shoreline change is not pronounced, but it can be outlined that the entire unit is strongly affected by winter storms. In conformity with the origin classification of Shepard (1967), the southern Romanian littoral is in secondary category shore, with two characteristic subtype: erosional shores (with cliffs), and accumulation shores (barrier shores), created within the lithological and structural nonuniformities of the Dobrogea region. Thus, from geomorphological point of view the main characteristic of this unit is the development of the cliffs, with a distinct passage from Danube facies to organogenous one - Mamaia sector or Midia Cape - Singol Cape Sector, where the surface beach width presents important variations after the Midia Port extension, and now is a pocket beach, with an average retreat of about 1.5 - 2 m/year. In cold seasons, during storms, the beach is flooded and this required in time a series of beach protection work extensions.

South of the Eforie South area, the presence of the Sarmatian limestone plate at the base of the cliff's loess deposits gives a bigger stability, but for the erosion control there were performed certain protection works, including embankments armored with geotextiles and stone revetments (Fig. 3.38).

Fig. 3.38 Cliff protection at south of Tuzla Cape (southern Romanian coast) *(original)*

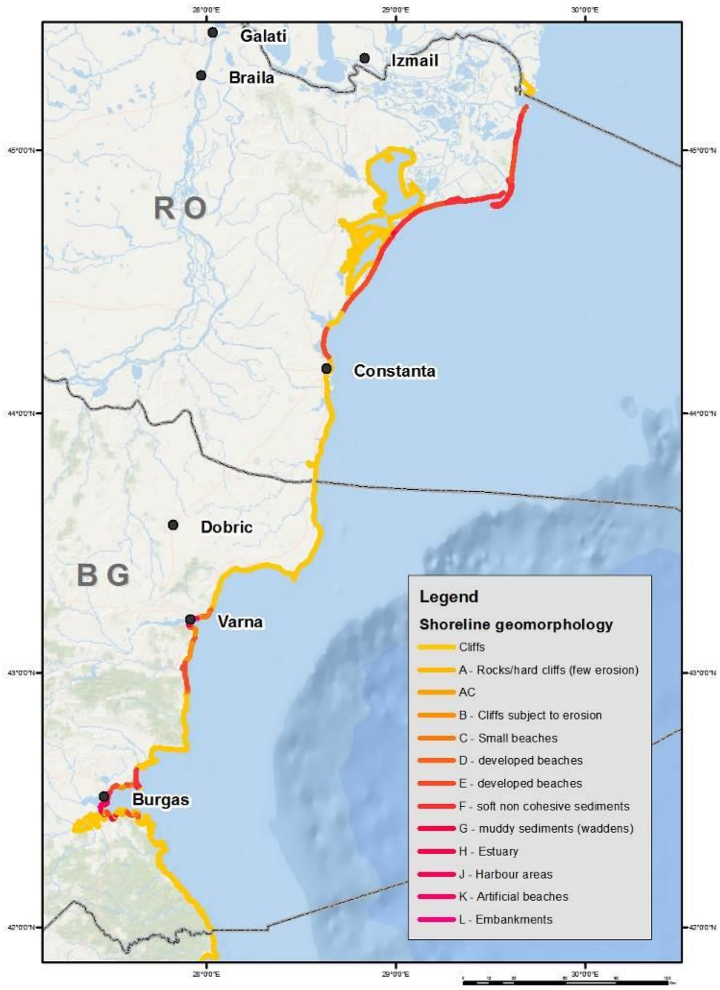


Fig. 3.39 Shoreline geomorphology in Romania and Bulgaria *(original map)*

Turkey

Erosional and denudation coasts with steep rocky cliffs are widespread along the Turkish Black Sea coast (Fig. 3.40). The eastern Turkish coast is composed of rocky promontories (Fig. 3.41) alternating with pocket beaches. Here, steep cliffs develop parallel to the coastline and consist of Mesosoic-Tertiary igneous-sedimentary formations. The western shoreline is bordered by the North Anatolian Mountains and consists mainly of rocky coasts cut in volcanic sediments.

High ridges trending east-west rise abruptly from the Black Sea coast and the coastal plain is thus narrow, opening out only in the deltas of the Kızılırmak and Yeşilırmak Rivers. In the western section, between the Sakarya and Kızılırmak rivers, there are four main ridges, the Küre, the Bolu, the Ilgaz, and the Köroglu mountains, with maximum elevations of 1,950, 2,524 and 2,338 m, respectively. East of the Yesilırmak the system is higher, narrower, and steeper, with a maximum elevation of 3,932 m in the Kaçkar range.

Their elevation progressively lowers westwards up to the Bosphorus Strait, where the height is lower than 300 m. High plateaus overlook the Bosphorus Strait with alternating volcanic headlands and sandy beaches (Kennedy et al., 2014).

Fig. 3.40 Turkish Black Sea coastline *(Source: Karsli et al., 2014)*

Fig. 3.41 Sinop promontory overlooking the Black Sea *(Source: http://sinopbalatlar.net/)*

Ukraine

The morphological characteristics of the Black Sea and the Sea of Azov coastland is an important parameter which predetermines spatial spread of various specific bottom biocoenoses. A schematic map of the Black Sea and the Sea of Azov corridor coastal structure is shown in Fig. 3.42. Spatial biocoenoses can be assessed when studying morphology of the Black Sea coasts (Zenkovich, 1960; Shuiskiy, Vykhovanets, 1989).

More detailed characteristics of physical and geographical conditions within the coastal zone of the Black Sea and the Sea of Azov can be obtained on the basis of results of the study of morphology and dynamics of coasts (Zenkovich, 1960). North-western part of the Black Sea includes four various coast areas: the Danube delta, the north-western part proper which extends from the Danube delta to the Dnieper-and-Bug liman, the sloping coasts from the Dnieper liman to the apex of the Karkinit inlet, and the western Crimea region (Fig. 3.42).

Northward of the Danube delta the forest-steppe surface raises not more than 5-7 m above the sea level. Beyond the long strip of the coast bar vast limans of the Tuzla group are located. Near the sea coast, towards the Dniester, the land becomes higher; at the Burnas cape – vill. Budaki site upright argillaceous and loess cliffs occur quite often. Further down the Dniester liman pontic limestone are observed in the cliff base. In the extreme depth of the Odessa bay the coast turns eastward and proceeds latitudinally to Ochakov and the Dnieper-and-Bug liman. Here, the biggest typical limans are located along the coast: Khadjibei, Kuyalnik, Dofinovskiy, Adjalykskiy, Tiligulskiy and Berezanskiy. Wide area between the Dniester liman and the Karkinit inlet is exclusively lowland. Yegorlyk angle is in the northern part, on the isthmus between the liman and the inlet. More eastward, along the Dnieper, sandy terraces extend. Further, towards Perekop and Sivash, sands disappear and are replaced with flat and almost continuous surface made with brown clays. As a result of partial deepening of this flat surface a complex sloping coastal line has been formed with the inlets: Yegorlyk, Tendra and Djarylgach. Washing out of shells and sand as well as alongside movement of these deposits resulted in a formation of big accumulative forms – spits and submerged bars (banks): the Tendra spit and Djarylgach island in the Black Sea, and the Bakal spit - in the Sea of Azov.

High areas of the Tarkhankut peninsula have a big flat-bottom valley division. Deep lowlands of the biggest flat-bottom valleys make inlets at the coast which are connected with strong rocks. In the west Crimea, southward of Tarkhankut, a lagoon area exists between the Donuzlav lake and Yevpatoriya which is made of strong Sarmatian limestones. As we approach the submountain region of the Crimean mountain chain, the area becomes gradually higher and its geological structure more complex. Commencing from the Sevastopol bay and further to Khersones cape typical Rias inlets are found which are quite small changed with abrasion.

On the south the Sea of Azov with the Kerch peninsula are located. The Kerch coast is strongly divided as here there are intermittent rocks of various strengths. Quite often strong Sarmatian reef limestones face the sea, they are made of dead bottom zooids accumulations. Reef limestone forms a number of protruding capes: Kazantip, Zyuk, Khrony, Tarkha, etc.

Рис. 2.1

Fig. 3.42 Ukraine's shorelines types

Besides, the conducted expert assessment allowed of determining the level of anthropogenic transformation of sea coast (Fig. 3.43, Table 3.4).

Fig. 3.43 Anthropogenic transformation of the sea coast in Ukraine

Table 3.4 Length of the Black Sea and the Sea of Azov coastlines of various types

Coast type	Length*, km	% of the total length
Non-transformed	2090.27	47.62
Non-transformed (low recreation load)	665.76	15.17
Non-transformed (high recreation load)	1113.59	25.37
Transformed (construction)	241.76	5.51
Transformed (coast protection construction)	278.53	6.34
Total	**4389.90**	

***Note -** the total length of the shoreline including the Dnieper-and-Bug liman, Sivash lagoon and the coasts of inlets of the Black Sea and the Sea of Azov.

Within the shallow shelf zone the salinity and its distribution across the top layer are unstable and are defined, basically, by river runoff and the wind strength and direction. In winter, due to active mixing of waters, the salinity in the entire area is homogenous (17-18.6‰). In spring the north-western region of the sea receives, due to river floods, 60% of the total runoff volume, which causes intensive desalination of the water in those areas which are adjacent to estuaries. Desalination includes a 20-25 m thick water layer. Prevailing is a transfer of fresh water southward along the western coast. The biggest zone impacted by desalination reaches 120-130 miles eastward (Fig. 3). The on-going reduction of river runoff leads to higher salinity in the estuarine areas. In autumn salinity increases evenly as the river runoff at that period reaches its maximum. High diversity and unsteadiness of salinity values is typical for the Kerch Bay area. Throughout all seasons the salinity values are within 11-17‰. Mean water salinity in the Kerch Bay equals 13.6‰. Salinity of water in the southern part of the Kerch Strait lies within 17-18‰, and in the northern part water is less saline and has 11-14‰ (Shnyukov et al., 1982). As the western and northern forms of atmospheric circulation are forecast to develop, the Sea of Azov salinity in the next 10-15 years will be, basically, at the level of 10-11‰. The upper layers of the north-western area of the Black Sea will, probably, preserve the desalination stage which has been observed since 1964 (Gargopa, 2002).

Due to its low lands and sheltered marine areas, the Ukrainian shore is developed by the sediment input from the major rivers as Dniester, Bug and Dnieper, as well the Danube river, forming the deltas and marine lagoons, the coastal areas present the characteristics of a low lands, built by sedimentary soft deposits.

Conclusions. Concluding, it can be mentioned that the varied coastal geomophology of the encompassed areas gives to the Black Sea coast a unique specificity among the all enclosed seas, and due to this diversity it should be approached carefully within the ICZM process implementation.

3.3.5. Coastal erosion

Bulgaria

The Bulgarian coastal zone is characterised by a rather high elevation as 70% of the coastline is characterised by low, middle and high mountains. Erosion poses the greatest threat to the coastal zones of Bulgaria. About 45% of the coastline is currently subject to erosion, assumed to be caused by a combination of human activities as well as natural events such as extreme wind waves Particularly vulnerable to coastal erosion are the areas around the cities of Varna (Varna), Primorsko (Bourgas), Sarafovo (Bourgas) and Shabla (Dobrich).

From Bulgarian coast about 575 300 t/a of eroded material is transported into the sea. The intensity of the transported sediment material, depend on geological and climatic factors. The coastal zone ensure exchange of terrigenous material on the land to the deep water sea zones as the sediments, coming from lithosphere and formed by means of mechanical desintegration and hydrodynamic differentiation. Division into detached morphodynamic systems of the Bulgarian Black Sea coast is done (P e y c h e v, A n d r e e v a, 1998).

The aeolian drift is calculated at 15 100 t/a by analogy of results, received for coasts of Ukraine (Vykhovanets, 1999), with estimate of the length of the Bulgarian beaches. The total amount of sediment originating from coastal erosion, river transport and aeolian drift is 1,371,000 t/a , of which 215 000 t/a are beach-forming and 1 156 000 t/a are marine sediments. The alluviums coming from the river are suspended load and bed load. Sediments are divided into coastal and marine ones: beachforming sediments are coarser than 0.25 mm on the deeper pebble shores, and coarser than 0.1 mm on sandy shores. (2003, Petko Dimitrov, Delcho Solakov, Veselin Peychev, Dimitar Dimitrov).

The main Bulgarian rivers running direct to the Black Sea are Kamchya (length 245 km), Veleka (length 147 km) and Rezovska (length 112 km). The total amount of the sediment load is 780 600 t/a (Dimitrov et al., 2000). The length of the eroded coast, formed by volcano-sedimentary complex between Bourgas and river Rezovska is 99.0 km. Erosionís average yearly rate is 0.01 m/a (Peychev, 1998).

The Lower and Middle Sarmatian sediments of Crimean - Caucasian type are represented by clay, marl, sandstone and limestone relatively resistant to erosion, which compose the jutting capes between the towns of Nessebar and Pomorie. Erosion is highest rates on the Bulgarian coast (1.05 m/a) are measured in Pliocene and Pleistocene aleurities and clays in region Bourgas and Pomorie. The length of the eroded coast in region is 9.8 km. Between Pomorie and Nessebar eroded coast is formed by Sarmatian limestone. The coast is length is 8.0 km and erosion is average rate is 0.09 m/a. The coast between Nessebar and cape Emine is formed by the Emine bent with geological structure consisting of sandstones, argylites and sandish limestones. The length of eroded coast is 12.8 km. The average yearly rate of erosion is 0.08 m/a. (2 0 0 3, Petko Dimitrov, Delcho Solakov, Veselin Peychev, Dimitar Dimitrov).

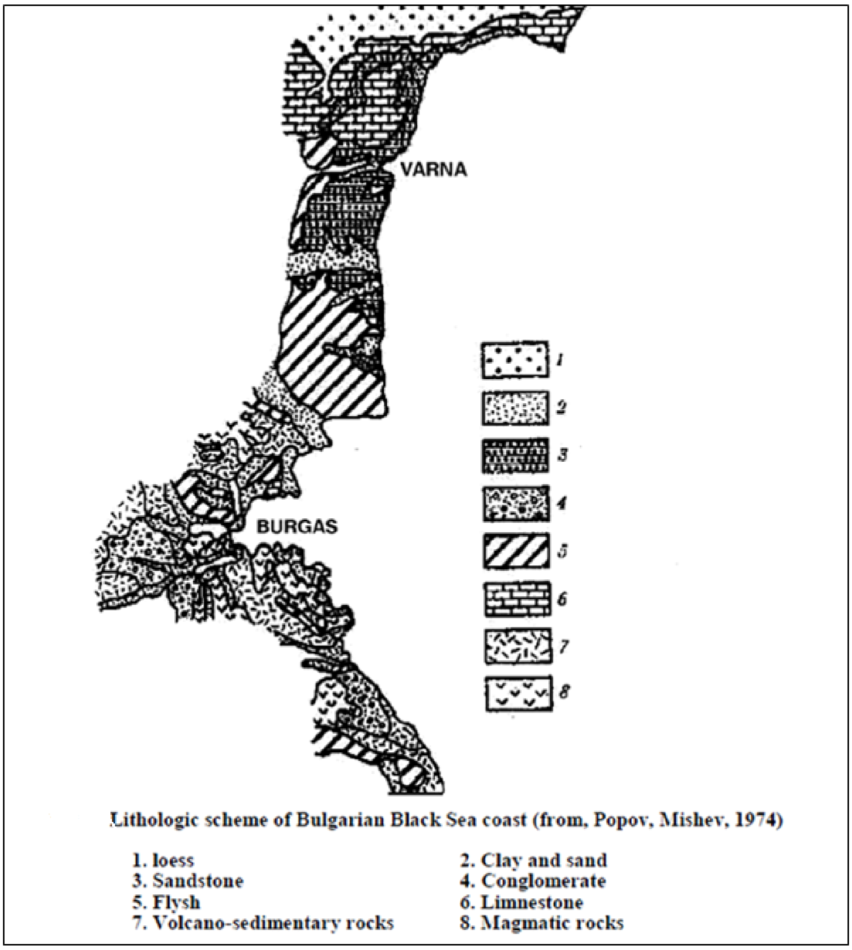


Fig. 3.44 Lithologic scheme of the Bulgarian Black Sea coast *(source: Popov & Mishev, 1974)*

The large river valleys (Kamchya, Shkorpilovska, Dvoinitsa) are refilled with Quaternary alluvium of significant thickness. The beaches of the central source province are formed near the mouths of the big rivers. The length of the eroded coast between cape Emine and cape Galata is 29.5 km. The average yearly rate of erosion is 0.12 m/a. The Northern source province covers the northern part of the Moesian plate. The coast between Varna and Shabla is formed by Neogene carbonate complex. The length of the eroded coast in Varna Bay is 3.5 km and erosion.s rate is 0.20 m/a. The length of the eroded coast between Varna and Kavarna is 24.9 km and erosion.s rate is 0.15 m/y. The length of the eroded coast between Kavarna and Shabla is 36.8 km and erosion.s rate is 0.05 m/y. The region cape Shabla - cape Sivriburun is formed by clear brown loess, locally passing into silt clays. The length of the eroded coast is 12.5 km.The erosion rate is 0.30 m/a, but separate cases cliff's destruction is 1-2 m/a (P e y c h e v, 1998).

The risk of flooding due to Sea Level Rise (SLR) is rather limited as SLR is expected to be modest, tides are non-existent and currents are very weak along the Black Sea shoreline. Also the significant altitude of most parts of the Bulgarian coastal zones (70%) makes the risk of coastal flooding less severe.

Moldova

Water erosion is a process considered one of the most complex form of soil degradation in Moldova in relation to the degree of manifestation, particularly on the arable land that are located on the 80% of slopes. Water erosion is accentuated by the natural factors action as the climate: high intensity of torrential, presence of clay and compact soils with low water permeability or destructured soils. Surface erosion on the cultivated soils are intensified by incorrect soil tillage, unorganized and intensive grazing, excessive deforestation, which enhances and accelerates the erosion processes (Leah, 2013).

Soil erosion is an important issue in Moldova. In fact, in around 30% of arable land different levels of erosion are evident and 20% of this land is strongly eroded (Danube Pollution Reduction Program National Planning Workshop Report, 1998).

The hydrographic system of the Moldovan part of the Danube River Basin consists of the Prut River and its tributaries, as well as the Yalpugh and Cahul River with the tributaries of Yalpugh. The Prut River is the second biggest river in the Republic of Moldova and it forms the state border between Moldova and Romania at a length of 695 km.

The Prut within Moldova’s boundaries is 695 km long. Its water availability is estimated at 2.9 mln.m^3/year in a typical year. The length of the Yalpugh River is 114 km, the length of the Cahul River is 38 km. They have a common average annual volume of less than 1 km^3. The total available volume of surface water resources in the Moldovan part of the Danube River Basin is estimated at 507.2 mln.m^3 in a typical year. The intensity of bank erosion processes varies between 20 to 30 cm per year (Danube Pollution Reduction Program National Planning Workshop Report, 1998).

Soils in the Prut River floodplain are characterized by heavy granulometric composition while local sub-regional chernozemes have a light granulometric composition and therefore are easily exposed to washouts even on gentle slopes; among washed out soils weakly eroded one prevail (10,3%). In the area of concern on hillsides light soil easily exposed to erosion prevails; on the tops of terraces non-eroded and weakly eroded carbonated chernozems predominate. Composing the terraces' thickness loessy loams and soil forming on them are easily exposed to destroying impact of erosion. For that reason, ravines are being formed in the area even on the slopes with low inclination. In the terraced part of the sub-region heavy-loamy soils, ordinary loamy soil (27%) and carbonated chernozems (28%) prevail; loamy soil are on 90% full-profile, carbonated chernozem - on 50%. About 4% of the territory is covered by meadow-chernozem inwashed soils, and more than 29% belong to all categories of alluvial soils (Ramsar, 2005).

Romania

The evolution of the Romanian shore sector is the result of the balance between losses and supplies of sedimentary material. In the last decades, this balance was negative for large sectors of the Romanian Black Sea shore, as a consequence of the new conditions disturbing the pre-existent natural environment. These conditions are related to certain human interventions, including the development of the inland hydrotechnical works, especially the two hydro-dams on the Danube river, having as effect the decrease of solid discharge with more than 50% (Bondar and Panin, 2002), the extension of the navigation jetties (Sulina Branch jetties seaward prolonged with 6 km), as well the commercial ports jetties having as effect the deviation of the coastal sediments drift by moving their discharging point in the sea, and also the subsequent development of the coastal protection (groins etc.).

At the above mentioned causes, the shoreline responds with an accentuated dynamics. Thus, under these disturbing factors during the last years the Romanian shore was strongly affected; the elaborated studies shown that the erosion process was extended over about 70% of shore length, having strong vulnerable character in several sectors, along the Romanian littoral.

In the *Nothern Sector*, Danube Delta Biosphere Reserve, during the last approximately 50 years, the beach surface was diminished by more than 2600 ha (about 55 ha/year), and the natural supply of sediments induced just in the same period an increase of 350 ha (about 7 ha/year). On shore sectors the surface loss were determined for Sulina - Sf. Gheorghe: 791 ha, Ciotica - South Perisor: 732 ha, South Perisor - South Periteasca: 12 ha, South Periteasca - North Chituc: 363 ha, and Chituc Levee: 458 ha.

Thus, shoreline retreated over variable distances from one shore sector to another. The maximum value of the changing, in several beach sections, had exceeded 500 m (Casla Vadanei sector).

During severe storms, the sea covers completely the shore where the sand banks are washed by waves and currents, thus being affected especially the Razim-Sinoe sector. Also, based on coastal monitoring extended over the northern unit for the time interval of 1962-2012, the evaluation of the coastal process magnitude (erosion/stability/accretion), performed through grouping of the modification rates at beach face on magnitude classes [VSE - (less then -325m), SE - (-325÷-225.1m), ME - (-225÷-125.1m), LE - (-125÷-25.1m), RS - (-25÷25m), LA - (25.1÷125m), MA - (125.1÷225m), SA - (225.1÷325m), VSA - (more than 325m)] presented erosion for more than 70 % of total registered cases/sections (Fig. 3.45 and 3.46).

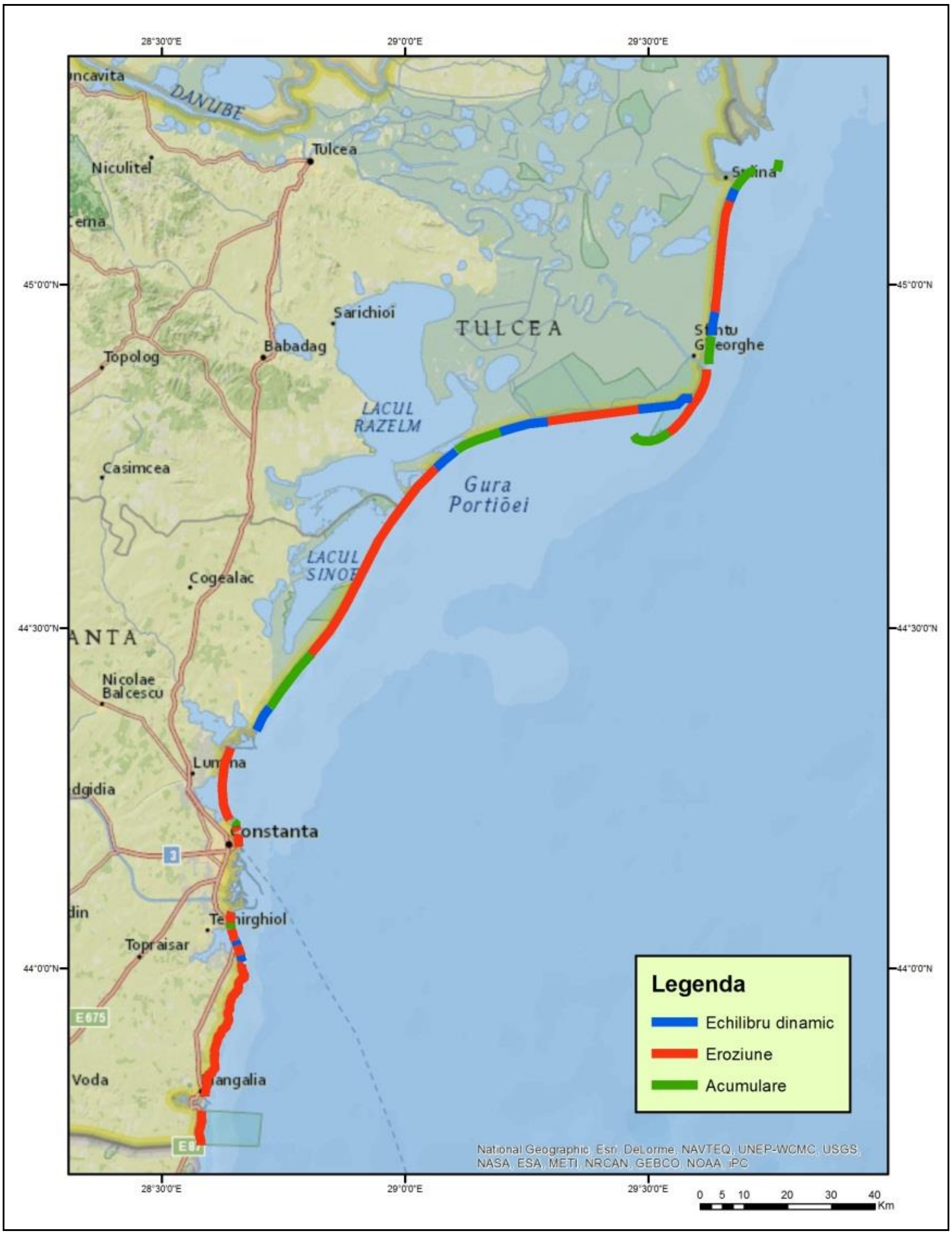


Fig. 3.45 Geomorphological state of the Romanian coast, 2014
(Classification share of processes) *(original map)*

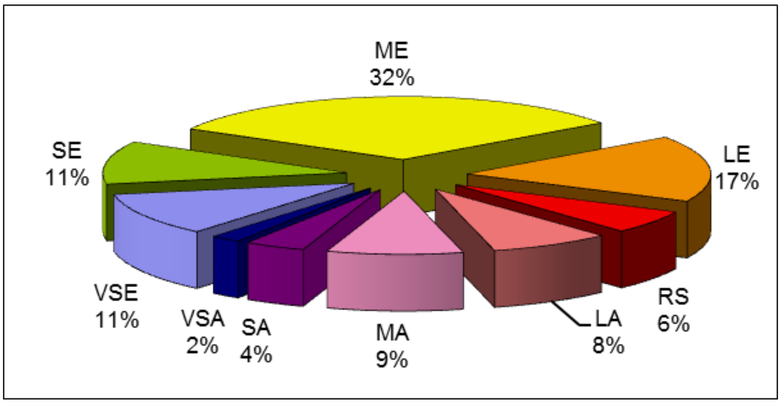


Fig. 3.46 The relative percentage of the littoral erosive processes in the Sulina - Vadu shore sector, Romania (1962 - 2012) *(original)*

The *Southern Sector* (extended from Midia to Vama Veche) due to its structural and morphological relief compared with them northern one, is mainly affected by the marine abrasion. Due to its geological structure, especially of the hard substratum consisting in a limestone plate, and to specific hydro-meteorological conditions as well, the shore has suffered intense irreversible modifications in several sectors. Also, the beaches of the southern area of the Techirghiol sand-belt (Eforie South International Camp) retreated with more than 40 m (1981 - 1992), the northern part of Neptun beach with 24 m (1981 - 1992), and Venus - Saturn beach with 36 m (1983 - 1992). Also, between 1981 and 2012, the evaluation of southern coastal processes (erosion/stability/accretion) accomplished through assembling the sea-land interface rates/rhythms of modification in intensity and evolution sense classes [VSE - (less than 35 m), SE - (-35÷-25.1m), ME - (-25÷-15.1m), LE - (-15÷-5.1m), RS - (-5÷5 m), LA - (5.1÷15m), MA - (15.1÷25m), SA - (25.1÷35m), VSA - (more than 35 m)] had shown a more balanced situation of beach evolution in this zone.

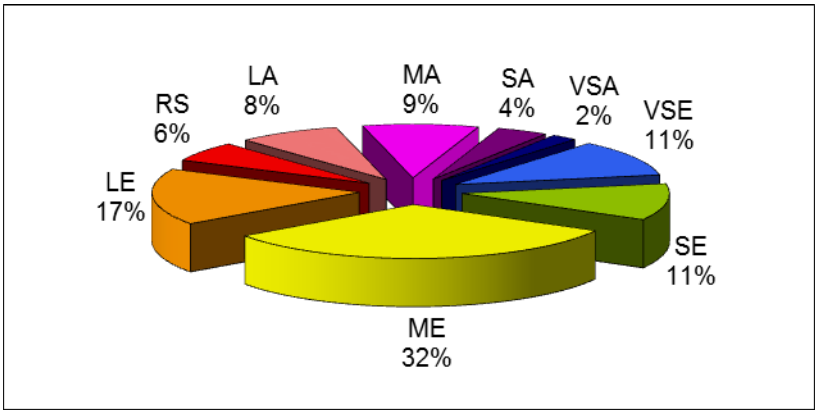


Fig. 3.47 The relative share of littoral erosive processes in the Navodari - Vama Veche shore sector, Romania (1981 - 2012) *(original)*

The development of the three ports (Constanta, Midia and Mangalia) resulted also in a major change in sediment drift along the coast. Since 1980 there has been an increase of the erosion rates compared with previous periods. The only sector characterized by accumulation is Midia, although even here the rates were slightly lower compared to the 1980s (about 2 m/year). The erosion was more pronounced in the northern and central barrier of Mamaia after 1980 (values over 2 m/year).

The Eforie barrier was characterized by rates of erosion of 2 m/year, with higher values along the southern extremity. Slightly lower erosion rates (less than 2 m/year) were recorded at the Neptun seaside. The highest rates of erosion are recorded in the Mangalia, at the south breakwater, with rates of over 4 m/year.

The Vama Veche - 2 Mai coastal area was a line of accumulation, however, in the period 1960-1980, due to the effect of the southern breakwater of the port of Mangalia on sedimentary contribution, this section of coast has become one of erosion, with the erosion rate of approximately 3 - 4 m/year.

Due to erosive process intensification, the execution of certain protection measures was required at very short deadlines and a necessary fundamental research according to the necessities and the existent concrete situations in the areas was almost impossible. The temporal behavior and morphological effects over the nearest/adjacent zones agreed with to the forecasts in different proportions, and the acquired results after detailed research for the quantification of induced geomorphologic modifications entailed some corrections for optimisation. Thus, in the last 10 years, two Masterplans of coastal protection were extended in 2005 and 2011 with the help of JICA (Japan International Cooperation Agency) through the ECOH Company and, respectively, EU structural funds trrough Halcrow Romania. At present stage, for several sectors including Mamaia, Tomis and Eforie North, there are certain ongoing works for protection, which will be finalized in one year.

The southern sector is also affected by marine abrasion, due to its structural and morphological features. Because of the particularity and irreversibility of high shore changes, under combined action of natural factors, represented by wave action, sea level rise, hydrodynamic drag through precipitations and infiltrations of the ground-water, the rhythms of morphological changes are exclusively negative, presenting average values between 0.1 ÷ 0.5 m/year, up to few meters at storm events of the severe cold season. The cliffs of this sector were monitored on continuous basis starting from 1987 and several vulnerable areas in the sectors of Eforie South - North Costinesti and 2 Mai - Vama Veche were recorded. For the period 1987-2002, the maximum retreat, about 25 m, was recorded in the Eforie South - North Costinesti sector. This sector consists of natural terraced cliffs of 20 - 40 m height, formed by fossil soils - succession of quaternary loess and paleoloess, with limestone deposits at the base - in several areas there was mean retreat of about 1m/year - shown the historical marks represented by the strongholds from Second World (Fig. 3.48).

Fig. 3.48 Blockhouse as an historical landmark **-** at two stages 1995 and 2003 *(original)*

In the Costinesti shore sector, in the past, few destructive anthropogenic actions (break-off the cliffs escarpment, the exploitations of beach sediments) were registered. But in recent time massive cliff-protection actions were done, including compacting and a placement of seawalls or revetments (Fig. 3.49).

Fig. 3.49 Costinesti 2012 (Romania) - new arrangements of the cliff-protection *(original)*

Turkey

In most of the developing countries, denser the population in coastal areas, the more vulnerable they become to severe environmental problems such as coastal erosion, exploitation and depletion of natural resources and extinction of endangered species. Wetlands at coastal areas are one of the most adversely affected areas due to their diverse floras and faunas. In Turkey, there are 14 sites designated as “Wetlands of International Importance” with a total surface area of 179,898 ha and 5 of these sites are located at coastal areas. Despite this small number, Turkey has - in fact - more than 130 important wetland zones that should be considered as Ramsar areas. Due to bureaucracy and work over load within the ministry, these areas are still not labeled as Ramsar areas.

One of these sites is Bafra alluvial plain (Kızılırmak Delta) where the Kızılırmak River discharges into the Black Sea. The site was designated as RAMSAR Area in 15.04.1998. It has a surface area of 21,700 ha including dunes, beaches, shallow lakes, seasonal marshes and wooded areas. Numerous species of water birds, several of which are globally threatened, breed at this site. Over 92,000 water birds of various species winter at the site. In recent years, eutrophication, deforestation, illegal constructions and coastal erosion have become increasingly problematic in Kızılırmak coastal wetland. The location of Bafra alluvial Plain is shown in Fig. 3.50. and Fig. 3.51. (Baykal et.al., 2012).

The Kızılırmak River, which rises in the Eastern Anatolian Mountains, flows in a northwestern direction and discharges into the Black Sea by forming a conic alluvial delta. It is the longest river in Turkey, with a length of 1,355 km, draining a basin of 74,515 km^2. The amount of sediment carried by the Kızılırmak River was 23.1 million tons/year till 1960’s prior to any flow regulatory structures and decreased to 18 million tons/year following the construction of Hirfanlı

Dam in 1960, and almost came to a cease with the toal amount of 0.46 million tons /year after the constructions of Altınkaya Dam in 1988 and Derbent Dam in 1991. This drastic decrease in the amount of sediment carried by the Kızılırmak River resulted in severe erosion with a maximum 1 km wide band of shoreline since 1988 according to the Regional Directorate of State Hydraulic Works and formal local residents.

Regarding the coastal erosion problem at Bafra alluvial plain, Kuleli et al. (2011) focused on the shoreline change rate analysis by automatic image techniques using multi-temporal Landsat images and Digital Shoreline Analysis System (DSAS) along five Ramsar wetlands of Turkey. For the Kızılırmak Delta, they have used three satellite images for the years 1989, 1999 and 2009 and found 16.1 m/year erosion rate for the Kızılırmak Delta.

The first remedial measure against this severe coastal erosion problem at the river mouth was held in 2000 by State Hydraulic Works (DSI) based on the findings of the physical and mathematical model studies. It was composed of two Y-type and one I-type groins constructed at the eastern shoreline of the river mouth. After the construction of first remedial system, the shoreline retreat slowed down between the groins and trapping of sediment initiated. However, recession at the shoreline due to wave action continued to the east from the third groin (I-groin) as almost no sediment is carried by the Kızılırmak River. Later, two jetties were constructed at the west and east sides of river mouth between the years 2001-2004 to prevent seasonal closure of the river mouth. Between the years 2004-2005, the coastal defense system was extended with the construction five more I-type groins to prevent the collapse of drainage channel. Although, the drainage channel has been saved against wave action constructing the new series of five I-type groins, shoreline retreat at the east side of the defense system could not been prevented and continued to further east (Baykal, et.al., 2012).

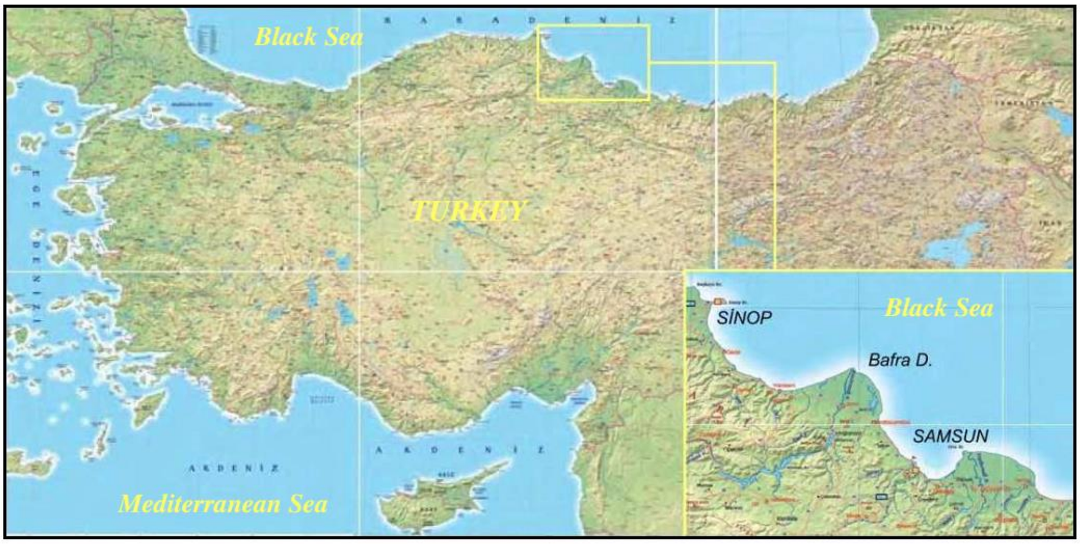


Fig. 3.50 Location of Bafra alluvial plain *(Google Earth, 2011)*

Fig. 3.51 Bafra alluvial plain and plan view of the existing shore protection system at the Kızılırmak River mouth *(Google Earth, 2011)*

According to the assessment of impacts of sea level rise on the Kızılırmak Delta, the most vulnerable location to sea level rise along the coasts of the least vulnerable region of Turkey, the Black Sea Region, coastal retreat of 2.5-5 m/year combined with sea level rise would significantly accelerate the loss of land along the coasts of the delta. Three lagoons and 15,000 ha of wetlands would be threatened by sea level rise. Although the dunes are located on the northwestern coast of delta, which are 7-12 m high and 200-300 m wide, act as natural protection, the dams constructed on Kızılırmak River during the past 50 years have decreased the amount of sediment transported by 97 %. The coarse grained bottom sediment trapped by reservoirs is another parameter that increases the severity of coastal erosion. Intensive agriculture, reed burning to improve grazing conditions and illegal sand extractions are other threats. The results along the coast are likely to be gradual erosion of the lagoon barriers and total loss of wetlands (UNFCCC, 2013).

Ukraine

The Ukraine coastline is 2,700 km long and includes the northern and western shores of the Black Sea and the Sea of Azov. The coastline may be divided into 8 areas:

- The northern part of the Danube Delta (75 km): a system of sand and silt bars in an expanding coastline (3-40 m/year, up to 130-180 m/year locally);
- The north-western firth area (355 km): lagoons separated from the sea by sand bars, erosion rates up to 3 m/year);
- The Dnieper-Karkinita area (660 km): alluvial-marine depositional plain;
- The West Crimean area (275 km): erosional coast and highly erodible rocks; most popular tourist areas with many beaches; up to 70% of the Crimean west coast is suffering from significant erosion; formerly magnificent sand beaches are being replaced by a ‘stone chaos’, because of unauthorized coastal protection works;
- The South Crimean area (350 km): mainly solid rocks, up to 50% of the coastline affected by landslides;

- The Kerch area (320 km): numerous curved bays and capes, mainly made up of reef limestones; some 20% of the coastline consists of bays separated by sand/shell and pebble/sand bars; a significant part of the coast is subject to landslides;
- The Arabat-Sivash area (180 km), in the western part of the Sea of Azov: sandy Arabatskaya spit more than 120 km long; low and flat shoreline;
- The North-Azov area (480 km): both parts that accumulate and erode; also landslides.

Storm waves from the south, southwest and southeast have the greatest impact; waves can reach up to 4-7 m near the coast. During the last 60 years the Black Sea water level has risen by about 15 cm; the current average rate of sea level rise is 0.25 cm/year, of which 0.1 cm/year is due to land subsidence and the rest is due to an increase in fresh water input that exceeds the sea water evaporation rate. Coastal retreat under the influence of sea level rise is estimated to be 0.2-0.3 m per 1 cm sea level rise. The highest erosion rates (on average 5-8 m/year) are on landslide eroding shores in cliffs made of clay rocks, typical for the north-western Black Sea coast and the Sea of Azov. The lowest erosion rate was a few centimeters per year, observed on strong limestone conglomerates, sandstones or other rock coasts, on the southern Crimean coast. Beach erosion has been accelerated by human impact: 'hard' coastal protection works, near-coastal sand and pebble mining, dredging, river regulation and dam building.

A percentage of 2.7% of the Ukrainian population lives less than 10 m above sea level. Homes as well as industrial premises, arable land and tourist sites are already experiencing erosion problems. An increase in short, intense rainfall events combined with projected rises in sea level mean erosion could be an escalating issue for the Ukrainian coast, particularly after 2050.

The adaptation strategies to coastal erosion in Ukraine include "hard" coastal protection works include seawalls, groins, breakwaters, transverse dikes. Also beach nourishments have been carried out (http://www.climateadaptation.eu/ukraine/coastal-erosion/).

In conclusion, the coastal erosion within the Black Sea encompass areas, related to the loss of sediments deposits from emerged and submerges beaches as well rocky ones by action of the waves and currents, drainage or high winds, is also in relations with sediment depositions, both on rocky and non-rocky coasts, it is developed with different rhythms of magnitude and it is perceived in different ways by local people. In order to address the erosion issues/threat, within ICZM implementation plans, some additional Masterplans for coastal erosion control should be developed.

3.3.6. Black Sea sediments

The sediment pattern in the nearshore zone of the Black Sea is governed by surface and longshore bottom currents and wave action (Ross et al., 1978). In the deep basin, the sediment pattern is controlled by an isolated cyclonic current system and bottom morphology. Large quantities of detritus from the Danube, Dnieper, etc. are deposited and trapped on the broad western shelf, whereas the terrigenous material derived from the geosyncline drainage areas (Pontic and Caucasus mountains, and Crimean peninsula) easily crosses the narrow shelf and enters the deep basin, often in the form of turbidite deposits. Textural analyses of cores from the western and eastern basins reflect these differences in the shelf morphology. A rather uniform sedimentation pattern of mainly fine-grained material predominates in the western basin, whereas abundant turbidites and silty material in the cores off the eastern coast indicate high variability in the sedimentation pattern.

Recent sedimentation in the Black Sea is governed by the deposition of terrigenous allochthonous material of low carbonate content and the autochthonous production of large quantities of biogenic carbonate material (coccolithophorids). The highest clay and carbonate content is in central areas of the western and eastern basins. Because the biogenic constituents are composed of clay-sized calcite, the total carbonate content, as well as the amount of the >2µm fraction, increase simultaneously with the Coccolith portion.

On the basis of grain size, carbonate, and organic carbon content, 12 genetic types of modern Black Sea sediments can be distinguished (Figure 3.52)

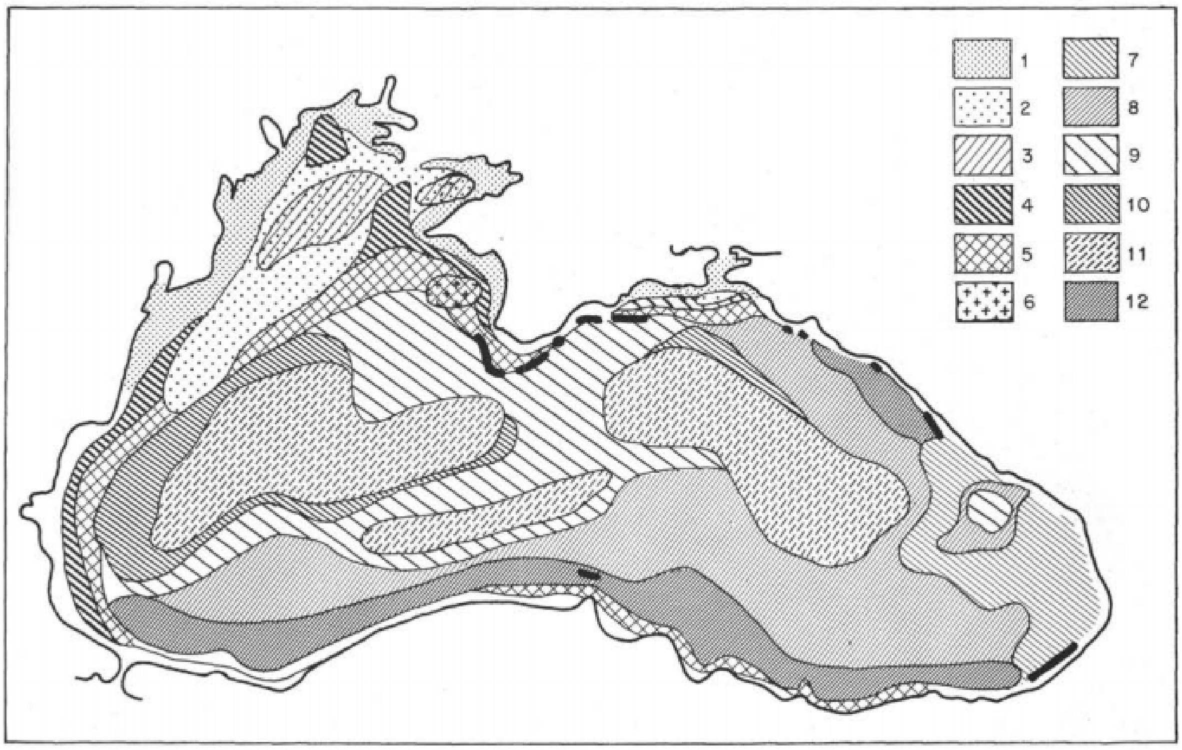


Fig. 3.52 Compositional-genetic types of modern Black Sea sediments, from Shimkus and Trimonis, 1974. Shallow-water sediments: (1) organogenic-clastic, very coarse-grained and coarse-grained sediments; (2) carbonate-rich shelly sediments; ($CaCO_3$ 50%); (3) sediments covered by overgrowth of Phyllophora; (4) carbonate-poor and carbonate-bearing, organogenic-terrigenous mytilid muds ($CaCO_3$ = 10-50%); (5) carbonate-poor and carbonate-bearing phaseolina muds concretions. Deep-water sediments: (7) carbonate-free terrigenous sediments ($CaCO_3$ content 10%); (8) carbonate-poor organogenic-terrigenous muds ($CaCO_3$ content = 10-30%); (9) carbonate-poor, organogenic-terrigenous, finely dispersed muds ($CaCO_3$ content = 10-30%); (10) carbonate-bearing, organogenic-terrigenous, finely dispersed Coccolith muds ($CaCO_3$ content = 30-50%); (11) carbonate-rich (locally carbonate-bearing), finely dispersed Coccolith muds rich in organic matter; (12) modern sediments of considerable diversity with predominance of carbon-poor organogenic-terrigenic muds *(after Ross et al., 1978)*

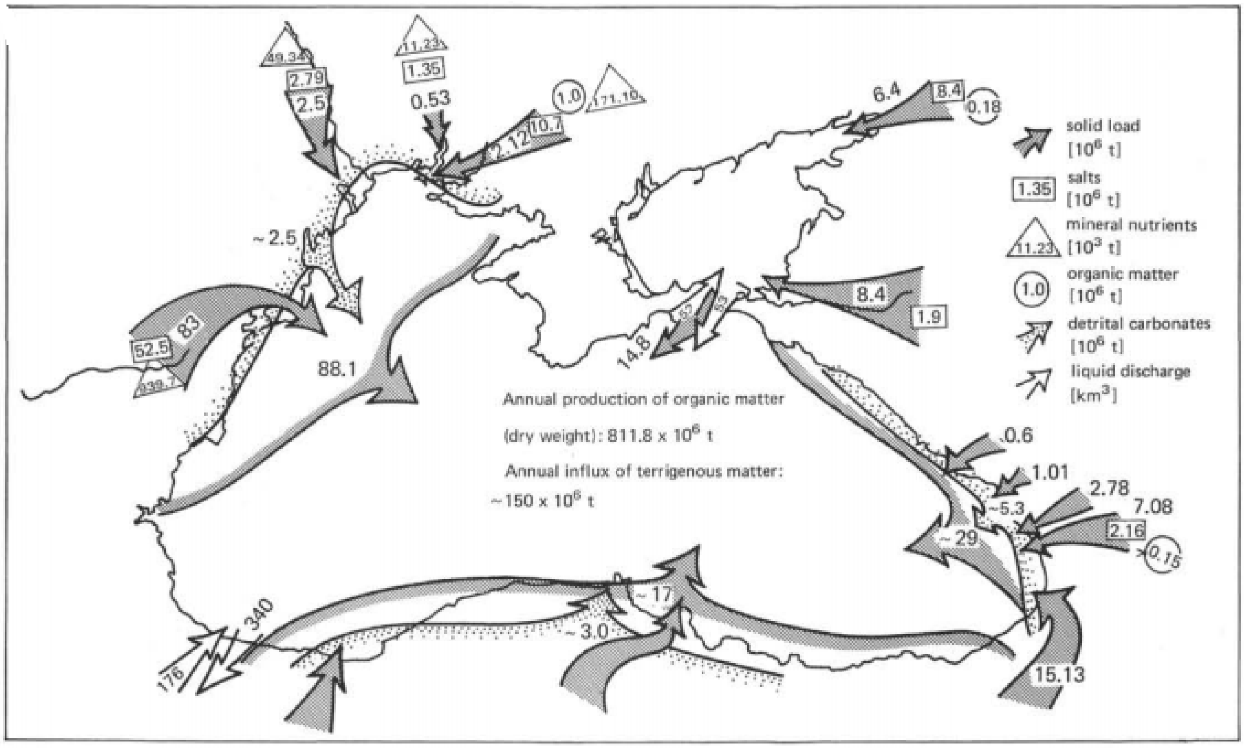


Fig. 3.53 Supply of sedimentary material to Black Sea basin on an annual basis
(from Ross et al., 1978)

The more recent extensive study of Oaie & Secrieru, 2004, revealed the sedimentary structure of the Black Sea.

Western Part of the Black Sea Basin

Danube Prodelta. Terrigenous mainly non-carbonate muds ($CaCO_3 \approx 10\%$) dominate the Upper Holocene sediment sections. Due to the high sedimentation rates, which do not allow the development of mollusks, shells and their fragments are absent or scarce near the Danube mouth; hydrogen sulphide (H_2S) is frequently present in sediments enriched in organic matter. Fluid and semiliquid muds make up the top fluffy layer (0-3, 0-4 cm) of the core. Near the mouth of the Sulina distributary, the grain size composition is rather homogenous. In the section of terrigenous Upper Holocene sediments from the southern part of Prodelta several rhythmic sequences of clayey silts and silty clays were identified. In the lower part of the section interlayers of mixed sediments and sandy mud were observed. Southward of the Danube Delta, the shelly material is more abundant in sediments, particularly in the lower part of the cores determining a higher concentration of the sandy fraction. The shells and shell fragments are either dispersed over the entire sections or concentrated in single layers. The fluffy layer was not observed here. The amount of shells and detritus is rather variable. Visual observation and $CaCO_3$ determinations show that their amount increases considerably at depths greater than 14.5 cm, but its concentration is also important in some thin interlayers. The uneven distribution of shelly material determines the heterogeneity of grain size composition of sediments. They are represented in the lower part mainly by sand, in the upper section by alternating clayey sands and silts and in the surface layer, by silty clay.

A complex of mollusks, with *Modiolus phaseolinus* typical for Upper Holocene, was observed everywhere in this area (sea depth is 56 m) in the upper part of the section (0-12 cm). Besides, here are *Mytilus galloprovincialis*, *Cardium* and fresh-water mollusks (*Dreissena*, *Monodacna*). Deeper, between 13-35 cm, *Mytilus galloprovincialis*, typical for Middle Holocene, prevails and *Cardium, Dreissena, Monodacna* are permanently present. *Modiolus phaseolinus* has never been met.

Dnieper Prodelta. The cores collected in this region, at a sea depth up to 20 m, consisted in an alternation of clay silt interlayers and silty clay. Rare shells of *Cardium, Mytilus, Paphia* and others were found in them. The macrofauna composition indicated young sediments, most probably Upper Holocene. The changes of grain size composition are connected to the cyclic accumulation of Dnieper sediments, with addition of more or less abrasion material.

Middle Zone of the North-Western Shelf. Closer to the Danube Prodelta the Upper Holocene sediments (0-12 cm) are mainly represented by sands and sandy clays. The sand is represented by unbroken shelly material with shelly detritus and variable amounts of clay. The ratios of unbroken shells to their detritus determine the grain size profile of sediments under conditions of low accumulation of clayey material. The bad sorting (sizing) of Middle Holocene sediments can be the effect of more intensive accumulation of the Danube sediments during the eastward advancing of the Danube Prodelta.

To the Dniester mouth zone, the Upper Holocene is composed mainly of shells of benthic mollusks with little addition of mud. The shelly material is predominant and determines the grain size composition, consisting mainly in sandy and coarser fractions. The sharp changes of clay fraction concentrations, increasing in the upper part of the core, are related to quantitative fluctuations of terrigenous pelitic material, mostly clay. The presence of sandy clays in some interlayers, is, most likely, caused by the intensification of the Dnieper sediment runoff accumulation.

Lower Zone of the North-Western Shelf. The cores recovered sections of Upper and Middle Holocene sediments at water depths of 76 and 65 m, respectively. Muddy sediments from both stratigraphic units have a considerable addition of shelly material unevenly distributed along the section. Sandy and coarser fractions are entirely composed of shelly material. The layers were formed under more active lithodynamic conditions that promoted grinding of shelly material or accumulation of fine-dispersed shelly detritus from adjacent regions. The Upper Holocene is characterized by an alternation of sandy muds and sandy clays with muds; the Middle Holocene consists of muddy sands covered by sandy mud.

The Upper Holocene substage was singled out by the domination of *Modiolus phaseolinus* (0-15 cm). The characteristic sediments are silty clay and sandy clay in the upper part, and clayey sand - in the lower. The distribution of grain size types in this section of Upper Holocene indicates repeated changes of lithodynamic conditions during its formation and repeated increases and decreases of the intensity of clayey material accumulation, as well as of shelly detritus. The Middle Holocene substage (15-33 cm) is characterized by the presence of large shells of *Mytilus* and their detritus. The lower part of the core (30-32 cm) is represented by silty detrital sand with rare unbroken shells of *Dreissena*. These deposits emphasize a discordant bedding of Holocene section on the Pleistocene one.

Upper Holocene is composed of silty clays alternating with layers of clays and mixed sediments. The sediments were accumulated in calmer hydrodynamic conditions that promoted the supply of terrigenous material from the Danube Prodelta.

Middle Holocene deposits are represented and shelly silt, i.e. by alternation of shelly (about 80% $CaCO_3$) silty sands, clayey sands and mixed sediments. In the Upper Holocene the clay fraction content is obviously increased compared to the Middle Holocene. The data indicate that in the lower zone of the north-western Black Sea shelf the sediments were accumulated under active lithodynamic conditions, intensified in the first half of the Middle Holocene and in certain stages of the Upper Holocene. The lithodynamic activity was probably caused by the impact of internal waves upon the shelf edge and periodic origin of anticyclonic eddies. The latter caused a spotty character of spatial distribution of bottom sediments of different types, accumulated under oscillatory sea level rise, in the shelf marginal zone during the Middle and Upper Holocene.

Lower Zone of the North-Western Shelf. Detailed litho-sedimentological studies were performed, which recovered sections of Upper and Middle Holocene sediments at water depths of 76 and 65 m, respectively. Muddy sediments from both stratigraphic units have considerable addition of shelly material unevenly distributed along the section. The $CaCO_3$ concentration was 50-60% for the most part of the cores. Only in some interlayers it either decreased to 20-40% or increased to 70%. Sandy and coarser fractions are entirely composed of shelly material. The absence of a significant quantitative correlation between the $CaCO_3$ concentration and the concentrations of the >0.63 mm and >0.1 mm fractions points to the fact that finer shelly detritus is also present. These layers were formed under more active lithodynamic conditions that promoted grinding of shelly material or accumulation of fine-dispersed shelly detritus from adjacent regions.

The distribution of grain size types indicates repeated changes of lithodynamic conditions during its formation and repeated increases and decreases of the intensity of clayey material accumulation as well as of shelly detritus. The Middle Holocene substage (15-33 cm) is characterized by the presence of large shells of *Mytilus* and their detritus. The lower part of the core (30-32 cm) is represented by silty detrital sand with rare unbroken shells of *Dreissena*. These deposits emphasize a discordant bedding of Holocene section on the Pleistocene one.

North-Western Continental Slope. The top part of all the cores is overlaid by a fluid or semiliquid "fluff" layer, 3.5-4.5 cm thick, enriched in organic matter and several heavy metals. Continuous accumulation of fine laminated carbonate coccolith oozes, enriched in organic matter, took place during Upper Holocene. Sapropelic fine laminated muds and sapropels are widespread in the Middle Holocene. The obtained cores are similar in lithological composition but they reveal different parts of the Holocene. The bottom part of Upper Holocene section is represented by a thin layer (1-4 cm) of coccolithic ooze, accumulated during the first appearance of *E. huxleyi* in the Black Sea. A thin transition layer of sapropelic mud (2-3 cm) marks the short period of its disappearance. Then the main layer of coccolith ooze continues upwards in the section.

Cores sampled from the upper zone of the slope, near the submerged Vityaz canyon, consist of muds. The concentrations of pelitic material are rather high. They are higher in the Upper Holocene, representing 80-90 %. Coccoliths, with a size varying from 0.004 to 0.001 mm, greatly influence the concentration of this size fraction, and this may explain the presence of rhythmic grain size changes.

In cores collected from the upper continental slope (water depth 485 m), in the area near the Bosphorus canyon (Turkey), the black semiliquid terrigenous silts are, probably, of Upper Holocene age. They are underlaid along an uneven boundary by sandy clay with lens texture, due to the presence of soft clayey pebbles. Large *Dreissena* and *Monodacna* specimens have been revealed in the upper part of the layer. Another core, collected from the upper zone of the slope near underwater valley, roughly 100 km north-east of the above described region (water depth 600 m) recovered only a section of the Upper Holocene, represented by coccolithic muds. Their grain size composition is rather homogeneous, silty clays alternating with clays dominating. Five rhythmic sequences of silty-clay-clay were identified, pointing to a definite cyclic recurrence in sediment accumulation. Rhythmic changes are observed in the concentrations of the clay fraction, connected mainly with accumulation of clay material.

The role of coccoliths in the formation of grain size profile of sediments is considerably lower than in the Upper Holocene sediments in station BS 98-13. The lower carbonate concentrations in muds (30-50% of $CaCO_3$) points to that.

Anatolian Continental Slope

The core sampled from the lower zone of the slope (water depth 1,912 m) consisted entirely of Upper Holocene low-calcareous terrigenous muds. Detailed sedimentological investigations showed a rather homogeneous grain size composition, the sediments being dominated by well sorted muds, with a single interlayer of silt. These muds have almost no sandy material. The coarse aleurite fraction is rather scanty, but the pelitic material is abundant (about 70% and more). A definite rhythm is observed in the changes of aleuritic and pelitic material concentrations. The sediment composition resembles the so called "homogenites", formed by fast settling of fine-dispersed material from the cloud of nearbottom suspension, which appeared as a result of the rolling of bottom sediments, probably by seismic shocks. The section was probably formed as a result of repeated settling of terrigenous material transported by turbiditic flows all over the adjacent submarine valley.

Kerch Area

The Kerch Strait is located between the Sea of Azov and the Black Sea. The Sea of Azov, as a shallow basin, is controlled by the water and sediment discharges of Don and Kuban rivers, the water surplus flowing from the Sea of Azov to the Black Sea. The sediment input is trapped in the Azov Sea, the changes of water, sediments and pollutants being limited in space. The bottom sediments are mainly fine (mud, clay, silt). Near shores a larger amount of sand is mixed with mud or clay. In the deepest part of the sea (>10 m water depth) the fine sediments show a large quantity of ostracods. The sedimentation rates were calculated for Holocene deposits using the stratigraphic zonation. During the Late Holocene 0.5-0.8 kg/m2 of sediments were deposited. During Middle (6,000-3,000 ky) and Early (7,000-6,000 ky) Holocene, minimum 2 kg/m2 sediments were deposited (Shcherbakov, 1991). A significant part of the bottom sediment is the bivalve populations. Around Kerch area banks of *Mytilus* and *Ostrea* are present. Three cores were located near the Crimea coast, one of in the abyssal area of the Black Sea, at 2,147 m water depth. One core, located at 36 m water depth, was dominated by sandy silt (0-10 cm depth) and clayey sandy silt with various intercalations between 10 cm and 20 cm depth. Living worms were present. Shell fragments were present under 3 cm depth. At 20-22 cm depth, in the core, *Cardium* shells and *Mactra* form a continuous layer. Another core was dominated by sandy mud to clay and silty clay. Shell hash was dispersed. Rare whole *Modiolus phaseolinus* shells were located at 26-28 cm. At 33-35 cm a shelly layer with whole *Modiolus phaseolinus* and *Paphia* shells was described. On the Kerch transect the surface bottom sediments are dominated by mud and silty mud and sandy silt in the southwestern part of the Crimea coast. To the shoreline the bottom sediments are mixed with many shells and shell fragments, oxidized on the surface. At 600 m water depth, the bottom sediments are dominated by clay, mud and silty clay (0-20 cm). The entire sediment core consists in coccolithic mud – it is greenish gray, very soft, microlaminated and enriched in organic matter. Biological studies indicated Upper and Middle Holocene substages.

The Coruh Polygon

The area is located on the Georgian continental shelf and receives a contribution in sediments of 11,100 m^3, 4,400 m^3 of which remain on the coastal area and 6,700 m^3 discharge into the deepest part of the basin (Shimkus, 1997). The most important sediment contribution comes from the Coruh, Riomi, Inguri and Kodori mountain rivers. The highest contribution as water input comes from river Coruh (6.3 km^3/y); the same river delivers 7.5x106 t/y sediment, representing 31% of the terrigenous contribution of Anatolian and Caucasian areas (Algan *et al.*, 1997). The main flow direction of the marine current, active in front of the river Coruh mouth is from south to north, with some local coastal orientations. All these currents contribute to the deposition of sediment along the coast, on the shelf and on the continental slope. Sedimentological and biological observations were made on cores extracted from here. One core was dominated by mud and clayey silt (0-20 cm depth), soft to compact, with lenses of sand/silt and irregular laminae, with many burrowing holes. Another core penetrated a succession of silty sand (0-11 cm depth), sandy silt, clayey silt and clayey sandy silt. Vertical and horizontal burrows disturb the sediment. Several whole shells of *Paphia* are present. The age of the bottom sediment of Coruh area is Upper Holocene.

Sinop Polygon

The studied area is situated on a narrow Turkish continental shelf. The annual sediment contribution of different rivers is 2410 m^3 (Algan *et al.*, 1997). All the rivers are short, with small drainage areas, the sediment sources being located in Caucasus Mountains and on Anatolian highland. An important part of the bottom sediment is transported to the deep sea zone through submarine canyons. One core extracted from here was dominated by sandy mud, mud and silty clay. Many large *Mytilus galloprovincialis* shells are concentrated to the core top. Between 3-4 cm and 17-22 cm there are many *Modiolus phaseolinus* shells. The mollusks from the extracted cores show that the biocoenosis is of Holocene and Neoeuxinian stages (analyses by IOBAS, Bulgaria - IAEA Report, 2004). It seems likely that the shells of mollusks and their fragments are deposited under the influence of marine currents, wave's action and rise of the Black Sea level. The presence of oval shaped mineral grains (1-6 mm) in the mud and shell detritus indicates dynamic conditions of sedimentation. The dominance of shell detritus over whole mollusk shells, between 40-24 cm, is a characteristic feature of shallow environment in littoral and sublittoral zones, with more active influence of marine waves than water currents. In the interval ranging from 0 to 24 cm depth, whole shells increase to full domination over shell detritus in the uppermost part. The differences among these intervals are explained by the raising Black Sea level (e.g. creation of deeper water conditions with the decreasing influence of the waves and the increasing influence of the marine currents).

Abyssal Area

During the Upper Holocene the accumulation of fine laminated carbonate coccolith oozes, enriched in organic matter took place. Sapropelic mud and sapropels are widespread beginning with the Middle Holocene. The lower part of the Upper Holocene section is represented by coccolith ooze, accumulated during the first appearance of *Emiliana huxleyi* in the Black Sea. The laminated sedimentary sequences in the abyssal Eastern Black Sea basin (Unit I - coccolithic ooze; Unit II - sapropelic mud) are continuous and can be traced throughout the entire basin (Ross and Degens, 1974). Unit I, representing an alternation of white and black laminae, has a base starting with the first occurrence of the characteristic conditions: the decreasing in rainfall, reducing of the river discharges, tolerable salinity (>110/00) for the coccolithophoride *Emiliana huxleyi*. The first invasion period contains ≈50 couplets of white/black laminae which have about 0.3 mm thickness each (Hay et al., 1991). White laminae are dominated by the presence of *Emiliana huxleyi* while black laminae contain mostly terrigenous matter. Unit II which is also called the "sapropelic unit", is dominated by high concentration of terrigenous matter representing a large contribution of river discharges. This unit is also laminated, but the laminae are very thin and not so easily distinguishable. The deposition of the turbiditic layer, at the base of Unit I, indicates the presence of a higher energy. Three major processes control the variability of the hemipelagic sedimentation: primary production, river input and storms introducing resuspension.

Even in some areas of the Romanain shore, where the beach is absent since 20 years ago and intervention is ongoing and carefully approached within two Masterplans, the coastal protection solutions that solve only local problems generally produce erosion in the adjacent down drift area, so a sustainable solutions must be aware of regional impacts on share equally on ecosystem. Therefore, the present erosion is related to unbalance in the sediment situation, and the consideration of regional effects/impacts towards a Regional Sediment Management, as a key to controlling and managing the coast, is required. The Black Sea coastal environment in Romania is generally under oblique waves and marine currents that impact the coast, as a result of northerly winds as well as the Coriolis force within the basin, producing a generally south-trending littoral drift and a concequently a long shore sediment transport. The beach area in front of the Danube Delta has a different share of shells in sediments from one area to another, in the same area and in the same sub domains of the beach. These shells belong mostly to the bivalves category, *Mya Arenaria* predominantly, but also there are individuals of the *Mytilus galloprovincialis* species, *Scapharca inaequivalvis* and rarely, *Venus gallina* and *Cardium edule.*

It is worth nothing that the majority of shells belong to the *Mya Arenaria*, species that invaded the Black Sea some decades ago, similarly to *Scapharca inaequivalvis*. The surface sedimentary deposits on the Romanian coast in front of the Danube Delta are composed mainly from fine grained sand. The source of sediments in this area is the Danube, through its arms. The drastic decrease volume of sediments carried by the Danube triggers erosion processes, increasing the percentage of carbonate fraction, especially in the south area (Portita, Periboina).This increase of the carbonate fraction (fragments of shell) will lead to modifying of the cumulative curves.

The most significant anthropogenic impact to the Romanian coast is related to the construction of hydrotechnical works (dams) on the Danube River and the jetties at Sulina. After the mergence of the Iron Gates I dam, constructed in 1970, followed by the Iron Gates II, constructed in 1983, the decreasing of the sediment discharge was 45-70%, (Fig. 3.54).

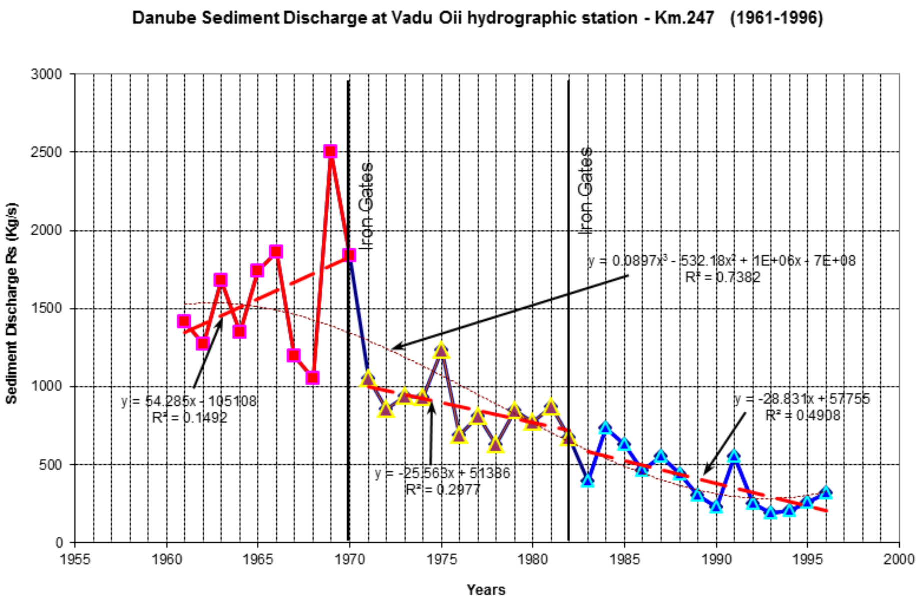


Fig. 3.54 Danube sediment discharge at Vadu Oii hydrographic station, Km 247, 1961-1996.
(after Panin and Jipa, 2002)

The longshore sediment transport along the Romanian shore based on certain data compiled by Giosan et. al (1999), using the USACE SMS Software, illustrates the sedimentary and erosional character of the coast by showing its magnitudes and directions (Fig. 3.55). The authors give the quantity of 800,000 m^3/year of sand which is lost from the Sulina mouth. Shoreline erosion southwards could be significantly reduced through newer shoreline management techniques grounded on natural processes that permit flexibility and can reduce maintenance costs and improve ecological quality.

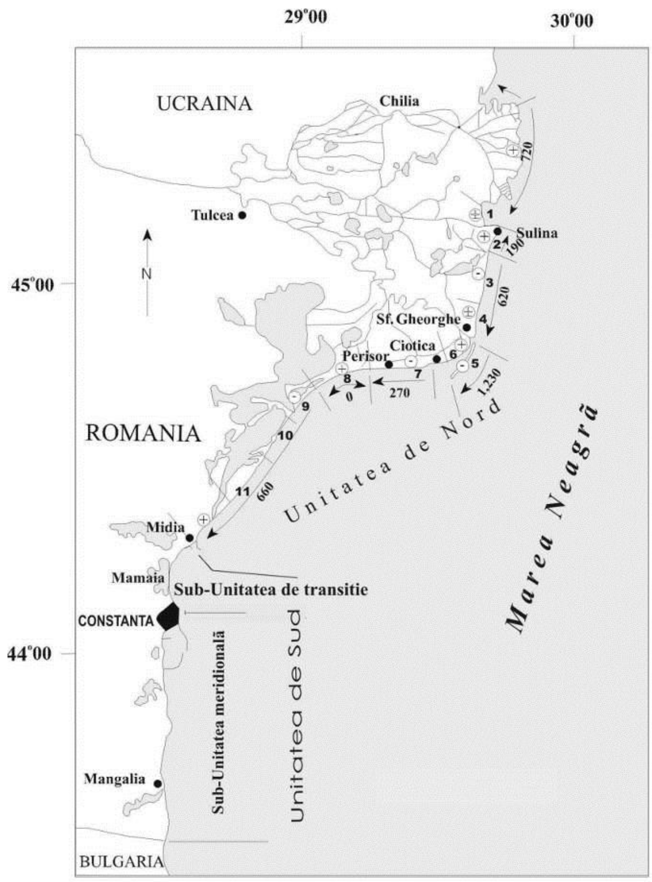


Fig. 3.55 Longshore sediment transport model on Danube Delta coast (thousand qm/year)
(after Giosan et al., 1997)

The sediment budget is unbalanced by activities such as sand dredging, entrapment in reservoirs, or impoundment by coastal engineering structures, and the sediment status indicates the degree to which the sediment balance is in equilibrium, evaluated based on the function and use of the coastline at proper scales.

In the past decades, the Danube's sediment quantities discharged in the Black Sea were estimated to about 7.35 kg/s/year, but taking in consideration the changing in distribution through the three branches (53.3% on Chilia, 5.8% on Sulina and approx. 21.9% on Sf. Gheorghe in 2000), their effect on the coast was changed too.

On the southern shore, the human intervention is in another order of magnitude because of the complexity of the sediment patterns, but the preparation of the tourist beaches during summer by extracting the organic fractions of the sediments contributes to the acceleration of erosion.

Conclusions. Because coastal erosion at the Black Sea Coast has been both prolonged and rapid, regional intervention must be both immediate and well-planned. After analyzing the results regarding the shoreline variability for different Black Sea sectors, due to the variability of geomorphological changes and various erosion causes, the conclusions are that it is necessary to deepen the issues, practically and theoretically, in order to reach a correct understanding of the coastal processes and their impacts under new climate conditions. In general, the effects of hydrological and meteorological factors, especially of storms surges, are not limited only to the natural shore. They are extended to areas governed by anthropogenic factors, where the impacts of winter storms are more visible and consequences become more dramatic on short terms, due to strong wind/waves magnitude, or their durations.

The magnitude of shoreline retreat is proportional with the average seasonal and annual sea-level rise. The continuous shoreline and sea-level monitoring allows the extension of efficient specific shore protection solutions on specific shore sectors. The currently methods emphasize the general characteristic of the shore response, which together with the proper arrangements works will make possible the correction and good management practices at different space and time scales, namely a proper Regional Sediment Management in connection with environmental-friendly coastal construction works.

***

A comprehensive analysis of the natural drivers in the Black Sea coastal zone has resulted in identifying a series of pressures exerted on the environment by natural factors, as follows:

Climate change/extreme phenomena:

- Sea level rise
- Storm intensification
- Extreme warming of seawater in summer (temperatures above 28-30°C)
- Increasing incidence of extreme phenomena such as marine tornado/waterspout
- Changes in dominant wind frequency, causing the increasing incidence of coastal upwelling processes
- Increasing incidence of heat waves/air humidity above 80%, overcomings of the UV index etc.
- Precipitation/drought intensification
- Salt water penetration in coastal aquifers
- High salinity variability of water masses from lagoons and coastal waters.

Enhancement of coastal erosion processes:

- Beach erosion
- Shoreline retreat at a forecast sea level rise
- Decrease of sedimentary transport rates
- Beach flooding after storms
- Instability in river outflow mouths and lagoon entrance channels
- Littoral belts erosion and vulnerability
- Cliff erosion and instability
- Property loss/damages to the infrastructure in high coastal hazard areas
- Extension of the interchange zone between shoreline retreat/advancement

3.4. Anthropogenic pressures and impacts

The current period, following the 1990s, is regarded as a period of relaxation of human pressure, in particular in relation to the economic collapse of the socialist block countries, which led to the abandonment of many polluting activities in agriculture, industry, urban development in the Black Sea coastal region. It should be noted that, by 2007, the so-called anoxic “dead zones“ in the Western Black Sea disappeared, the frequency of hypoxia conditions decreased, the biomasses of the fodder zooplankton species increased and the invasive species abundances dropped.

However, the ecological state of the Black Sea ecosystem has continued to be a concern due to the loss of biodiversity caused primarily by the socio-economic pressures, namely eutrophication, overfishing, even if the fishing fleet has disappeared in the highest proportion, pollution by oil and hazardous substances, introduction of new invasive species, coastal erosion, transportation and tourism in the wider climate change context.

Thus, various provisions of the legislation in force contain many references to marine pollution, however not adequately quantifying and including in the regulations/rules of good practice and national or European regulations the action of the various pressures exerted by the socio-economic environment, such as biodiversity loss and degradation, habitat loss, overfishing, eutrophication due to certain gaps which lie in insufficient funding of research programmes and projects, lack of expertise and advanced research equipment.

However, many of the parameters and indicators analyzed in environmental state reports (such as, for example, nutrients, hazardous substances, biodiversity, fish stocks etc.) are already in direct accordance with the requirements of the Marine Strategy Framework Directive (MSFD).

It will be necessary to extend the MSFD for indicators of hydro-morphological changes crucially impacting especially in coastal areas, namely the rates of shoreline retreat, rising sea levels, changing the topography and bathymetry of shallow areas as a result of extending various coastal protection constructions which cause changes in the annual and seasonal velocity regime of currents modified by exposure to wave action, inducing changes in the mixing characteristics, turbidity (optical regime change), residence time etc. and changes in habitat distributions in areas which deserve special attention due to their characteristics, location or strategic importance, respectivley, by undergoing extreme/specific pressures, for areas requiring special protection regime. Thus, it can be stated that the main anthropogenic pressures identified in the Black Sea coastal zone result from the pronounced development of various socio-economic activities in the coastal zone natural space: tourism and leisure, buildings/holiday homes in tourist areas, expansion and modernization of existing tourist marinas, harbors and navigation, marine fisheries, agriculture and food industry, petrochemical industry, refineries, offshore oil and gas activities etc.

As a result of these pressures, the Black Sea coastline faced significant problems regarding habitat destruction, coastal erosion, water pollution and depletion of natural resources. The rapid population growth in residential areas, in previously tourist areas and the rapid development of the related infrastructure have led to severe degradation and decline in the quality of the Black Sea coastal zone, along with the large-scale exploitation of natural resources (NIMRD Report, 2013).

3.4.1. Development and construction

The Black Sea coastal zone is an area where great numbers of human activities demand use of the coastal space and therefore it has a special role in protecting the sea. The sea has a profound influence on the coastal environment and its use by the people. But human use also has a profound influence on the environmental state of the coastal waters. The habitats of many plant and animal species in the coastal zone are more numerous than other places in the sea. For the people the coast is the area where they come into contact with the sea.

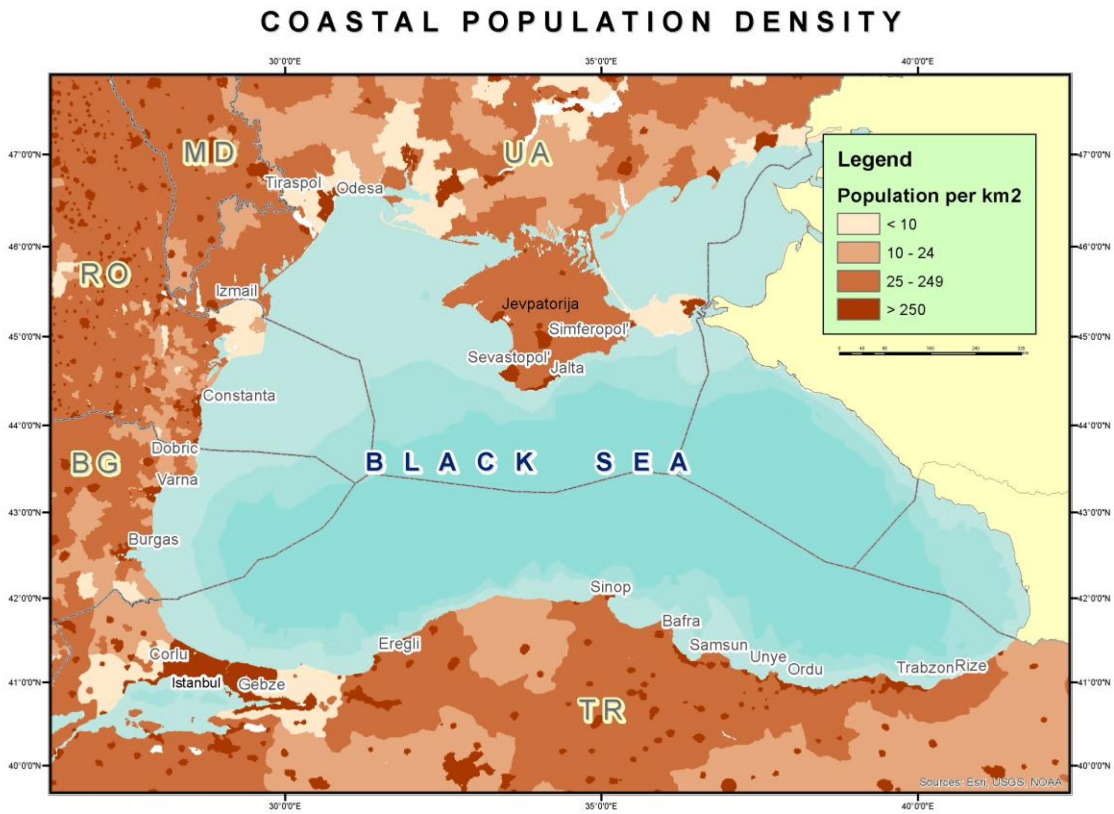


Fig. 3.56 Black Sea coastal population density *(original map)*

The economic activity of municipalities along the Black Sea is of particular significance for protecting the sea. One economic use of the coastal zone quite often denies opportunities to other activities. The construction of coastal highways limits the development of coastal tourism and wildlife reserves. The construction of hotels on the beach and in the immediate vicinity of the shore puts a burden of waste from human activities on the environment and the quality of the beach and the coastal waters deteriorate.

Fig. 3.57 Illegal constructions on the beach (Eforie, Romania)

The growth of beach resorts is a reason for concern. In many places the restrictions on construction are not observed. Powerful interest groups are trying to take entire sections of the coast that contain the most significant biodiversity. Many hotels, both new and old discharge much of their waste straight into the waterways without treatment. Even this changing of the local environment can have huge effects. Industrial enterprises also contribute to the coastal pollution. Farming can cause nutrients and pesticides, harmful to the marine environment and human health, to be washed into the water through runoff. The felling of trees can lead to unstable topsoil, leading to erosion, which has become a very serious problem for the Bulgarian coast. Even dams and dikes can stop the flow of important sediments into the sea, thus weakening beaches that act as normal storm breakers (http://www.blackseascene.net).

Among the most common coastal zone construction practices that jeopardize marine ecosystems around the Black Sea are various types of excavation (digging, dredging, quarrying and mining). Wetlands are particularly at risk from shoreline development, because they do not have the carrying capacity that land areas have for supporting commercial and industrial activities or urban occupancy. Any construction work that causes soil loss can be a major source of impact to coastal biodiversity. Quarries that supply rock or aggregate can give rise to water quality problems from release of sediments from excavated materials (Clark, 1995).

Coastal constructions in the Black Sea region

Focus: Romania

The coastal protection works affect the local alluvial transport and help to maintain a beach along the front. The hydraulic structures existing in the study area are: dams, breakwaters, jetties, sea walls, touristic ports etc.

Fig. 3.58 Mamaia breakwater (Romania)

Fig. 3.59 South Eforie groin (Romania)

The many coastal protection constructions built since 1980 have led to fluctuations in the shoreline position, as these structures were determined by forming the accumulation of localized deposits, unnoticed in previous periods. Along the southern littoral, in a period of about 70 years starting with 1936, closely related to the development of inland hydro-technical works and the extension of navigation constructions, followed by progressive intensification of erosion processes, some coastal protection systems were designed and executed. All these shore protection and coastal development works, cumulating about 13.5 km, represented 49 shore-connected breakwaters, 24 longitudinal breakwaters (16 of them submerged), and more than 17.5 km seawalls and revetments. Also, about 14 km of cliff were consolidated.

Although a large part of this sector was protected by coastal constructions, these had not the expected effect in the shore stabilization. The implementation of these protection systems was started between 1936 and 1940 and continued gradually, between 1956 - 1960, 1967 - 1970, 1981 - 1985 and 1989 - 1990 until 1991, when such shore protection and coastal development works were stopped. For the limitation of erosional effects, several surveillance, physical and numerical modeling, design implementation and monitoring actions of the hydrotechnical structures for coastal protection were gradually extended.

Starting with 2000, recent actions, carried out with the support of the Environment Ministry, were included in the development of the coastal erosion survey programme; they consists in data collection and storage, through the use of specific measurements, in order to realize a complex database, as an informational support with the view of the coastal protection and rehabilitation solutions design and implementation.

Therefore, taking into account the need for the protection of the shore against both natural and anthropogenic factors, several coastal protection measures can be used.

Current worldwide applicable trends for shore protection are environmental-friendly; the action is valid for short term and limited to monitoring, and the implementation of the "hard" (structural) and "soft"(non-structural) solutions, on short and medium terms. In conformity with the "European Code of Conduct for Coastal Zones" (1999), the documentation regarding the situation and the trends in coastal protection includes two principal types of solutions:

- ***"hard " structures,*** capable of resisting the waves and tides energy. These structures include: shore-connected breakwaters (groins of different shapes and sizes), parallel breakwaters designed to keep the sediments on the beach. The impact of these protection structures produces a disturbance of natural landscapes and natural processes, and also high, costs of design, execution, maintenance and monitoring.

Groins are barriers or walls perpendicular to the sea, often made of greenharts, concrete, rock or wood. Beach material builds up on the downdrift side, where littoral drift is predominantly in one direction, creating a wider and a more plentiful beach, therefore enhancing the protection for the coast because the sand material filters and absorbs the wave energy. However, there is a corresponding loss of beach material on the updrift side, requiring that another groin to be built there. Moreover, groins do not protect the beach against storm-driven waves and if placed too close together will create currents, which will carry sand material offshore.

Walls of concrete or rock, built at the base of a cliff or at the back of a beach, are used to protect a settlement against erosion or flooding. They are usually about 3-5 metres (10-16 ft) high. Older-style vertical seawalls reflected all the energy of the waves back out to sea, and for this purpose were often given recurved crest walls which also increase the local turbulence, and thus increasing entrainment of sand and sediment. During storms, sea walls help longshore drift.

- ***"soft" structures,*** which "work with nature", in the way of natural defense principle applicability (natural transport and accumulation of sand deposits of an artificial beach nourishment, dunes formation by reed fences and vegetation curtain). These coastal protection solutions are generally environmental friendly, leading to a dynamic equilibrium of the local coastal processes. Also, this kind of solutions has economical benefits through its milder environment impact.

Beach replenishment or nourishment is one of the most popular soft engineering techniques of coastal protection management schemes. This involves importing sand off the beach and piling it on top of the existing sand. The imported sand must be of a similar quality to the existing beach material so it can integrate with the natural processes occurring there, without causing any adverse effects. Beach nourishment can be used alongside the groin schemes. The scheme requires constant maintenance: 1 to 10-year life before first major recharge. Also, vegetation can be used to encourage dune growth by trapping and stabilising blown sand.

In practice, many coastal protection systems incorporate aspects of both kinds of solutions. For the northern, as well as for southern Romanian littoral, a Regional Sediment Management practice in agreement with natural coastal dynamics is encouraged, much more than a traditional/classical one (which would fight against sea action); thus, the soft solutions, which use the natural processes in coastal protection, are very adequate; among these, the artificial nourishment of beaches is a largely used method, in the conditions of the properly located sediment sources, a premise lacking at the Romanian littoral.

3.4.2 Agriculture and fisheries

Afforestation of dune ecosystems and heathlands for commercial timber production with alien *Pinus* species, construction of highways and urbanisation along the coast constitute the main pressures on biodiversity in the south of the region. Wetlands, both in the northwest and in the south, suffer from reclamation schemes.

On the coastal fringes of Turkey, most of the higher-value crops are grown. The relative warmth and dampness of the Black Sea coastlands make this region one of the most intensively cultivated despite its limited lowlands. The building of enclosures for agriculture, forest plantations and pisciculture in the Danube Delta, have damaged the ecosystems of stagnant waters, reed plots and riverbanks. Large quantities of reeds that grow in shallow water in the Danube Delta are used in the manufacture of paper and textile fibres. The parcelling and the controlled hydrographic conditions have put pressure on natural ecosystems. In some cases, these have been proved to be economically inefficient and the natural hydrographic conditions have been restored (Fig. 3.60).

Traditionally, Istanbul heathlands are used for bee farming and grazing. Heathers are also used for broom production, an important element of the rural economy in the Istanbul region. Huge irrigation schemes were introduced in Romania 25 years ago (about 3.2 million ha), it is estimated that 200 000 ha have been salinized through irrigation, which represents about 6 % of total irrigated land. Part of this area is in the Black Sea region. Salinization has direct negative effects on soil biology and crop productivity. It also has indirect effects in that it leads to loss of soil stability through changes in soil structure (alkalinisation). Salinization is reversible but reclamation of saline/alkaline soils is expensive, as it requires complex amelioration techniques. Waterlogging occurs in the lower Danube valley and along the Black Sea coast. It is the result of flooding due to the raising of water table by irrigation and an increase in the amount of rain run-off. This leads to decline in soil structure.

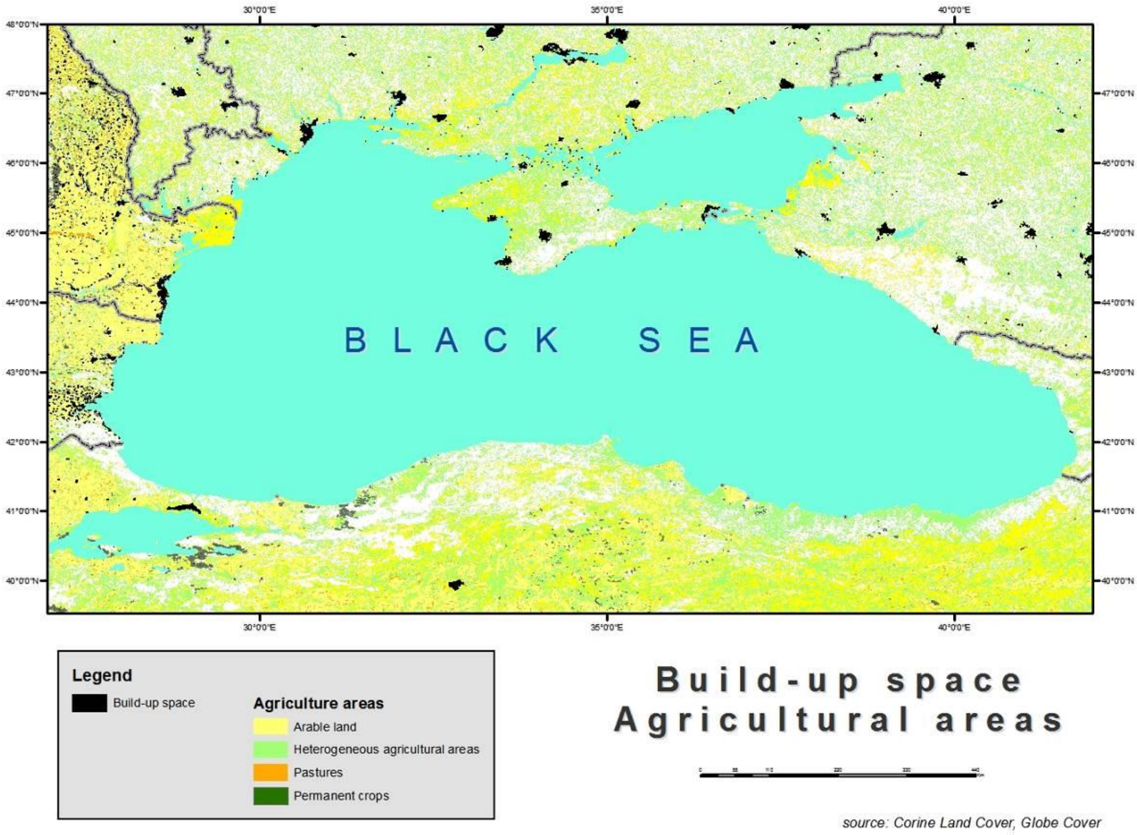


Fig. 3.60 Build-up space vs. agricultural areas in the Black Sea coastal zone *(original map)*

Agriculture in countries around Black Sea (Ukraine, Turkey, Georgia, Russia, Romania, Bulgaria), nearest countries (Belarus, Moldova, Poland, Kazakhstan, Armenia, Azerbaijan, Latvia, Estonia, Lithuania, Hungary and Czech) and other countries around the Globe include poultry, grain, forestry, horticulture, fish, seafood, fruits, vegetables, livestock, crops, biofuel, fertilizers, dairy, farming, cultivation, machinery, market intelligence, organic farming, precision, agriculture, electronics, lands, crops.

Important cities/towns along the coast include Batumi, Bourgas, Constanta, Giresun, Hopa, Istanbul, Kerch, Kherson, Mangalia, Navodari, Novorossiysk, Odessa, Ordu, Poti, Rize, Samsun, Sevastopol, Sochi, Sukhumi, Trabzon, Varna, Yalta and Zonguldak (Fig. 3.61).

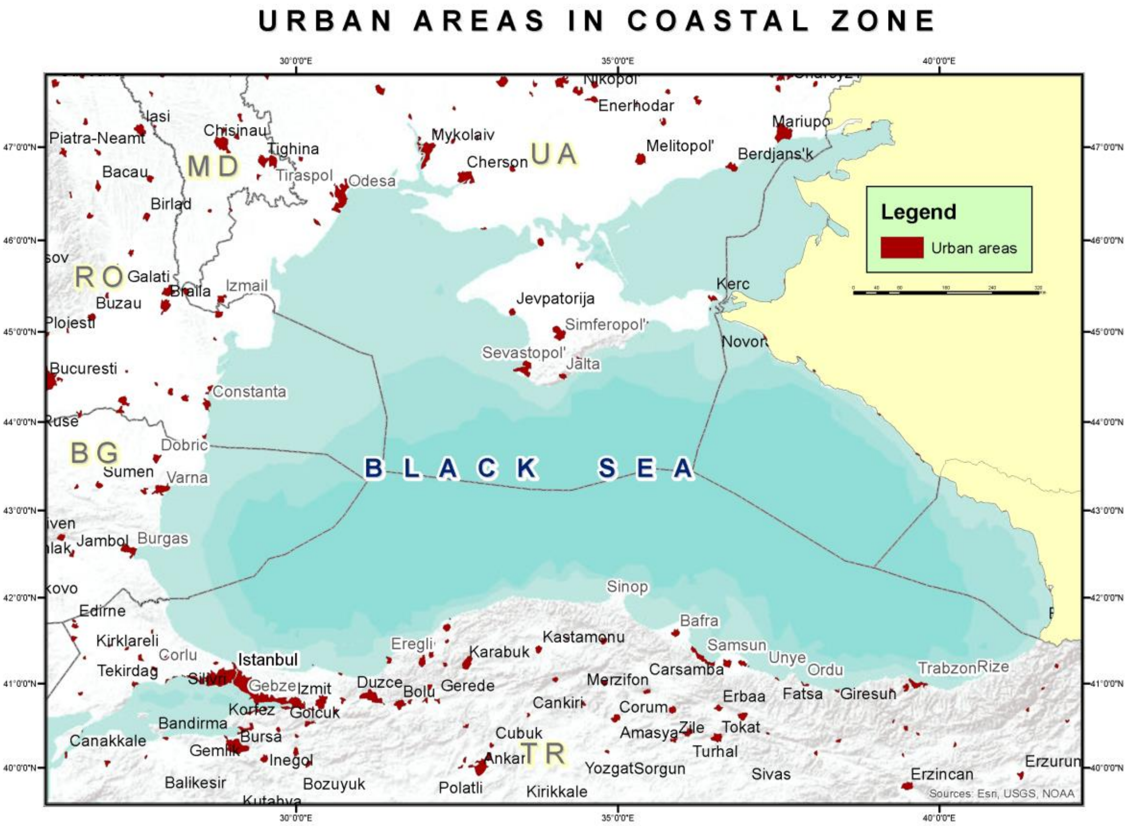


Fig. 3.61 Urban areas in the Black Sea coastal zone *(original map)*

Marine aquaculture in the Black Sea is relatively underdeveloped. With the exception of Turkey where European sea bream and sea bass are cultivated intensively, most mariculture focuses on molluscs, with Bulgaria dominating. As extractive species tend to exert fewer pressures on the environment, and because the size of the mariculture sector is small and poorly monitored, no dramatic environmental impacts from mariculture have been noted to date.

Current state of the marine fisheries in the Black Sea

Fishing Gears and Methods

Fishing gears allowed for the use in the fishing activity and their characteristics are defined by fishing rules; annually these rules can be specified.

The following fishing gears are allowed for the use in the Black Sea by fishing rules ("The Rules of Special Commercial Fishing in the Black Sea Basin", par. 13 and 14) (NIMRD Interim Report SRCSSMBSF, 2013):

- midwater trawls - for the fishing of sprat and whiting;
- purse seines - for the fishing of so-iuy mullet, European anchovy, horse mackerel, mackerel, bluefish, bonito, grey mullet;
- ring nets - for the fishing of so-iuy mullet, European anchovy, horse mackerel, mackerel, bluefish, bonito, grey mullet;
- pound nets - for undirected fishing, for the fishing of so-iuy mullet and grey mullet;
- uncovered stationary traps with closing entrances - for the fishing of so-iuy mullet and grey mullet;
- stationary covered traps - for undirected fishing;

- fyke nets - for undirected fishing, for the fishing of gobies;
- beach seines - for undirected fishing, for the fishing of gobies, grey mullet, red mullet, Black Sea anchovy, Tyulka sprat, sand smelt;
- gillnets - for the fishing of gobies, turbot, European flounder, picked dogfish and ray and stingray, so-iuy mullet, Black Sea shad;
- lift nets - for the fishing of horse mackerel;
- cast nets - for the fishing of horse mackerel, so-iuy mullet;
- pots - for the fishing of gobies;
- hand beach seines and hand nets - for the capture of shrimps and amphipoda;
- longlines - for the fishing of picked dogfish and ray and stingray;
- different hand gears and manual harvesting - for the capture of Mediterranean mussel and the veined rapa whelk;
- Khizhnyak's dredges - for the capture of Mediterranean mussel and veined rapa whelk;
- the fishing of grey mullet with encircling gillnets is allowed in 2013 ("The Regime of Special Commercial Fishing in the Black Sea Basin in 2013", par. 18.3);

The use of other fishing gears is prohibited.

It should be taken into account that the possibility of fishing any target is defined not only by the fact that such fishing should be allowed by fishing rules, but also by the availability of limit for the capture of this target at the sufficient rate. So, the fishing of mackerel, bluefish, bonito is allowed by fishing rules, but in is not actually exercised, because the absence of limits does not allow to do it.

Number of Vessels

At present, the Black Sea fishing operates a total of 7,064 fishing units (not including Russia and Georgia), of which 75.8% belong to Turkey, 14.3% - Bulgaria, Ukraine - 7.3% and only 2.6% Romania (Table 3.3).

In Turkey the registered number is 5,358 vessels, of which: 70.2 % (vessels 6 - 12 m), 13.8% (12 - 18 m), 8.6 % (18 - 24 m), 6.7 % (24 - 40 m) and 0.7 % (> 40 m) and in Bulgaria are recorded a number of 1,009 fishing units, of which: 33.9% boats smaller than 6 m, 8.0 % vessels 6 - 12 m, 5.2%, vessels 12 -18 m, 1.6 % - vessels 18 -24 m and 1.2 % vessels 24 - 40 m (Table 3.5).

Table 3.5 The number of vessels registered in the Black Sea region

Length of vessels	*Turkey*	*Bulgaria*	*Ukraine*	*Romania*	*TOTAL*
< 6	0	343	0	34	**377**
6 - 12	3,762	586	393	145	**4,886**
12-18	738	52	39	2	**831**
18 - 24	463	16	44	1	**524**
24 - 40	360	12	25	1	**398**
> 40	35	0	13	0	**48**
TOTAL	**5,358**	**1,009**	**514**	**183**	**7,064**

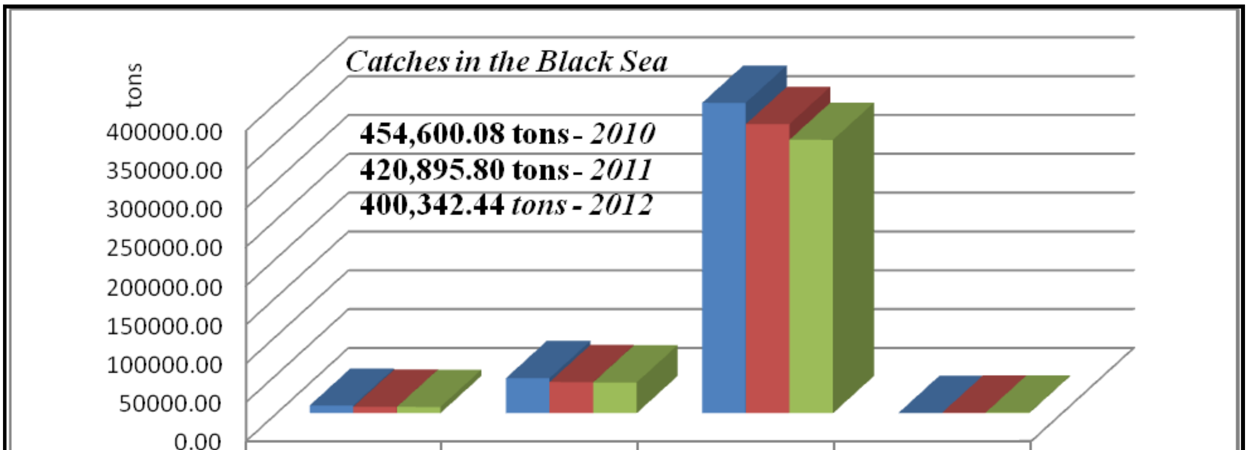
About 500 vessels are registered in the Black Sea region of Ukraine. It should be noted that the majority of vessels is technologically depreciated, therefore the number of actually working vessels is significantly less than it is registered (Reznik, 2011). Small vessels for artisanal fishing prevail / 76.5 % (Table 3.3). The officially registered catch made up about 45 thousand tons in 2011 and about 40 thousand tons in 2012. The core of catches is made up by fish - 99%, and small pelagic fish species (sprat and anchovy) prevail among fish in catch. The prevalent type of fisheries is industrial, which brings 95% of recorded fish products. The portion of artisanal fisheries is quite small - 5%, though its role is important from the point of view of ensuring people employment. It should be noted that actual catches are bigger than those indicated by official statistics because of presence of unrecorded catch. Ukrainian fishers currently exercise fishing in the Black Sea only within the limits of waters under the jurisdiction of Ukraine.

In 2012, the Romanian fishing fleet capacity at the Black Sea was of 491 vessels registered in the FFR at the beginning of the year, structured on length classes as following: 34 boats smaller than 6 m (6.92%); 153 boats in the length class 6-12 m (31.16 %) and 4 boats/vessels bigger than 12 m (0.81%) (Table 3.3). The remaining 61.11% is represented by non-operating boats, which, despite being recorded in the boat and vessel register, do not perform fishing activity.

Total catch of the Black Sea

The total catch of the four states participating in the project, namely Turkey, Bulgaria, Ukraine and Romania, ranged, in the past three years, between 455,000 tons and 400,000 tons. The total catch recorded a downwards trend, in 2011 being by 7.41% smaller than in 2010, and in 2012 by 4.88% than in 2011 and by 11.93% than in 2010 (Fig. 3.62).

Turkey is by far the main fishing country in the Black Sea, reaching a catch exceeding 85% (87.91 - 88.43%) of the total catch, followed at great distance by Ukraine, with almost 10% (9.50 - 9.80 %), Bulgaria with 2% (1.94 - 2.13 %) and under 1% Romania (0.06 - 0.21 %).



	Bulgaria	Ukraina	Turkey	Romania
2010	9685.90	45000.00	399656.00	258.18
2011	8147.60	40000.00	372180.00	568.20
2012	7944.70	39548.00	352012.00	837.74

Fig. 3.62 Total catch of Bulgaria, Turkey, Ukraine and Romania, during 2010 - 2012

Out of the total catch recorded during 2010-2012, the small pelagic species are the background of Black Sea fisheries, with a percentage of 78%, followed at great distance by demersal species 2%, other species 17% and the rapa whelk 3% (Fig. 3.63).

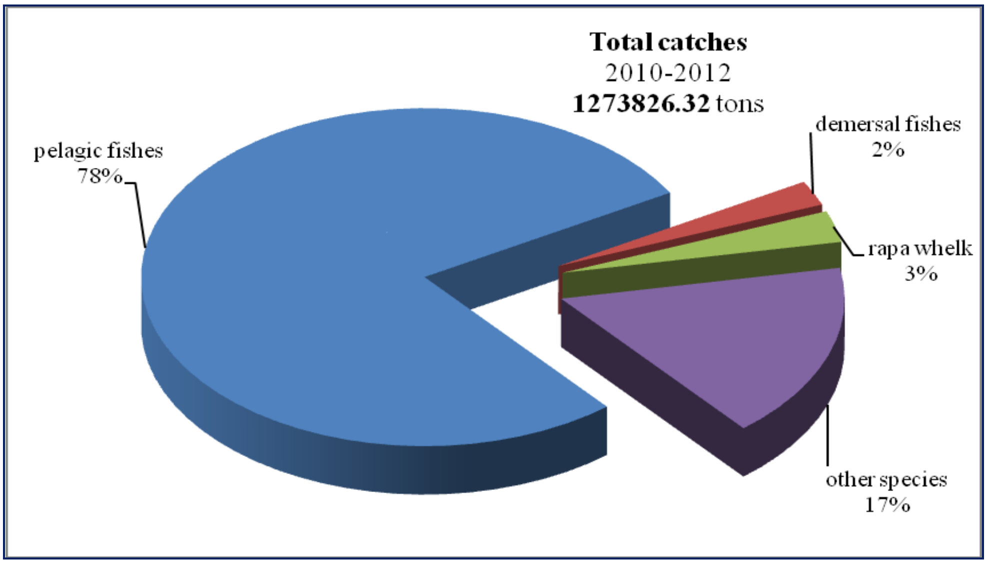


Fig. 3.63 Share on species of the total catch in the Black Sea, during 2010-2012

The state of key pelagic fish

Pelagic fish, particularly their small-sized plankton-eating types are the most abundant in the Black Sea ichthyocoenosis. This factor defines their leading role in fisheries. The main target species of fisheries is European anchovy (*Engraulis encrasicolus*), whose catch has varied from 31% in 1991 to 75% in 1995 of the total MLR harvest during the last 15 years. Mediterranean horse mackerel (*Trachurus mediterraneus*), European sprat (*Sprattus sprattus*), Atlantic bonito (*Sarda sarda*) and bluefish (*Pomatomus saltatrix*) are the major pelagics in terms of fishing value. The latter of these three species are large-sized predators which enter the Black Sea from the Marmara and Aegean Seas for feeding and spawning in spring and turn back for wintering in late autumn. The catch data suggest the partial recovery of the major pelagic species after the fishery collapse in 1991. From the Black Sea fisheries perspective, the most important demersal fish species are whiting (*Merlangius merlangus*), picked dogfish (*Squalus acanthias*), turbot (*Psetta maxima*), striped, red mullets (*Mullus barbatus*, *M. surmuletus*) and four species of family *Mugilidae*, including the so-iuy mullet (*Mugil soiuy*). The demersal species are intended mainly for the human consumption and for export. In the last decade, among molluscs, increasing commercial value has the blue mussel (*Mytilus galloprovincialis*) along with the rapa whelk (*Rapana venosa*), the catch of the rapa whelk is going on during the summer through diving method. The total catch of these demersal fish species in 1996-2005 was lower on the average than in 1989 - 2005 and had a tendency of reduction after 2000.

Minimum sizes

Commercial fishing is forbidden if by-catch of fish or other aquatic organisms smaller than established value exceeds the established norms. For these purposes, the following minimal sizes of fish or other aquatic organisms are established in the Black Sea (Table 3.6):

Table 3.6 The species minimum admissible length (cm)

Latin name		**BG**	**GE**	**RO**	**RU**	**TR**	**UA**
Acipenser guldenstadti	Danube sturgeon	120	p	140	110	p	p
Acipenser stellatus	Starry sturgeon	120	p	100	100	p	p
Alosa tanaica	Caspian shad	15		15	11		11
Alosa immaculata	Black Sea shad	22	17	22	17		17
Atherina boyeri	Sand smelt			7			
Belone belone euxini	Garfish	25					
Clupeonella cultriventris	Kilka			7			
	Sardine					11	
Engraulis encrasicolus ponticus	Anchovy	8	7	7	6.5	9	
Gobiidae	Gobies nei	12	11		11		11
Huso huso	Beluga	180	p	170	p	p	p
Liza aurata	Grey mullet	25		25	20	30	20
Merlangius merlangus euxinus	Whiting	8	12		12	13	12
Mugil cephalus	Golden grey mullet	25		25	20	30	20
Mugil soiuy	So-iuy mullet	30		25	38	35	38
Mugilidae	Mullet nei	30	20	25			20
Mullus barbatus	Red mullet	8	8.5		8.5	13	8.5
Mytilus galloprovincialis	Mussel	7			5		5
Natantian decapods nei	Decapod nei				3.5		3.5
Platichthys flessus luscus	European flounder	20		20	15	20	
Pomatomus saltatrix	Bluefish					20	
Psetta maeotica	Turbot	45		45	35	45	35
Rapana venosa	Rapa whelk	6.0		5.5	5.5		
Sarda sarda	Atlantic bonito	28				25	
Scomber scombrus	Mackerel	22					15
Sprattus sprattus phalericus	Sprat	7	6	7	6	no	6
Squalus acanthias	Picked dogfish	90	85	120	85		85
Trachurus mediterraneus	Horse mackerel	12		12	10	13	10
Venus gallina	Venus					1.7	

Table 3.7 Common fisheries legislation for the Black Sea countries

Countries	Romania	Ukraine	Turkey	Bulgaria
Legal responsible in fisheries	NAFA Ministry of Agriculture and Rural Development	Committee for Fisheries Ministry of Agrarian Policy and Food	General Fisheries Directorates Ministry of Food, Agriculture and Livestock	NAFA Ministry of Agriculture and Food Supply
Policy Framework	Council Regulation (EC) no. 1198/2006 of July 27, 2006	Internal legislation	Internal legislation	Council Regulation (EC) Internal legislation
Basic law for the fisheries sector	Law no. 192/ 2001(amended by GEO no.23/2008)	Ukrainian Law "On Protection of Natural Environment", No. 1264-XII of 1991, Art. 41 Ukrainian Law "On Fish Industry, Commercial Fisheries and Fish Resources Protection", No. 3677-VI of 2011	The Law No: 1163 on cooperatives, The Law No: 2674 on continental Waters, The Law No: 2872 on environment The Law No: 3285 on animal health and sanitation The Law No: 3621 on coasts	Fishery and Aquaculture Act (FAA) was adopted in 2001 FAA, 2001 - Changes and additions concerning: licenses, prohibitions, regulations and control of fishing vessels and stationary fishing gears from 01.01.2007 according to obligations of Bulgaria to follow CFP of EU without transition period taken into account.
Species and Periods of prohibition	***Danube shad*** (*Alosa immaculata*) 24 Apr -12 June, 30 days prohibited depends on area **spiny dogfish** (*Squalus acanthias*) 15 March - 30 April, 47 days, and all year pregnant individuals, prohibited ***turbot*** (*Psetta maeotica*) - Under EC Regulation no. 1261/2012 ***Acipenseridae*** - from Apr 2007 to Apr 2016, 10 years, prohibited ***marine mammals*** - whole year, prohibited; ***gobies*** - from May 1 to 30	***grey mullet*** (*Mugil cephalus*) - from August 20 to September 10; ***turbot*** (*Psetta maeotica*) - in exclusive economic zone from May 1 to May 30 and in the territorial sea for 15 days timed to this period (the specific terms of the prohibition are established by the fish protection authorities by agreement with scientific organizations); ***European flounder*** (*Platichthys flesus*) - from February 15 to April 30; ***gobies*** - from May 1 to June 15.	No fishing activity for turbot shall be permitted from 15 April to 15 June No fishing activity for anchovy shall be permitted from 15 April to 31 August All methods of baby clam harvesting with any gears are prohibited between 1st May - 31st August For all season, shark and **dolphin** catching are prohibited in the Black Sea and other coastal lines of Turkey	In 02.2012 by Order of NAFA, 4 years period of sturgeons ban in the Danube River has been introduced. * During the fishing season for horse mackerel (*Trachurus mediterraneus*), from 15th September to 15th November fishery banned zones: from a) to e)., are opened only for scads fishing with allowable by catch not exceeding 5%. * All fishery activities with all kind of gears are prohibited in the radius of 500 m area of Thermo Electrical Power Stations warm water inflow into the Varna lake system. * The prohibition periods for fishing: - sturgeons in the waters of Danube River and Black Sea in accordance with the international agreements; - shad (*Alosa* sp.) - 30 days in Danube river in accordance with international agreements; - turbot (*Psetta maeotica*) - 60 days - 15

				April-15 June -with all kind of fishing gears (Under EC Regulation no. 1261/2012); - gobies - 15 April - 15 May only with net gears; - gobies - whole year in 1km distance from harbors with exception the trap nets situated in these areas - *Eriphia verucosa* - 1 April-31 May.
Gears, minimum mesh size and fishing methods	a/ in marine fishing, all kind of trammel nets, sturgeon gill nets, drifted gill nets whose total length is higher than 2.5 m, as well as the turbot gill net manufactured from threads with thickness smaller the 6.350 m/Kg; b/ the trawl in marine zone under the 20 m depths; c/ gears type dredge and bottom trawl in the Black Sea; j/ gill nets for shad, during 1 August -31 December m/ hooks and lines and little hooks and lines in natural fish basins; n/ fishing gears monofilament net. **It is banned** to utilize the fishing gears with minimum mesh size smaller then: a/ a = 30 mm, 2a - 60 mm respectively, at the actively fishing gears for Danube shad and mugill; b/ a = 20 mm, 2a = 40 mm respectively, at gears codend type settled at the dams of littoral lakes;	a/ The number of the vessels fishing with midwater trawls from November 1 to December 31 is limited to 20 units (par.10). b/ The number of gillnets used for the capture of turbot and ray and stingray should not exceed 7700 units; the gillnet length should not exceed 100 m (par. 12 and 13). c/ The number of beach seines used for the capture of shrimps in the Black Sea outside Crimea should not exceed 37 units (par. 18.5). d/ The number of gillnets used for the fishing of so-iuy mullet westward of the meridian 32°13' EL should not exceed 280 units; the gillnet length should not exceed 100 m (par. 20). - pound nets for undirected fishing - 6 (in a pound), 10 (in a heart), 14 (in a lead line); - midwater trawls for the fishing of sprat - 6;	The minimum legal mesh size for nets used to catch turbot shall be 400 mm	Ordinance № 37/10Nov. 2008 and m.3., al.1 from FAA the mesh sizes of the gears for different fish species have been established: - during the prohibition period for turbot, commercial fishery for shad (*Alosa spp.*) should be fulfilled by one layer nets with minimum mesh size not less than 36 mm; - commercial fishery for Gobies should be carried out with net gears with mesh size of the net not les than 22 mm; - with council regulation 1139/2008, quota for turbot fishery (50:50, Bulgaria and Romania) has been established with minimum mesh size of the gillnets: 400 mm;

	c/ a = 7 mm, 2a = 14 mm respectively, at the room catching of pound nets in the Black Sea Romanian littoral zone; d/ a = 180 mm, 2a = 360 mm respectively, beyond the territorial waters, and 200 mm, 2a = 400 mm respectively, in the territorial waters at the turbot gill nets; e/ a = 7 mm, 2a = 14 mm respectively, at the trawl in the Black Sea; f/ a = 10 mm, 2a = 20 mm respectively, at codend of beach seines. g) a = 100 mm, 2a = 200 mm for dogfish gillnets.	- midwater trawls for the fishing of whiting - 12; - purse seines and ring nets for the fishing of European anchovy and horse mackerel - 6; - purse seines and ring nets for the fishing of mackerel - 12; - purse seines and ring nets for the fishing of grey mullet - 20; - pound nets and uncovered stationary traps with closing entrances for the fishing of so-iuy mullet - 30 (in a pound) and 40 (in a heart and in a lead line); - fixe nets for the fishing of gobies - 18; - beach seines for the fishing of Black Sea anchovy, sprat, sand smelt - 6; - gillnets for the fishing of turbot - 180;		

3.4.3. Tourism

Carrying capacity of the Black Sea coastal zone. Tourism development is particularly important for the Black Sea region where the most popular tourist destinations are the coastal areas, protected areas and historical settlements. Nowadays most of the Black Sea resorts are tackling different socio- economic and environmental problems. Therefore management of tourism growth is necessary and has to focus on policy measures for implementing the sustainable tourism development in the Black Sea region.

Tourism Carrying Capacity needs to be considered as a process within a planning process for tourism development. Planning and implementation, these two processes are parallel and complementary and can provide a general framework guiding local community, planners and decision-makers. This framework consists of principles, goals, objectives and policy measures in regard to tourism development in an area on the basis of the area's distinctive characteristics/features respecting local capacities to sustain tourism.

Setting capacity limits for sustaining tourism activity in a place involves a vision about local development and decisions about managing tourism. These should be carried in the context of democratic community strategic planning, which requires participation of all major actors and the community at large. Consultation with relevant stakeholders is a key issue at all stages. The whole process is dynamic and cyclical.

Tourism Carrying Capacity is based on the analysis of key limiting factors for tourism development for different types of tourist destinations (coastal areas, protected areas, rural areas, historical settlements) in respect to carrying capacity components (physical-ecological, socio-demographic, political economic).

Carrying capacity considerations in each type of tourist destination:

Coastal areas. Coastal areas are normally associated with mass tourism, large scale construction and infrastructure, intensive land development and extensive urbanization, a prevalent model in most Black Sea destinations (E.g Mamaia, Romania, Sunny Beach Bulgaria). Carrying capacity issues revolve around considerations about tourist density, the use of beaches and tourist infrastructure, congestion of facilities, sea pollution, etc.

Protected Areas. Tourism in protected areas is associated with appreciating and observing nature, scientific endeavour and education. This type of tourism is associated with minimal development of infrastructure and small scale interventions in areas of normally-strong control and restrictive management (e.g Danube Delta Biosphere Reserve).

Carrying capacity issues concern the number of tourists, visitor flows and spatial patterns of concentration/dispersion vis-à-vis the protection of nature and the functioning of ecosystems, but also the quality of experience of visitors.

Rural areas. Tourism in rural areas covers a wide range of purposes (motivations) and is usually associated with visiting areas of special beauty, being in nature, low intensity activities but widely dispersed around low density-often remote- rural communities. In some areas agro-tourism falls within this category (e.g Danube Delta villages).

Carrying capacity issues involve questions about visitor flows, impacts on local society and culture, effects on rural economies, the spatial patterns of visitor flows etc.

Historical settlements and towns. Tourism is attracted to historic towns as a result of the built cultural heritage, urban amenities, lifestyle and cultural traditions, cultural events, etc. There can be several types of tourism in this category. The dominant type is mass tourism associated with large numbers of visitors centering on monuments, museums, etc. often of a short stay (even daily visits) (E.g. Nessebar, Bulgaria).

In considering carrying capacity, the three components (physical-ecological, socio-demographic, political-economic) acquire different weight or importance in different destinations. These differences depend from the type (characteristics/particularities) of the place, the type(s) of tourism present and the tourism/environment interface. The three are interrelated to some extent.

The characteristics of the locality provide the basic structure for the development of tourism. These can be evidenced in terms of local resources, the vulnerability of local natural ecosystems, population size, economic structure, culture and local heritage, etc. To some extent, the characteristics of a locality determine its resilience to pressures from tourism. The size, the structure and dynamism of the local society, culture and economy can be significant factors, which influence the local ability to cope with pressures and impacts from tourism

The type of tourism determines the basic characteristics of tourist behavior; to some extent and condition the tourist/local community, tourism/local economy and tourist development/environmental quality relationships. The type of tourism can be expressed in terms of the motive(s) for visiting a place, the mode of mobility and transport, the frequency-length of stay- and activity range of tourists, etc. In this context it is important to consider differences among types of tourists in terms of expectations, attitudes and behavior as these condition the pressures and impacts of tourism on a place.

The tourism/environment interface is a composite of the previous two factors mainly in the form and type of tourism development (spatial patterns), the phase in a life-cycle context of the destination, the level of organisational and technological systems employed, the management regime, etc. The tourism/environment interface is expressed in terms of constraints evolving either from the impacts of tourism on the environment or from the degradation of the environment on tourism.

Tourism in the Black Sea region is an important industry. It benefits from general trends in world tourism, that have seen global tourism receipts grow an average of 8% per year from 1980 to 2000, while world economic growth averaged 3% (Lanza et al. 2005). Nonetheless, even at the national level, tourism in the Black Sea countries involves a relatively small number of visitors and expenditures. For example, Bulgaria, Russia, Turkey and Ukraine accounted for only 13.7% of international tourist arrivals in Europe in 2006. For receipts, the share is even smaller: the same four countries received only 8% of total European tourism receipts and only Turkey indicates a share of receipts greater than its share of international arrivals (4.1% and 4.5%, respectively) (Lanza, et al., 2005).

Tourism, on the one hand, can (and today usually does) have major environmental impacts; on the other, it can be a way of promoting environmental awareness and encouraging natural regeneration.

In general tourism along the Black Sea coastal zones is rather well developed in Bulgaria, Romania and Ukraine (Fig. 3.64). Besides Istanbul, Odessa and Varna are the largest cities within the Black Sea region, with a high capacity to attract tourists. Tourism potential in Moldova and the hinterlands of Bulgaria, Romania and Ukraine could be better developed, put on an environmentally sustainable footing, and promoted to the local, regional and international tourism industry (such as travel offices and tourism agencies), by the tourism information providers, such as municipalities and regional authorities. The Black Sea countries mentioned are in possession of rich cultural heritage and provide beautiful green environment, mountains, cities, archaeological places, old monasteries, slumberous forests and endless hills. Moreover, the Bulgarian, Romanian and Ukrainian Black Sea coastal zone provide lot of opportunities for beach and water tourism. At the same time Black Sea municipalities suffer problems of city transportation, contamination by litter and wastes, bad water condition of coastal beach zone, lack of green belts and uncertainty of their legal status.

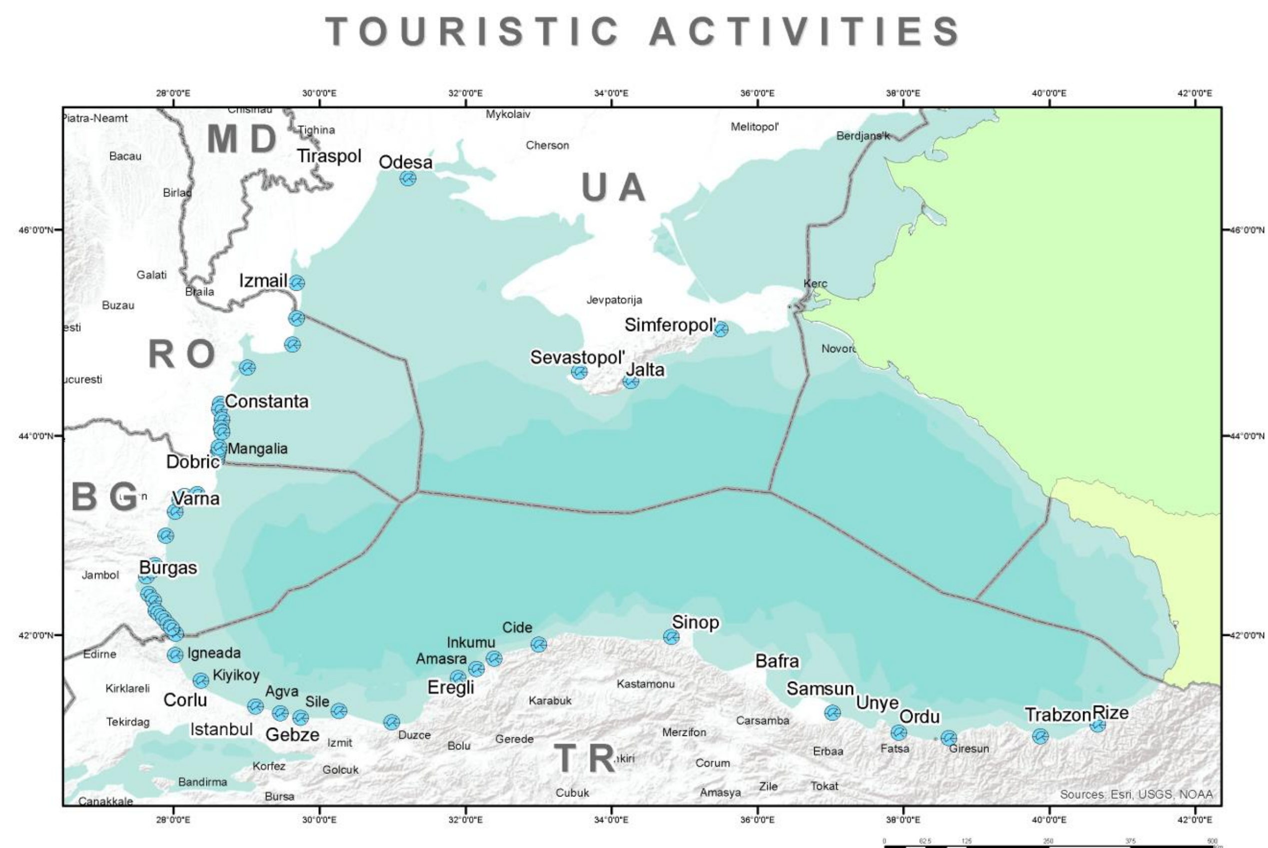


Fig. 3.64 Tourist activity area around the Black Sea *(original map)*

Bulgaria

Bulgaria has become one of the leading tourist destinations in Europe over the last couple of years. The youth is drawn by great beaches and, not least, the possibilities of partying all night long at reasonable prices, while the grown-up segment enjoys the same beaches but also the beautiful nature and the exciting history. Bulgaria benefits from a geographical position, which allows the country to offer skiing in winter and sunbathing at the beach and exploring the nature in summer. Even though tourism at present is the strongest drive for the Bulgarian economy, the sector is facing new challenges such as attracting new segments and improving the infrastructure.

The tourism sector is vital to Bulgarian economy, with a contribution of 13.6% to the Bulgarian GDP in 2013 (NSI, 2013). The Black Sea coast is very important for this sector, as it is a major destination for national and regional sea tourism. As such, 65.58% of the total capacity of beds is focused on the Black Sea coast.

Bourgas and Varna regions are home to a mass coastal tourism industry, more specifically located on the North of the Bourgas city and the North of Varna region. The scale of this industry is particularly visible in terms of number of beds and number of nights in the lodging facilities, which can be found in Bulgaria. These two regions are quite dependent to tourism, especially Varna where the sector accounts for 61% of the local gross domestic product (GDP), with trade services included (Moncheva et al., 2013). Dobrich region also holds more scattered sea tourism infrastructures.

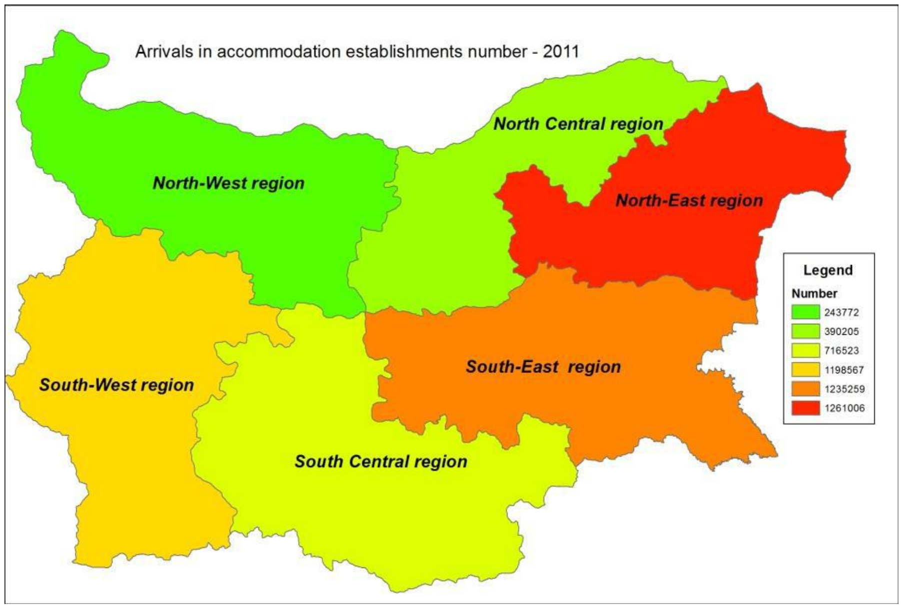
Table 3.8 Beds and number of nights in the lodging facilities in Black Sea bordering districts (Source: Ministry of Economy, Energy and Tourism)

Year	District			Total
	Bourgas	Varna	Dobrich	
2007	102,007	61,396	28,022	191,425
2008	98,933	61,222	24,433	184,588
2009	106,683	59,434	21,990	188,107
2010	101,627	58,736	22,217	182,580
2011	105,300	56,773	23,691	185,764

Table 3.9 Tourist statistics in coastal Bulgaria

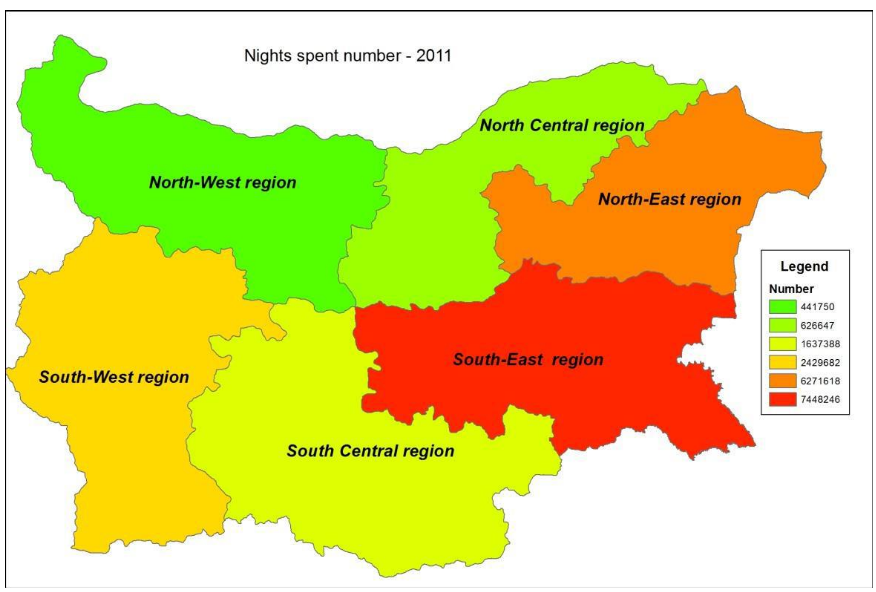
Tourism		**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Touristic accommodation capacities	Places/year	182 689	191 425	184 588	182 580	182 580	183 600	204 593
Touristic accommodation units in coastal zone	No./year	1 759	1 842	1 576	1 595	1 595	1595	1043
Number of tourist arrivals								
a) National	No./year	523 808	579 735	659 469	602 299	N/A	684 329	744 384
b) From abroad	No./year	1 330 107	401 050	1 363 388	1 267 023	N/A	1 434 580	1 688 338
Number of "Blue Flag" Beaches	No.	11	10	9	11	11	12	11
Carrying capacity of beaches	m^2/person	8 m^2/person for marine beaches and 12 m^2/person for beaches larger than 100000 m^2	8 m^2/person for marine beaches and 12 m^2/person for beaches larger than 100 000 m^2	8 m^2/person for marine beaches and 12 m^2/person for beaches larger than 100 000 m^2	8 m^2/person for marine beaches and 12 m^2/person for beaches larger than 100000 m^2	8 m^2/person for marine beaches and 12 m^2/person for beaches larger than 100 000 m^2	8 m^2/person for marine beaches and 12 m^2/person for beaches larger than 100 000 m^2	8 m^2/person for marine beaches and 12 m^2/person for beaches larger than 100 000 m^2
Number of tourist staying overnight	No. /year	12 333 332	12 292 124	12 152 281	10 035 438	11 218 139	12 352 633	13 897 502
Value of tourist expenditures	MEUR	329.096	381.813	232.694	210.318	210.302	240.724	279.325

Bulgaria's tourism industry is heavily concentrated in the Black Sea coastal resorts, where occupancy rates plunged dramatically in 2009. This led to several hotel closures in an area that had been characterised by high construction rates for new hotels in recent years. Unrestrained hotel construction activity in some of the country's largest seaside and mountain resorts, a shortage of skilled workers in the tourism sector and underdeveloped infrastructure are areas that the Bulgarian authorities still need to address.



Source: National Statistical Institute (NSI)

Fig. 3.65 Arrivals in accommodation establishments - 2011, Bulgaria



Source: National Statistical Institute (NSI)

Fig. 3.66 Number of nights spent by tourists - 2011, Bulgaria

Today, the Bulgarian coast totalizes 209 beaches for a length of 130 km. Many of them are large, but there are picturesque bays as well. Apart from them, the coastline is scattered with several infrastructures:

- Mineral water springs, offering spa and spa treatments;
- Blue Flag beaches and resorts, located in Albena, Bunite (Varna), Dunes, Elenite, Pomorie (east beach), Harmanite (Sozopol), St. Vlas (central beach and Venid), Sunny Beach (north and south beach) and Sunny Day;
- Holiday villages and campsites;
- Golf courses, in the vicinity of Balchik, the Black Sea Rama Lighthouse Golf Resort and Spa and the Thracian Cliffs Golf and Spa Resort.

Data from the National Statistical Institute (NSI) shows that in 2008 in the country there were 3 217 functioning shelter and accommodation sites with over 10 beds – hotels, motels, camping sites, mountain huts, and other places for short-term accommodation, with the number of rooms being 130.6 thousand in total. The total number of sheltering means and accommodation sites has decreased by 83 or 2,5 % in comparison with 2007, the biggest drop being in the group of “other places for short-term accommodation” - 204 (12.5%). This is mainly due to closing or decreasing the capacity of active accommodation bureaus and lodgings, which do not provide the necessary standard conditions for overnight stay. At the same time, the number of hotels has grown by 120 or by 7.9 % up to 1646 in 2008. Despite of the overall decrease in the places for accommodation, in 2008 the bed capacity in the shelter means or accommodation places has grown by 7.3% in comparison with the previous year and now reaches 293 thousand beds. 43.3% of the hotels in the country are situated on the Black Sea coast and 63.8 % of the hotel bed capacity is to be found in those. Out of 1 646 observed hotels in the country 364 are in the region of Bourgas, 257 are in the region of Varna, and 91 in the region of Dobrich. As regards the geographical coverage of the specialized infrastructure in the country, it should be noted that there is a great concentration of hotels on the Black Sea coast.

As a whole, 75% of the specialized structure is concentrated within 7 areas, which cover 8 - 10% of the territory of the country. The big complexes are more and more looking like whole cities, which makes it difficult to find conditions for resting, and that is the main aim of the tourists. Many potential attractions are not developed in a way which would realize their full potential (so that they would be able to attract enough visitors for a longer stay), and the tourist structure leading to them is either not complete, or is old, worn or missing altogether.

Varna region lies in the northeastern part of Bulgaria and covers a surface of 3820 square kilometers, i.e. about 3.5 % of the total area of Bulgaria. The region has a broad entrance to the Black sea. The population of Varna region amounts to about 490,000 inhabitants, by those approx. 70% lives in the city of Varna. Varna is the third biggest city of Bulgaria. Varna region is the largest touristic center of the Bulgarian Black Sea coast. The health resort complexes have more than 135 hotels with a capacity of more than 35 000 beds and 200 reconvalescent homes. The number of visitors in the tourism rose particularly in the last several years, which released a substantial building activity within this range. A new emphasis represents the development of the alternative tourism, including cultural or religious objects of interest as well as the village tourism (rural or traditional Bulgarian ways of life). In addition the beauty of nature is included more for the use of an ecologically compatible tourism than so far. The tourism, which took place in the Black Sea region until now mainly in the summer season, is to take place more strongly all year round. A further starting point for this is the numerous hot sources of mineral water, which can be used for balneological applications. (Varna and Dobrich regions provide 96.97% of tourist facilities, 95.5% of accommodations, 98.8% of stays marketed and 97.93% of accommodation revenues (the largest tourist complexes Zlatni Piassatsi, Albena, Saints Konstantin and Elena).

Moldova

Although it has a small area, the Republic of Moldova as a tourist destination has a great potential represented first of all by the geomorphologic aspect of its territory – an unusual diversity of landscape reservations or scenery and unique geological monuments of European and world value.

Over the last decade the priority forms of tourism in the Republic of Moldova have been: rural, wine, cultural tourism, health and beauty Tourism.

Tourism is one of the economic sectors with rapid development, and is also a source of environmental impact. Currently, the Republic of Moldova has over 400 important points of tourist attraction and is undertaking efforts to increase this number.

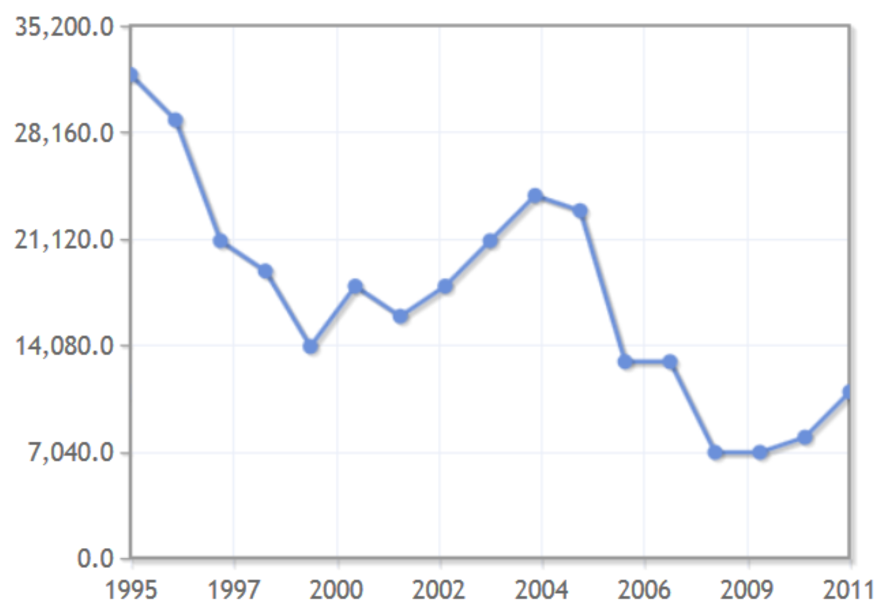


Fig. 3.67 Number of tourist arrivals in Moldova (1995-2011)
(Source: http://www.indexmundi.com/)

The analysis of tourist activity evolution over the last 10 years evidences a visible variation of the main indicators. Since 2001 the number of visitors involved in organized tourism has increased from 51,318 persons in 2001 up to 102,005 persons in 2004, a two-fold increase, and afterwards it decreased gradually down to 44,550 persons in 2010. The evolution of the number of tourists in the global, international tourism sector reflects the same trend, but the decrease in number of tourists in 2008-2010 is very stringent and is due to the global economic crisis. It should be mentioned that the tourism impact on the economy of the Republic of Moldova is rather insignificant for the time being: the revenues from tourism do not exceed 1–1.5% of the total revenue of all the national economy sectors. The Republic of Moldova has a valuable natural and sustainable potential, facilitating the development of such types of tourism as ecological, rural, winery, and health and beauty.

The value for International tourism, number of arrivals in Moldova was 11,000 as of 2011. As the chart below shows, over the past 16 years this indicator reached a maximum value of 32,000 in 1995 and a minimum value of 7,000 in 2008.

Although the country is landlocked, there is a ferry service between Giurgiulesti in Moldova and Istanbul, Turkey, plying the river Danube to reach the Black Sea.

Romania

Tourism is an important growth sector in the Romanian coastal zone. Mass tourism is developed and concentrated in the Black Sea resorts and ecotourism is developed in the Danube Delta region with Tulcea as its center of eco-tourism. In Romania, some 65% of its coastline is included in the Danube Delta Biosphere Reserve and subject to regulated tourism.

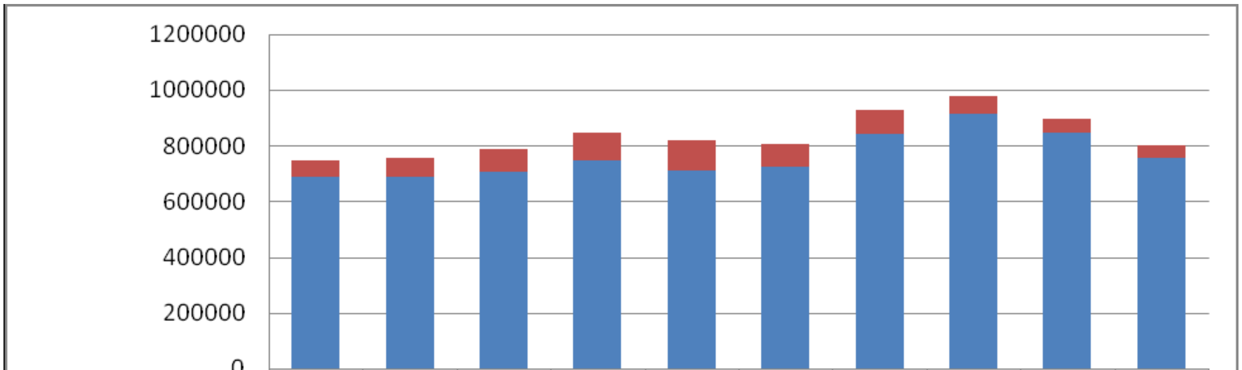
The remaining coastline is subject to mass tourism, especially in the "satellite" resorts south of Constanta, but here EU Directives apply to improve the environmental conditions.

Constanta County represents one of the most important tourism areas of Romania, mainly due to Black Sea Coast (82 km out of the total of 244 km, as represents the Romanian Black Sea Coast). This outstanding component of Constanta county concentrates about 38.2 % of Romania's tourism potential, by its 19 beach zones (out of which 13 resorts), with a significant infrastructure. This important infrastructure, alongside with some natural factors, especially the beaches quality, the rural tourism potential, ranks among the outstanding factors for high-class tourism in this area.

The majority of the seaside tourist resorts from Romania were rebuilt in the last years in order to satisfy two of the more important segments of the tourist market: the holiday tourism (they came for beach and/or the spa tourism - treatments and therapy) and visitors for weekend that prefer modern clubs and "party".

The oldest resorts are: Eforie Nord, from 1901, when the spa pavilion was built and Techirghiol, located on the lake with the same name, near the seaside, founded in 1909, followed by Eforie Sud and Mamaia. In the '70-'80, another resorts were established - Neptun, Costinesti, Olimp, Saturn, Jupiter, Venus, Cap Aurora. The newest localities that entered the tourist circuit after 1990, are Vama Veche, 2 Mai, Limanu, Tuzla, 23 August on the shore of the Tatlageac lake.

At the present moment, most of the resort are outdated on the European market. With a few exceptions, the seaside resorts are generally characterised by the presence of the tourist accommodation structures of the 1960s-1970s, with less space allotted for other fittings or panoramic views, with the numerous unattractive buildings, from an aesthetic point of view, for the tourists of the 21st century. Moreover, over 70% of the hotels are classified at the one star and two star categories (2008). In the last years, many hotels were modernized and reclassified with 3, 4 or 5 stars, especially in Mamaia resort, Neptun, Jupiter. Eforie North and South become more attractive for family because of numerous lodgings, guest house that were built here.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Foreign tourists	58025	67865	80087	98516	108828	82741	83259	65052	50091	48000
Romanian torists	687479	686302	708676	746962	712521	724117	842945	912923	847586	755000

Fig. 3.68 Total amount of tourists that arrived on Romanian Seaside (2001-2010)

Romania's accommodation capacity was massively developed during the 1970s, in the genuine communist era; most of the hotels that were built then were one and two stars establishments. Unfortunately, due to the late start of the privatization process, most of the hotels have not yet been renovated and refurbished; therefore, Romania's lodging facilities are still dominated by a huge number of accommodation places of low categories. The past 20 years have brought a quantitative growth of the lodging facilities, but the number of bed-places has not suffered significant changes. Despite the fact that new lodgings were built, with a higher qualitative offer, most of them are small hotels, villas or boarding houses; there are rather few cases of investments in large-scale accommodation facilities of higher classifications.

Analyzing the data provided by the Ministry of Tourism, we may reveal the fact that in 2009, from the total of 6,544 authorized tourist accommodation units, 1,538 possessed less than ten bed-places (473 of these establishments having, in fact, less than five bed-places), while the remaining 5,006 had at least ten bed-places. (Marton Balogh et al.-The impact of European funds upon the tourism development in macroregion one for Romania).

Around 42.7% of the accommodation capacity is located at the Romania seaside, 16.3% in Bucharest and other important cities, 15.7% in balnear resorts (spa resorts), 11.5% in mountain resorts, 0.8% in the Danube Delta and 12% in another tourist destinations. The seasonality is specific for the littoral, even if this is not proportionally reflected in the utilization index of accommodation capacity (41.3%), mainly due to the contribution of "social tourism". On the Black Sea littoral and Bucharest, both locations being situated near an airport, the tourist units have a bigger accommodation capacity that the other tourist regions (147 beds is the mean for the hotels on the seaside, and 48 for mountain areas). Bucharest and the Black Sea littoral are favorite destinations for group tourism. This kind of tourism is operated by the international tour-operators. The Black Sea offers the conditions for development of littoral tourism. Sea side resorts concentrate almost 50% of accommodation capacity (42.7%). 1-2 stars hotels represent more than 80% from the total, while the number of 3, 4 and 5 stars hotels is still very low. The accommodation structures are concentrated mainly in the coastal zone, with limited opportunity of expansion. The investments have, as main object, the rebuilding and development of present structures.

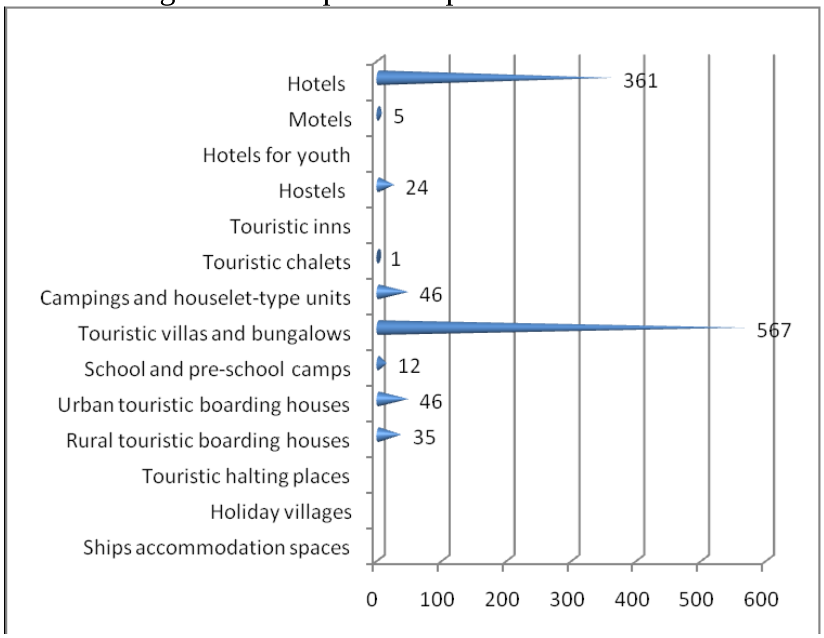


Fig. 3.69 Establishment of tourist reception with functions of tourist accommodation (2009) at the Romanian coast

An overview of the tourist indicators for the reporting period 2012 indicates a decrease of the tourist accommodation capacities in the coastal zone (Fig. 3.69). In the same time an important increase of the tourists arrivals occurred in 2012 (Fig. 3.70, 3.71). Relating the number of the tourists staying overnight in 2012, no data was available. It should be mentioned that data on the number of tourist arrivals are presented only for officially registered tourists, but the actual number may be higher (Fig. 3.72, Fig. 3.73).

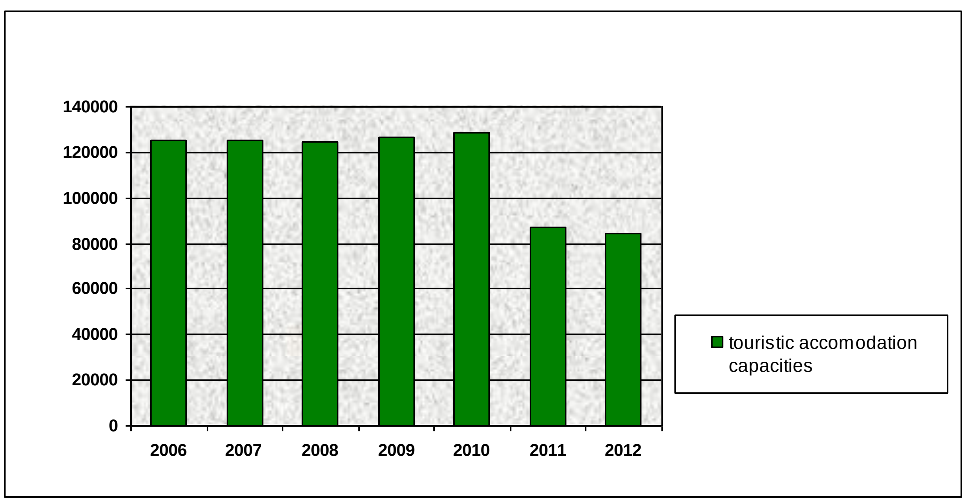


Fig. 3.70 Evolution of tourist accommodation capacities on the Romanian Black Sea coast in the period of 2006-2012

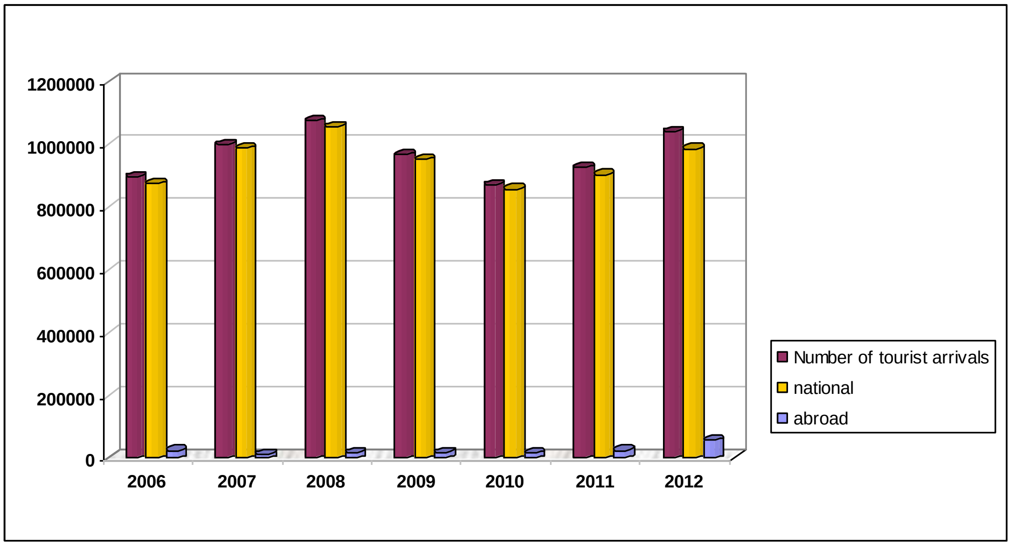


Fig. 3.71 Evolution of number of tourist arrivals on the Romanian Black Sea coast in the period of 2006-2012

Table 3.10 Tourist statistics at the Romanian Black Sea coast

Indicators	Units	2010	2011	2012	2013
Tourist accommodation capacities	Thousands places	128931	87407	89457	90121
Tourist accommodation units in the coastal zone	no/year	1224	790	874	883
Number of tourist arrivals	no/year	871510	926369	1041014	940626
a) National	no/year	808582	857646	954918	869412
b) From abroad	no/year	61928	68723	86096	71214
No. of tourist facilities conducting ecological audit	no	All	All	All	All
No. of “Blue Flag” beaches	no	N/A	1	1	1
Number of tourist staying overnight	no/year	3275411	3451592	3933293	3610697

Source: National Institute of Statistics, 2013 Statistical Yearbook

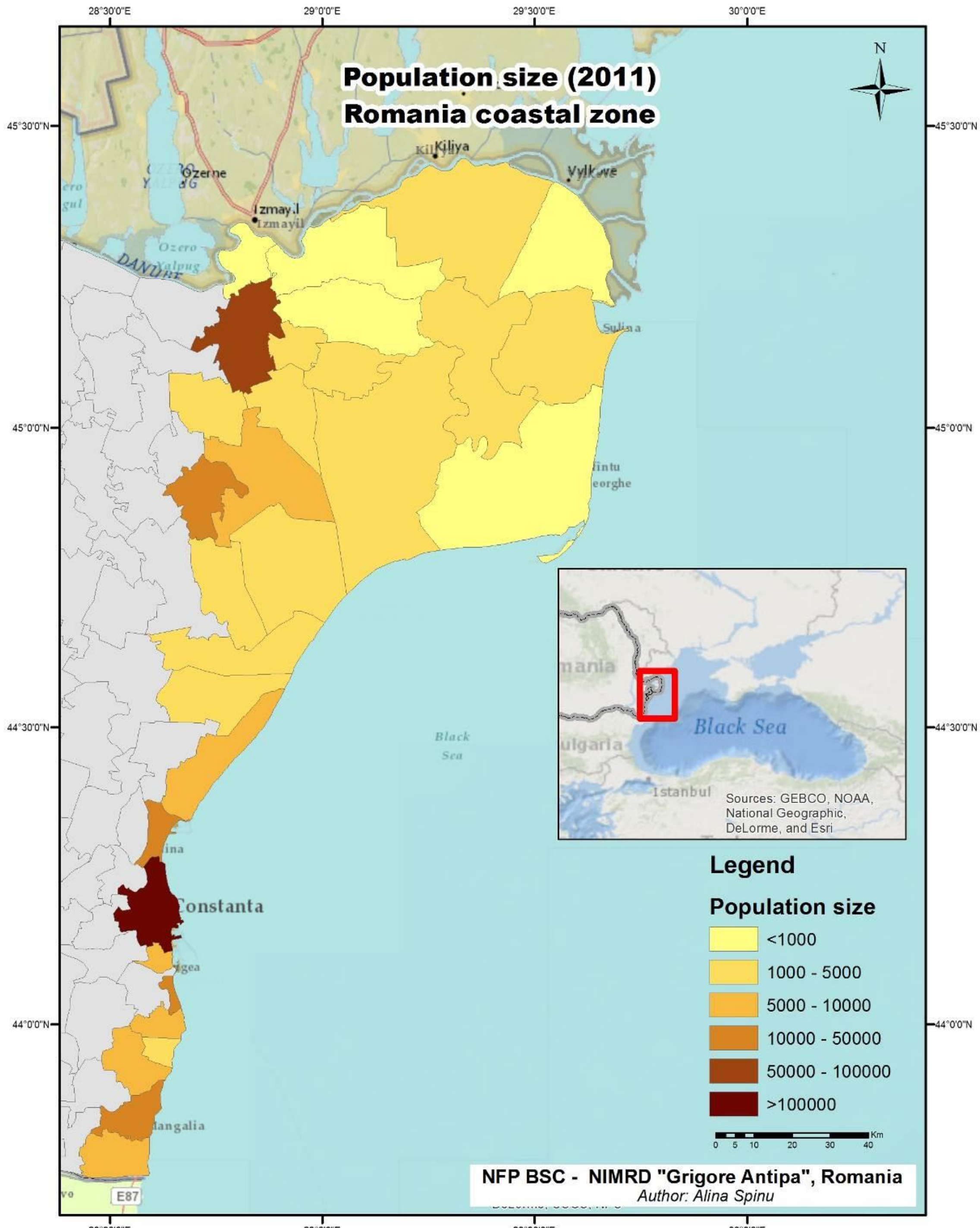


Fig. 3.72 Population size at the Romanian coast *(original map)*

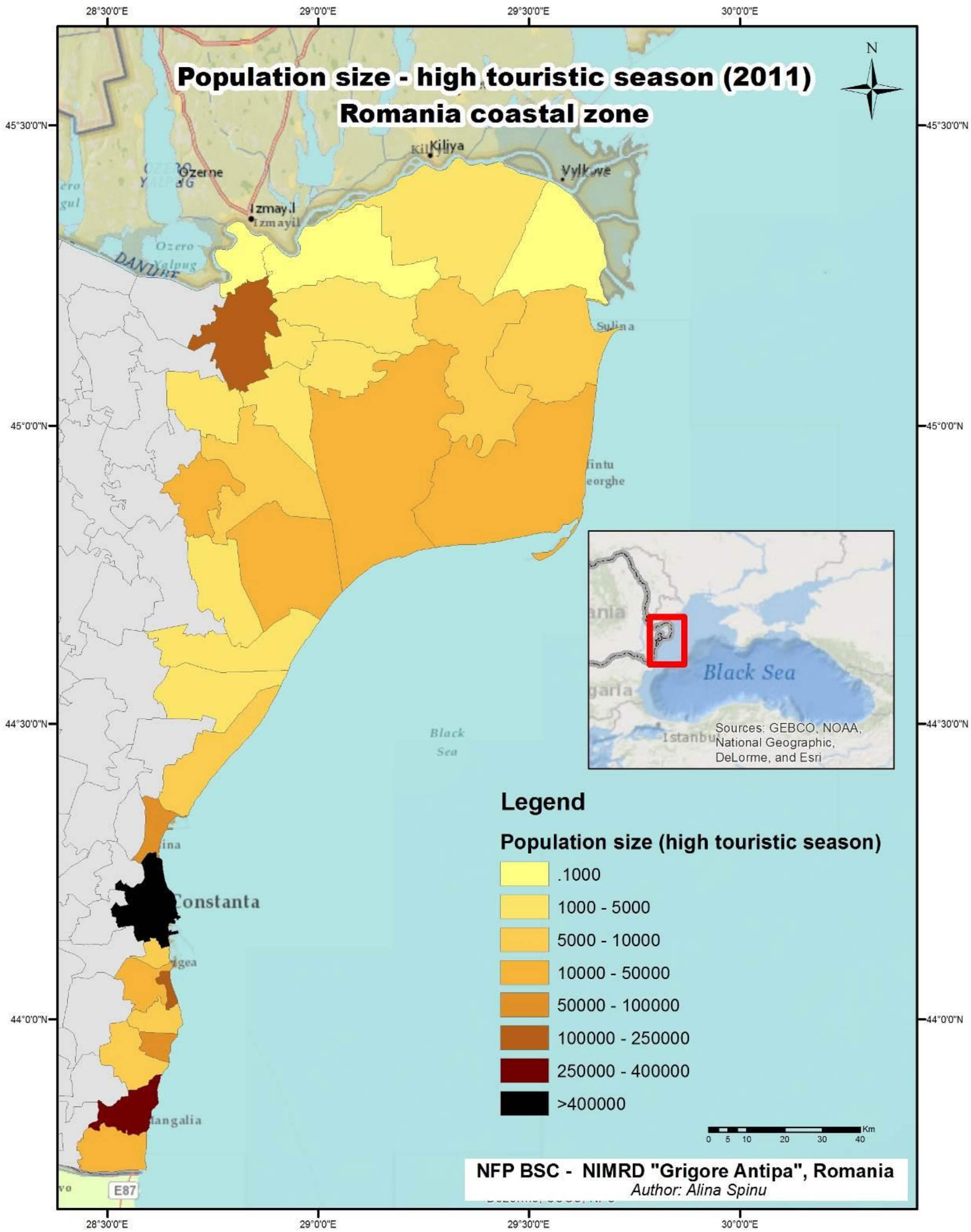


Fig. 3.73 Population size at the Romanian coast during high tourist season *(original map)*

Turkey

The regional distribution of foreign tourist in 2007 as derived from the location of the port of entry is very low at the Black Sea region of Turkey such as number of foreign tourists is 215,345 with a 1.45 % of total. However, the Black Sea Region with 11.9 % of total domestic tourists appears to be a far more popular destination for domestic rather than foreign tourists. Lush and green throughout the year, rocky mountains, the cool waters of the coast and plantations of tea, hazelnuts, tobacco and corn, the Black Sea region is a unique part of the Turkey. The Black Sea region of Turkey includes national parks, from east to the west, displaying geographical and biological diversity of the region. The summer season is short, yet offers a rich variety of travel alternatives to organised tourism and backpackers. Especially the festivities held at the high plains in the region throughout the summer attract local travelers and tourists (Fig. 3.74). However, there are also special touristic wetlands through the coast like Kızılırmak, Sarıkum and some others at the eastern part of the region (Figures 3.75-3.76) (Ministry of Culture and Tourism, 2007). The eastern coast of the Black Sea attracts more visitors than the western half, partly because it holds more of interest, and partly because it is easier to get to. However, western settlements are also appealing and offer opportunities for leisure (Fig. 3.74)

This is anticipated as an inland tourism development corridor to be developed for serving such metropolitan cities as Ankara and İstanbul, extending between Sile and Sinop Cities with an approximately length of 500 km. The region is going to be developed with a perspective of culture, coastal and nature tourism. For the purpose, the fisher huts found in settlements of Sile, Akcakoca, Amasra, Cide, Caylioglu and Sinop lying along this corridor will be resorted and each of these settlements will become a tourism site in a somewhat suitable marina/fishers' village concept. Along the corridor locations will be specially arranged for camping sites, allowing people to stop by and camp either in caravans or in tents and carefully planned inside conservation areas, which can become a focal point for the development of eco-tourism, in addition to a number of recreational, replenishment centers wisely placed in the core of woods.

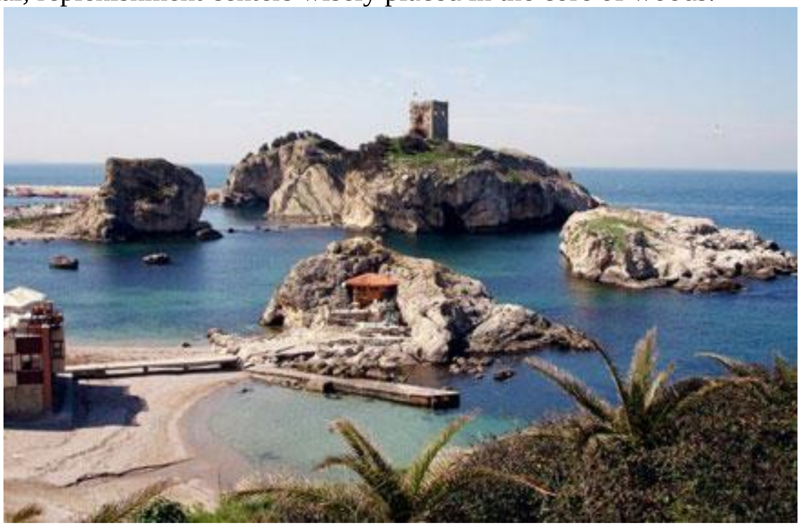


Fig. 3.74 Sile: attractive tourist destination on the north-western Turkish coast (*Source: http://www.booktr.com*)

Fig. 3.75 Tourist Sarıkum Wetland at the Western Black Sea coast of Turkey

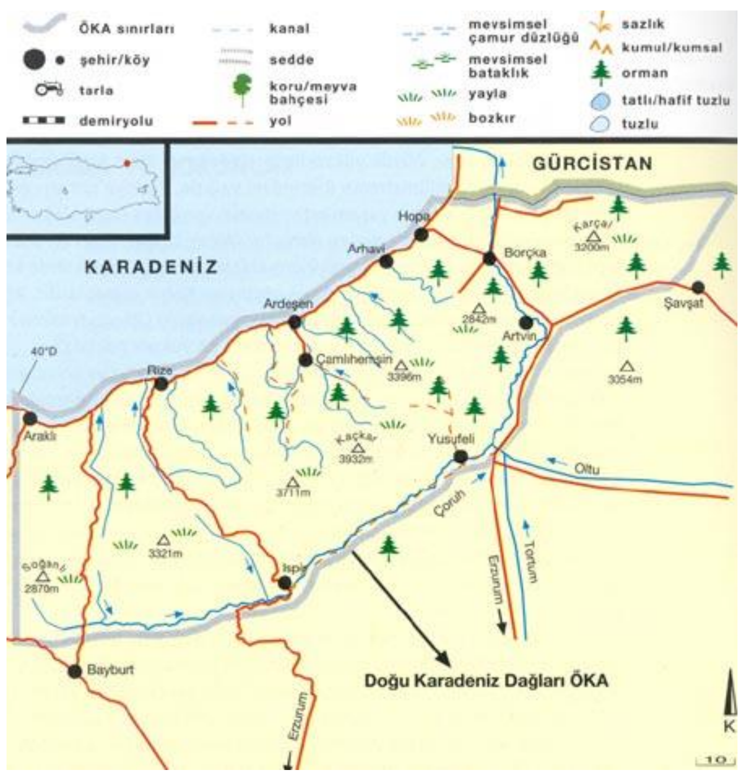


Fig. 3.76 Tourist wetlands at the Eastern Black Sea coast of Turkey

Ukraine

Ukraine has no national tourism strategy other than maximizing visits for economic purposes (e.g. hosting big events such as the 2012 European Football Championships with Poland) and recently promoting the country through its TV campaign "All about U". The marine and coastal zone is characterized by a pattern of mass tourism in and around municipalities (e.g. Odessa, Evpatoria, Yalta, Feodosia), with substantial areas under protection (e.g. Danube Biosphere Reserve, Black Sea Biosphere Reserve, Sivash National Park), which provides a good opportunity for a more integrated, sustainable tourism approach.

The number of tourist arrivals has increased between 2010-2011 and decreased between 2011-2012 (Figure 3.77).

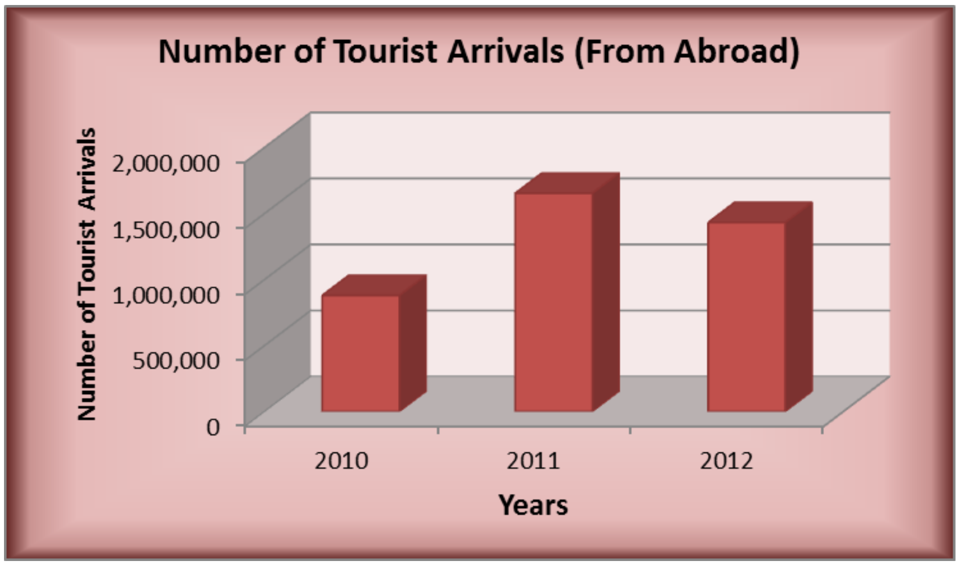


Fig. 3.77 Number of tourist arrivals in Ukraine

Ukraine has a lot of recreational and tourism resources, which can provide possibility of tourist and recreational complex development. In spite of this fact tourism today takes low rate in economics in comparison with other countries. Its part has been estimated as 1% of GDP of Ukraine. One of the reasons of this is lack of governmental regulation during 1988-1993 years which caused destruction of socially-oriented internal tourism and balance between active and passive tourism, destruction of the tourist infrastructure and decline in the service level, loss of tourist routs system, decline in the system of education in sphere of tourism. The environmental degradation has redoubled these problems. As a result Ukraine has lost more than 80% of incomes from international tourism.

In spite of the positive economic results mass tourism is causing a great stress on recreational territories and destroys ecological sustainability. One of the most important directions of tourism development in Ukraine is creation and development of environmental friendly and sustainable types of tourism.

The Odessa region lies in south-west Ukraine along the Black Sea coast and borders on the countries of Moldova and Romania. It is the largest in Ukraine, with a total area of 33 300 km^2 (the

approximate size of Moldova, Belgium or Netherlands), which is about 5.5% of the Ukraine territory. At present its population is 2.5 million, 66% of which live in the urban areas.
Strategic location and favorable natural conditions give the Odessa region considerable advantages in ecotourism development which now it is trying hard to exploit. The Odessa region has rich and unique biodiversity. Only in the Danube delta of the Odessa region, which is potential center of ecotourism development, there are 563 identified plant species (11% of all Ukrainian flora). The reserve's 5000 species of fauna include 153 species of nestling birds, 320 species of visiting birds, and 72 species of fish. The rare pygmy cormorant, red-breasted goose, and common and Dalmation pelicans are found here.

As ecotourism often involves travelling to remote destinations, which are in the main protected areas, reserves and nature parks are playing special role as a potential of ecotourism development. Protected areas occupy 96 760.33 ha. Nature reserves fund of the Odessa region consists of 117 objects and territories. They cover 2.94% of the territory of the Odessa region:

• *The Danube biosphere reserve (DBR)* was created by presidential decree on August 10, 1998, based on Dunaiski Plavnii nature reserve. By the decision of coordinative committee of UNESCO it was included in the Worlds network of Biosphere reserves. Its area is 46 402.9 ha. The DBR has the following areas of different nature conservation status: the core area, the buffer zone and the zone of anthropogenic landscapes. In the core area (formerly the Dunaisky Plavnii Nature Reserve) ecotours are conducted along special ecological paths. The zone of regulated protected regime includes the Stensovsko-Zhebriianski reed beds (7811 ha). Delta ecosystems of the Danube reserve have international importance and special interest for scientific ecotourism;

• *Tiligulsky regional landscape park* was established in 1997. Its total area is 13 954 ha; the water table area is 9981 ha. The park has three functional zones: core, recreation and economic. Economic zone includes a portion of the water table; core area comprises reserves Kosa Strelkai, Kairovskyi, Novonikolaevskyi and some other. The RLP satisfies the requirements of the Ramsar convention. The relative stability of Tiligulsky liman, a favorable climate and ecological factors have together formed a rich variety of flora, fauna and medicinal mud. Consequently the place is well known for its ecotourism potential;

• *Nizhnednestrovsky National natural park*. In 1998 the Odessa branch of the Reserve Research Center prepared the project of establishing Nizhnednestrovsky National Natural Park (NNP). The area cannot be determined, because the park still has no strict boundaries. Three functional zones can be singled out in the NNP.
All kinds of economic activities are prohibited in the core area. It includes 7620 ha of land and water area. The regulated recreation zone is situated on the perimeter of the core area and acts as a buffer zone. Traditional recreational activities are permitted there, but fishing and hunting are prohibited. Within the economic zone economic activities that are not harmful to the environment are permitted.

3.4.4 Transport and industry

All industries are flourishing in the Black Sea catchment area, including water-consuming ferrous and non-ferrous metallurgy (Ukraine, Bulgaria, etc.); chemical and petrochemical plants (Bulgaria, Romania, Ukraine, Hungary, Austria, etc.); power plants, some of them nuclear (all countries, but highest laden are Bulgaria, Romania, Ukraine, Russia, Hungary and Austria); machine engineering (all countries); and the food industry (all countries). Agriculture is a major polluter of the Black Sea of nutrients and, to a lesser degree, chemicals. Where intensive agriculture is practiced, it inevitably leads to runoff of nutrients and agricultural chemicals (Borysova et al., 2005).

For example, the Russian Federation's Ministry of Natural Resources found that substantial damage was caused to the Azov Sea by runoff from rice growing in the Slavyansk district of Krasnodar. The Kuban River discharges this runoff , which contains considerable amounts of nutrients and pesticides, into the Black Sea. Although fertilizer use has decreased in the region in recent years, mineral fertilizer storage and application is still a serious problem. Inappropriate storage (often in the open air) and excessive application leads to leaching into rivers and pollution of groundwater, which can affect human health.

Table 3.11 Dominant industries in the Black Sea coastal zone countries

Country	Dominant Industry
Bulgaria	**Energy, coal industry, metallurgy, chemical industry**
Georgia	Energy
Romania	**Energy, coal industry, metallurgy, chemical industry, machine-building, oil industry, petroleum refining industry**
Turkey	**Energy,chemical industry, coal industry and metallurgy**
Russian Federation	Energy, coal industry, metallurgy, chemical industry, machine-building
Moldova	**Food and beverage industry, Thermal and electric energy, Garment industry (especially leather dyeing)**
Ukraine	**Energy, coal industry, metallurgy, chemical industry, machine-building, oil industry, petroleum refining industry**

The ***transportation system*** is well developed in the Black Sea Basin. Transport on the Danube, Dnipro, Dniester and Don Rivers to the Black and Azov Seas involves ships of the "river-sea" type. Sea ships include the ocean ships, such as dry cargo ships, and the tankers for the transportation of oil products. Water transportation adversely impacts water quality in the region during normal operations and represents a serious potential risk during accidents such as spills. Motor transport prevails in the western part of the Black Sea Basin where there is a highly developed road network, while railway transportation is better developed in the eastern region (Ukraine, Russia and Georgia). The extensive transportation network and intense mobility of the population and goods in the region affects the water quality negatively through such avenues as spills of oil products on the roadways and the use of inadequate technologies to treat wastewater coming from the industries servicing the transportation network.

With reference to naval transportation, the Black Sea catchemnt area has registrered a total number of 63 ports, as follows:

Romania: 18 harbors (including rivers)
Ukraine: 18
Bulgaria: 2
Moldova: 1
Turkey: 24 (Black and Marmara Sea)

The quantities of inorganic fertilizers used in those Black Sea states with transitional economies were drastically reduced in the 1990s due to high prices and to the inability of the population involved in the agricultural sector to pay for fertilizers. For example, in Georgia the quantity of inorganic fertilizers used in the Black Sea catchment area constituted 300 - 370 thousand tonnes annually prior to 1989. In 1999, the applied volume of nutrients (N and P) amounted to 39.1 thousand tonnes of N and 36.9 thousand tonnes of P. Demand for mineral fertilizers in Ukraine is estimated at 7 million tonnes a year. Even in the most successful year, demand for mineral fertilizers was not covered by local production. Currently, even though three Ukrainian plants (Vynitsa, Sumy and Donetsk) produce approximately 600 thousand tonnes of phosphorus fertilizers a year, this is not sufficient to meet the country's needs. Total application of pesticides was reduced from 62.3 thousand tonnes in 1993 to 46.5 thousand tonnes in 1994. The high prices for fertilizers and pesticides and inability of the population to pay were major causes of reduced loads of discharges from diff use pollution sources.

Table 3.12 Immediate Causes of Eutrophication

Assessed area				**Immediate Causes**			
A- sea water B- fresh water	Discharge of effluents from agriculture and municipal waste water		Discharge of solids	Runoff and storm waters from coastal zone Increased recycling/ mobilisation of nutrients		Trapping of nutrients	Atmospheric deposition
Black Sea	**A**	**5**	**1**	**3**	**2**	**3**	**4**
	B	**5**	**1**	**3**	**2**	**3**	**1**
Azov Sea	A	5	3	5	1	2	3
	B	2	3	2	1	2	1

The area of arable land in the Dniepr Basin is 283,000 km^2, or 55.4% of the total basin area. Serious structural changes have taken place in the agricultural sector of the three riparian countries of the basin over the last decade, leading to a continuous reduction in the proportion of arable agricultural land compared with total agricultural output.

Mineral fertiliser application has signifi cantly increased over recent years, however, and livestock production has stabilised following a period of steep decline. Private sector involvement schemes have been set up, resulting in a 6% increase in the area of farmland allocated for individual farming activities. One of the major causes of the loss of arable land is deterioration of soil quality, with 50% of agricultural land being swamped or acidifi ed due to insufficient levels of lime. Large areas of agricultural land have also been inundated with shrubs. Erosion is also a continuing problem and inherent to agricultural fields located on slopes with gradients of greater than 1.5-2°. This has been aggravated because simple anti-erosion practices, such as lateral slope tillage, have been applied on only a third of this erosion-susceptible land.

Numerous studies also recognise that agricultural practices that are not friendly towards the environment, and towards water bodies in particular, are deeply rooted in the post-Soviet countries, and, to a lesser extent, in the post-socialist countries, as a heritage of the centralised planned economy of Soviet/socialist times. In order to change the attitudes and introduce agricultural techniques that would reduce nutrient discharge, public awareness must be signifi cantly raised, from the decision-making level down to the agricultural practitioners and farmers.

Economic growth in the Black Sea region slowed in 2012, relative to the outturns of the two previous years. As Figure 3.65 shows, the region's average real GDP growth in 2012 was an estimated 2.1%, roughly half the levels of growth achieved in 2010 and 2011. To some extent, this slowdown is disappointing, since the rates achieved in the previous years had seemed to imply that the region had put behind it the short but severe recession that resulted in the aftermath of the global financial crisis in September 2008 and led to a 6.4% contraction of GDP in 2009, among the highest in the world.

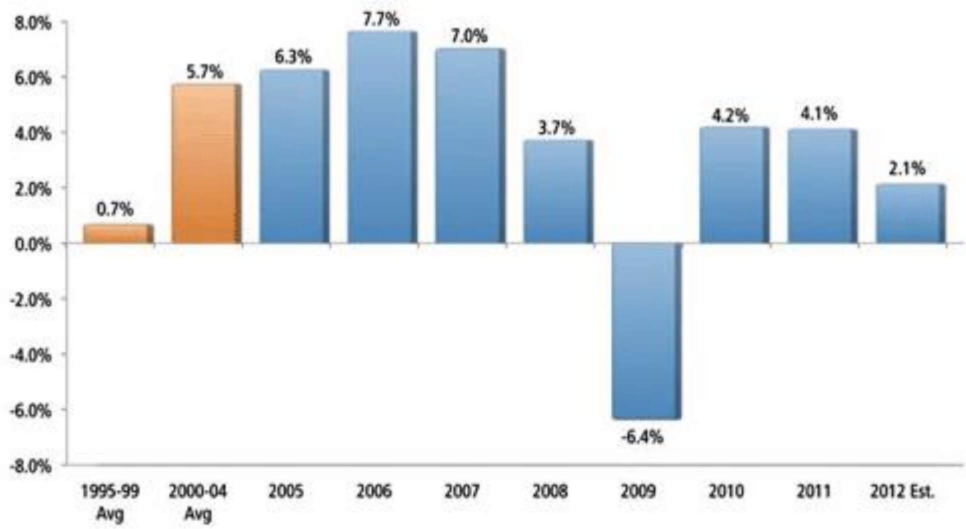


Fig. 3.78 Black Sea Region Average Annual Real GDP Growth

At first glance, it suggests that the more robust growth of the previous two years was due to recovery from the recession, and once this was achieved, growth slipped back to a mediocre post-crisis trend. Since the Black Sea region is largely composed of middle income countries, weak growth means that convergence to the higher income levels and living standards of western Europe becomes more difficult to achieve.

A second, closer look at the region reveals a more nuanced picture. The Black Sea region's 2.1% real GDP growth was achieved despite declines in agricultural production in most countries. While agriculture's share of GDP formation has generally declined over time, it remains a vital sector but also one which is prone to sizeable year on year fluctuations, vulnerable to exogenous factors. After a bumper year in 2011, poor weather in 2012- chiefly drought- affected agricultural production in most of the region negatively and put downward pressure on GDP output figures. By comparison, growth in services- including construction- and in industrial production was softer than in 2010 or 2011, but generally in positive territory and more stable than agriculture.

Weighed against other regions, the picture was mixed. Relative to key emerging market regions such as East Asia (7.5% GDP growth), South Asia (5.4%), Latin America (3.0%), or the Middle East and North Africa (3.8%), the Black Sea region's growth was much lower. However, the Black Sea region outperformed the entire European Union (EU) which suffered a contraction of approximately 0.5%, including the Eurozone, which shrank by 0.3% overall, as well as the eight Central European and Baltic countries- the 'CEE & Baltics' that joined the EU in 2004 and, as former 'transition' countries, are often compared to the countries of the greater Black Sea region- which grew at an anemic 0.9%.

The Eurozone's recession, and its continuing problems emanating from the debt crisis which spilled across borders, are the key reasons for the softness of growth in the Black Sea region. The EU, and more specifically the Eurozone area, is by far the most significant economic partner of the Member Countries of the Black Sea region. EU members are the most significant trade partners of most Black Sea Economic Cooperation (BSEC) Member Countries, and they are also the principal source of financing and foreign direct investment.

Economic downturns in the EU result in reduced demand for Black Sea exporters. The Eurozone crisis- which peaked in mid-2012 and subsequently subsided although at end 2012 was by no means over- impacted negatively the risk appetite of EU based financiers and potential investors, thus resulting in reduced interest (and ability) to undertake investment or provide other forms of financing to the Black Sea region. Put differently, high levels of uncertainty in the Eurozone spilled over into the Black Sea region and were key contributing factors to forestalled investment and consumption.

The EU effect becomes more obvious when looking at the outturns of individual BSEC Countries (See Table 3.13). Continuing a trend observed in 2010 and 2011, countries in the western part of the Black Sea region as a rule fared worse than countries in the eastern part of the Black Sea region. The western countries, of course, are closer geographically to the EU and they are also more tightly intertwined institutionally- with three Black Sea countries also being members of the EU- as well as economically, with a larger share of their external trade going to/ coming from the EU, greater ownership of domestic financial institutions by EU based banks, and tighter financing and investment links. The negative spillover is higher in the western part of the Black Sea region relative to the eastern part, and this is readily observed in individual country GDP figures. Growth rates showed considerable variation among countries, but only two countries, Armenia and Georgia, achieved high rates of real GDP growth in excess of 5%. Three states posted moderate growth of between 2-5%, four states registered low growth of less than 2%, and three states experienced contractions, in real terms. Nine out of the twelve BSEC countries posted lower GDP rates in 2012, relative to 2011, consistent with the overall climate of weaker growth. In three cases, the observed drops in growth were significant, exceeding 5%.

Table 3.13 Summary of Key Economic Indicators for 2012,
by BSEC Member Country Source: National Statistical Agencies

	GDP Growth	Inflation	Cur Acct Bal / GDP	Budget/ GDP	Public Debt/ GDP	FDI/ GDP
Albania	1.1%	2.0%	-11.7%	-3.4%	60.9%	6.5%
Armenia	7.2%	2.6%	-8.4%	-1.5%	44.2%	5.4%
Azerbaijan	2.2%	1.1%	21.7%	0.3%	12.6%	1.2%
Bulgaria	0.8%	3.0%	-1.3%	-0.8%	18.5%	3.7%
Georgia	6.1%	-0.9%	-11.5%	-2.9%	34.9%	5.5%
Greece	-6.4%	1.5%	-2.9%	-6.6%	157.5%	0.2%
Moldova	-0.8%	4.6%	-7.0%	-2.5%	28.3%	2.2%
Romania	0.2%	3.3%	-3.8%	-2.5%	34.6%	1.2%
Russia	3.4%	5.1%	3.7%	0.4%	11.5%	2.6%
Serbia	-1.7%	7.8%	-10.6%	-6.4%	44.5%	0.9%
Turkey	2.2%	8.9%	-6.0%	-2.0%	36.1%	1.6%
Ukraine	0.2%	0.6%	-8.4%	-3.3%	34.7%	4.4%

On the expenditure side, in most countries private consumption was the main contributing source of positive growth. Government consumption was generally down, as governments persisted with long running efforts to improve their fiscal position and reduce outstanding debt, both of which expanded during the economic downturn of 2009 when revenues had fallen sharply. Weaker economic growth meant that revenue projections became more uncertain, and this in turn necessitated reductions in spending in order to maintain, or avoid deterioration, in fiscal balances. Investment growth was also weak, in comparison with 2011, primarily due to the prevailing climate of uncertainty- which always has a dampening effect on investment. The principal exceptions to this trend were the energy rich states, which draw a large share of government revenues from the extraction and sale of oil and gas and have enjoyed windfalls from high energy prices in recent years. Notwithstanding the rising dependence of budget revenues upon energy prices (which are volatile and therefore prone to sharp adjustments upwards and downwards), the energy rich countries enjoyed a more robust fiscal position relative to the regional countries without significant energy resources, and they recycled a larger share of those earnings, mainly in the form of rising public salaries and higher public investments.

In contrast to previous years, external trade was an area of weakness with exports growing a very modest 2.3%. This came after two years of robust export growth of nearly 26% in 2010 and 28% in 2011. While a portion of these figures represented recovery from the trade crash in 2009 (when exports contracted 32.7%), exports reached historical record levels in 2011 both in absolute terms and as a share of GDP. By way of contrast, even though in nominal terms exports reached a record USD 923 billion in 2012, as a share of GDP they declined from 25.9% in 2011 to 25.8% in 2012.

Encouragingly, other key indicators show stable and sustainable trends. Consumer price inflation declined in all countries, continuing a trend of declining price pressures over the years. For the first time, all Black Sea region countries posted single digit rates of inflation, and for nine countries the rate was below 5%. What makes this achievement all the more impressive is that it occurred during a poor year for agricultural production. In the past food output had resulted in sharply higher food prices, and since food has a significant weighting in the consumer ‘basket’ of goods surveyed for calculation of price indices, this usually fed through to higher inflation in the economy as a whole. That this did not occur in 2012 was largely due to the effective monetary policies carried out over the years throughout the region. These policies have been applied consistently and established the credibility of governments’ ‘inflation fighting’ credentials, and thus led to lower expectations of price increases.

Fiscal adjustment also was sustained, as in most countries budget balances for 2012 improved relative to the balances achieved in 2011. This is a continuation of a process of fiscal consolidation that began in 2010 in an effort to offset the large deteriorations experienced in late 2008 and 2009 when the post-financial crisis economic recession resulted on the one hand in a decline in revenues, due to reduced economic activity, and on the other hand in increased spending to due systemic stabilizers such as increased unemployment and welfare benefits, support to the financial sector to avert disruptions, and in certain instances fiscal stimulus efforts to counteract sudden and substantial declines in private economic activity.

As a region, the Black Sea in 2012 had an estimated (i) GDP of around USD 3.6 trillion, (ii) population of 327 million, and (iii) an average per capita income of nearly USD 11,000. While these figures hide considerable differences in wealth, size, economic structure and growth trends, they highlight the tremendous possibilities that exists for broader and deeper economic cooperation among the countries of the Black Sea.

3.5 Protected areas and valuable natural sites/ecological network

Many coastal and offshore ecosystems continue to be degraded by anthropogenic causes, despite efforts to control or limit them. The causes of degradation are numerous, and can include: pollutants, runoff (carrying sediment and chemicals), coastal development, introduction of non-native or invasive species, overfishing, overhunting and by-catch, habitat alteration and rising sea level and climate change. Land and marine (offshore) based sources of pollution are some of the greatest threats to protected areas and valuable natural sites.

In response to these problems, policy-makers world-wide tend to develop strategies to protect, conserve and recover the marine environment (Borja *et al.*, 2008). In Europe, several policies refer in full or partially to the coastal and marine environment protection, such as the Habitats Directive (HD, 92/43/EEC), the Water Framework Directive (WFD, 2000/60/EC), the Common Fisheries Policy (CFP and the new reform COM (2010)241 final) or the Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 Establishing a Framework for Maritime Spatial Planning. Additionally to several existing international regional conventions dealing with the protection of European seas (i.e. OSPAR, in the Atlantic Ocean; HELCOM, in the Baltic Sea; Bucharest, in the Black Sea; Barcelona, in the Mediterranean Sea), in 2008, the European Parliament approved the Marine Strategy Framework Directive (MSFD, 2008/56/EC), for the protection of all seas of the European Union in parallel and synergistically, based on the ecosystem approach (Borja *et al.*, 2010).

3.5.1 Land and marine (offshore) based sources of pollution

The pollution of the Black Sea from land-based sources represents one of the biggest threats to its health state. The risk to not achieve and maintain the good ecological status is, most often, an elusive goal in the coastal zone, particularly in the neighbourhood of the human settlements and rivers mouths. The efforts undertaken at regional and local level contributed to the improving of the Black Sea waters quality, affected by eutrophication in the 80s, being spanned with the signature and implementation of the Convention on the Protection of the Black sea Against Pollution (Bucharest, 1992) by the riparian countries. Having as main objective the prevention, reduction and control of the Black Sea pollution for protecting the marine ecosystem, the Bucharest Convention and its four Protocols provides the legal framework for cooperation and concerted actions to meet these obligations.

Bulgaria

The main land-based activities in Bulgaria are based on urbanization - population, tourism and activities in the marine environment (uses of the sea) - fisheries and aquaculture, marine transport and port activities, shipbuilding and ship repair, extraction and transportation of oil and gas.

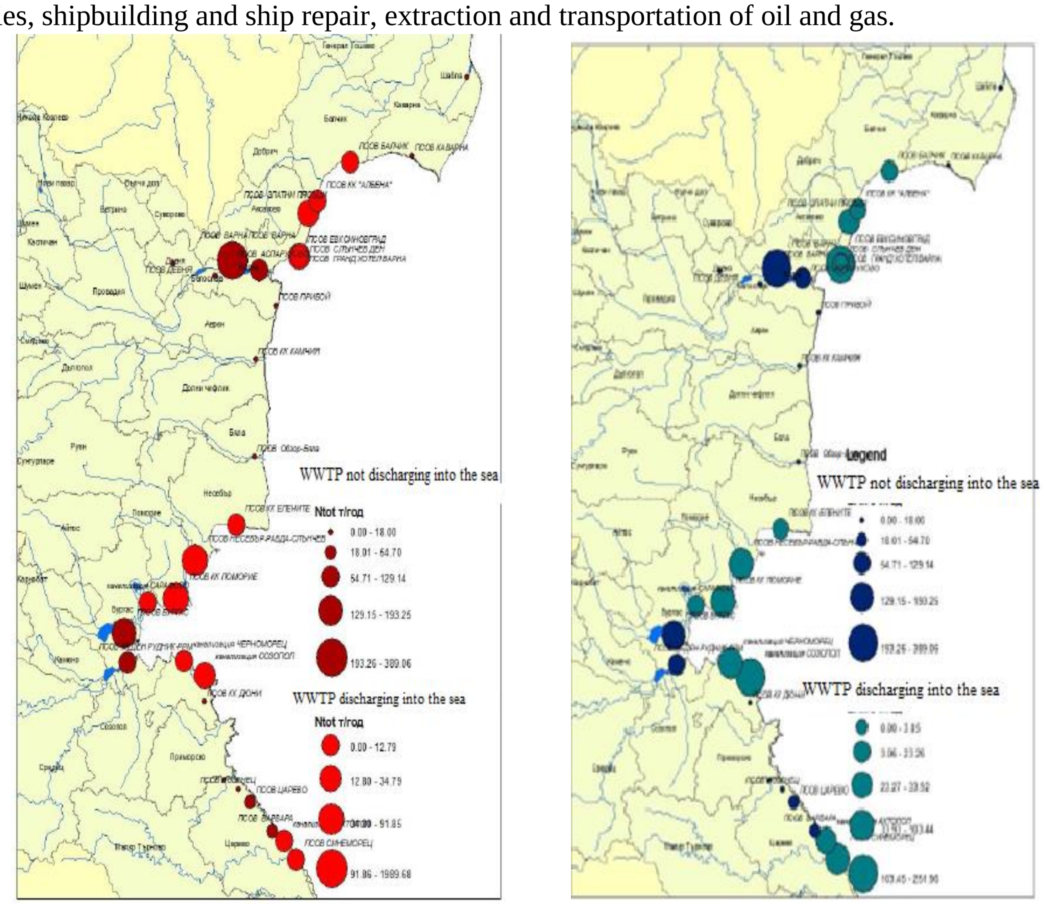


Fig. 3.79 Nitrogen (Left) and BOD_5 (Right) discharging from Bulgarian WWTPs

Along the Black Sea coast are 23 municipal wastewater treatment plants (WWTPs), 20 of which are for settlements with a population of more than 10 000. 11 are in a normal operation regime, 8 are in the process of being reconstructed and modernized and 4 settlements do not have a WWTP (Fig. 3.79). Still, sewerages have not been completely constructed in agglomerations and settlements. The implementation of large scale investment programs for the construction of sewerages is needed together with additional equipment of treatment plants with facilities for removal of nitrogen compounds.

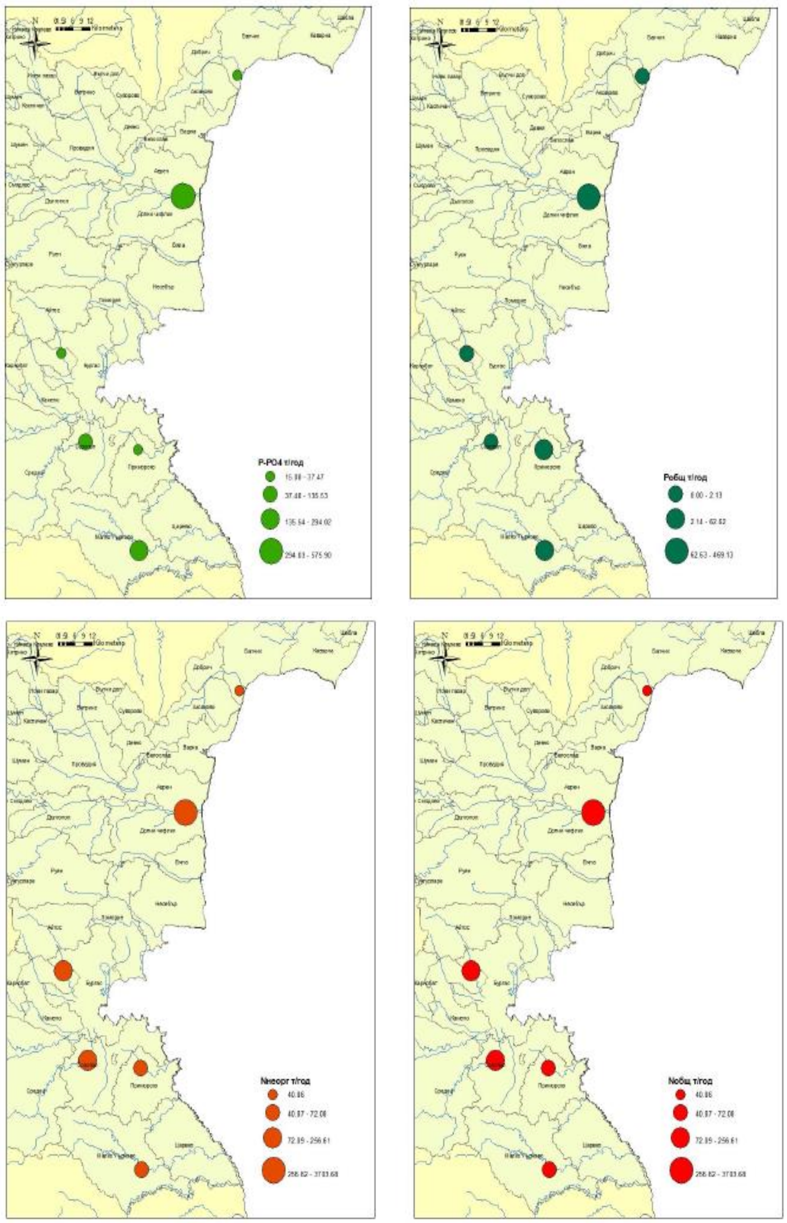


Fig. 3.80 Phosphorus (up) and nitrogen (down) sources on the Bulgarian Black Sea coast

Additionally, indirect discharge of the wastewater in the river mouths or in the vicinity of coastal seawater has a negative impact on the quality of the seawater. These are 9 additional agglomerations serviced by 7 WWTPs alongside river basins and around coastal lakes (Fig. 3.80).

The main WWTPs discharging into the Black Sea are reported by Bulgaria to the Black Sea Commission as hot spots (Table 3.14) (Avaz et al., 2013).

Table 3.14 Municipal sources identified as Hot Spots in Bulgaria

1	Balchik domestic WWTP
2	Varna WWTP
3	Kavarna WWTP
4	Albena WWTP
5	Golden sands WWTP
6	Sunny day WWTP
7	Grand hotel Varna WWTP
8	Evksinograd WWTP
9	Elenite WWTP
10	Asparuhovo domestic WWTP
11	Tsarevo domestic WWTP
12	Sozopol sewage
13	Pomorie domestic WWTP
14	Ravda - Sunny beach - Nessebar domestic WWTP
15	Obzor-Byala domestic WWTP
16	Meden Rudnik domestic WWTP
17	Bourgas domestic WWTP
18	Kiten - Primorsko domestic WWTP

From these municipal sources, the main discharge is coming from Varna area, the biggest city from the Bulgarian coast (Fig. 3.81 and Fig. 3.82) (Avaz et al., 2013).

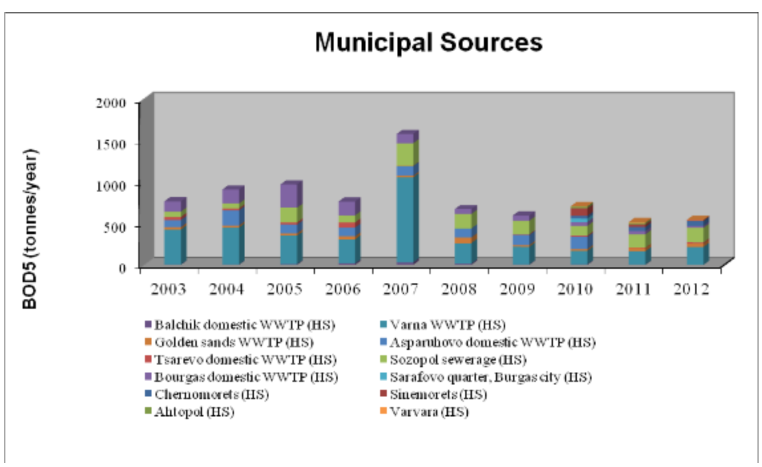


Fig. 3.81 BOD5 discharges from WWTPs, Bulgaria - 2003 - 2012

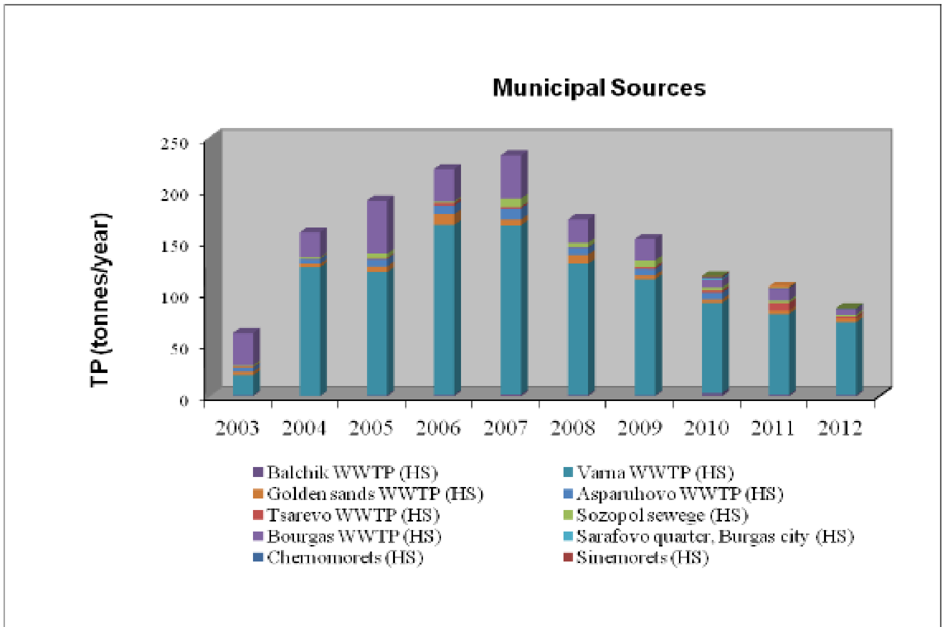


Fig. 3.82 TP discharges from WWTPs, Bulgaria - 2003 - 2012

Bulgaria identified and reports as industrial Hot Spots: Solvey SODI AD and Lukoil Neftochim Bourgas - central treatment plan (refinery) (Avaz et al., 2013).

There are 33 Rivers in the Black Sea Basin on the territory of Bulgaria (those, which directly or indirectly inflow into the Black Sea). The largest is Kamchia and it is also the most serious source of pollution among all Bulgarian Black Sea rivers (Avaz et al., 2013).

Submarine cable and pipeline routes

Bulgaria oil and gas resources are limited, but successive and recent exploration campaigns have revealed a potential for oil and gas developments offshore the Bulgarian coast, bringing several European and international investors on the market.

For the period 2006 – 2011, two permits for prospecting and exploration of oil and gas were granted. The first one was granted to domestic PDNG-Sofia Corp., and the second one to Scottish-based Melrose Resources Company. Melrose Resources invested in the Galata block in 2010, and launched gas production on its fields of Kavarna, East Kavarna and Kaliakra hundred miles from the Bulgarian coastline. It announced via press release on the 2nd of July 2014 an extension of its license of 2 years, enabling the company to pursue exploration on its block. Things accelerated in 2012, with successive contract negotiations: a contract for prospecting and exploration of oil and natural gas in "Block 1-21 Khan Asparuh" in deep waters of Black Sea was concluded with a consortium composed of Total E&P Bulgaria, Austria's OMV AG (OMV) and Spain's Repsol SA (REP). In October 2012 the government decided to initiate a tender procedure for issuance of a permit for prospecting and exploration of oil and natural gas in "Block 1-22 Teres." The study site is located in the Exclusive Economic Zone of Bulgaria in the deep waters of the Black Sea and has an area of 4032 sq. km. The Council of Ministers approved the launch of a competitive procedure for authorization of prospecting and exploration of oil and natural gas in the area "Block 1-23 St. Marina" (1,612 sq. km) in early 2013.

The location of the different oil and gas blocks granted or in the process of being granted can be seen in the Fig. 3.83.

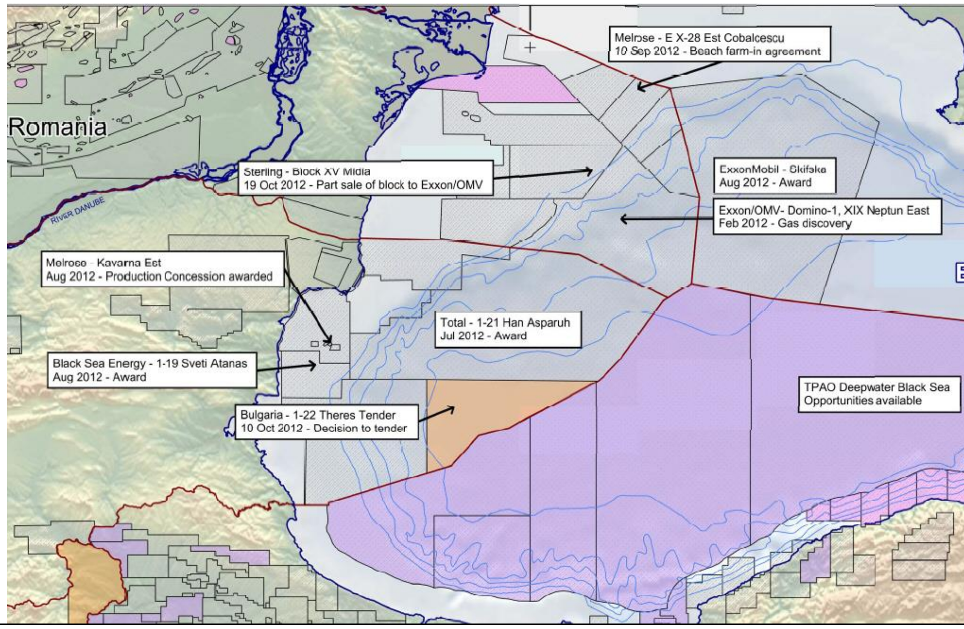


Fig. 3.83 Location of the different oil and gas blocks granted or in the process of being granted (*www.drillinginfo.com*)

Moldova

In the Republic of Moldova surface waters are represented by basins of the Dniester and Pruth rivers which are transborder water sources, inland rivers and natural and manmade reservoirs. The biggest surface water source is the Dniester River having a total annual discharge of circa 10.7 km^3. The second biggest river is Pruth, with an average annual discharge of circa 2.9 km^3. All other inland rivers flowing on the territory of the country have an average annual discharge of circa 1.22 km^3.

The waters of the Dniester and Pruth rivers are considered to be relatively clean to moderately polluted. The waters of small rivers are medium to highly polluted. Circa 44% of the population does not have access to safe drinking water sources. At present all towns and municipalities and over 65% of rural settlements have centralized drinking water supply systems. Only 50% of this type of systems is in satisfactory technical condition. The rest needs capital repairs or rather reconstruction (http://www.climateadaptation.eu/moldova/fresh-water-resources/).

Taking into consideration different sources of water and various usage restrictions (agreements on Transboundary Rivers, ecological water resources, etc.), the total economically available water resources in Moldova amount to 5.6 km^3, including 4.3 km^3 surface water and 1.3 km^3 ground water. Currently, about 65 to 70% of total water is used in industrial heating and cooling and hydro-energy production, 15 to 20% for drinking and domestic purposes and 5 to 8% for irrigation.

Moldova is downstream from Ukraine, and the two large rivers, Prut and Dniester, are already polluted from domestic, agricultural and industrial sources in Ukraine when they enter the country. On the Moldovian side, the most important source of water pollution is agro-chemical run-off. In the southern part of the Prut basin, there are also deposits of mineral salts and oil, which seep into the Prut causing pollution problems and unusual ecological conditions. Industrial pollution drains into the Dniester, which is the main source of drinking water of the Moldovan capital, Chisinau. This water supply was further polluted by petroleum products and runoff from damaged industrial enterprises during the conflict over Transnistria. Further south, efforts to increase the capacity of lakes for irrigation purposes have resulted in salinization, contaminating irrigation and drinking water abd adding to pollution in the Danube river basin (World Bank Study, 1994).

Industry

The share of industry in the GDP of Moldova accounts for 14.7% (2010), and its contribution to the GDP annual growth in 2010 accounted for +0.8%. As compared to other branches, the industrial sector has a major environmental impact. The use of thermo energy is the main pollutant source in the atmosphere through gas emissions resulting from the burning of solid and liquid fuel, and emissions of dust. The main economic-financial indicators in industry have evolved during the last years according to Fig. 3.84.

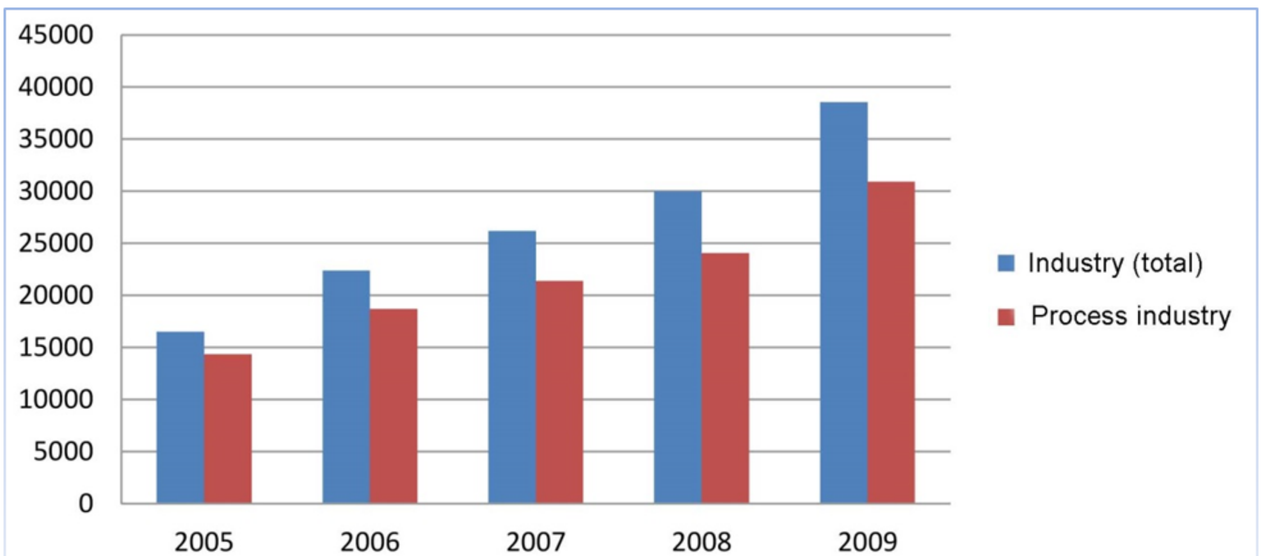


Fig. 3.84 Dynamics of industrial production in the Republic of Moldova, 2005-2010, thousand lei.

The industrial impact on the environment is expressed by the total volume of harmful substances, and those that are formed at the stationary sources of atmospheric air pollution in the country. This accounted for about 182.6-183.4 thousand tons (with small deviations) in 2006-2008, decreasing to 133.7 thousand tons by 2009. The share of the industrial sector in formation of polluting substances exceeds 90% (Fig. 3.85). Nevertheless, it should be mentioned that over the last four years there has been a decreasing trend for the level of air pollution coming from the industrial sector, which is caused by the decrease in production volume.

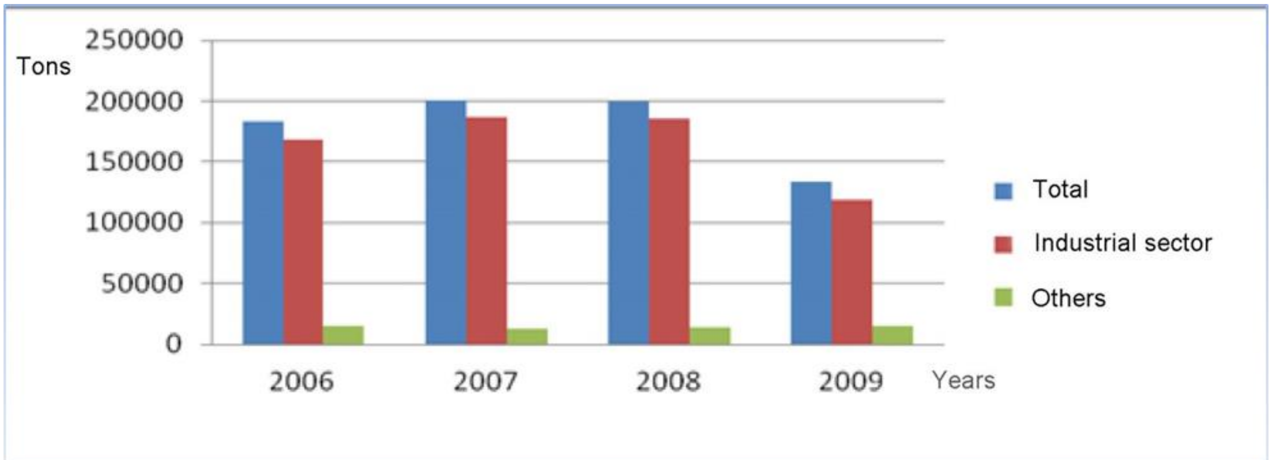


Fig. 3.85 Share of the industrial sector in emission of polluting substances from stationary sources (Moldova)

The total volume of polluting substances emitted into the atmosphere by stationary sources decreased from 20,332 tons in 2005 to 15,744 tons in 2009, with insignificant fluctuations for the industrial sector and other sources (Table 3.15).

Table 3.15 Volume of harmful substances emitted into the atmosphere from stationary sources by ingredients, 2009, tons (Moldova)

	Total	Of which:				
		Solid	Gas and liquid	Including:		
				SO_2	NO_x	CO
Total	15744.2	4317.0	11427.5	1557.8	1752.5	3914.6
Industrial sector	5107.1	2252.6	2854.6	192.3	645.8	1467.2
Others	10637.1	2064.4	8582.9	1365.5	1106.7	2447.4

About 95-96% of the total volume of polluting substances generated by stationary sources from the industrial sector are captured and neutralized, and 92–94% are used (Fig. 3.86 and Fig. 3.87).

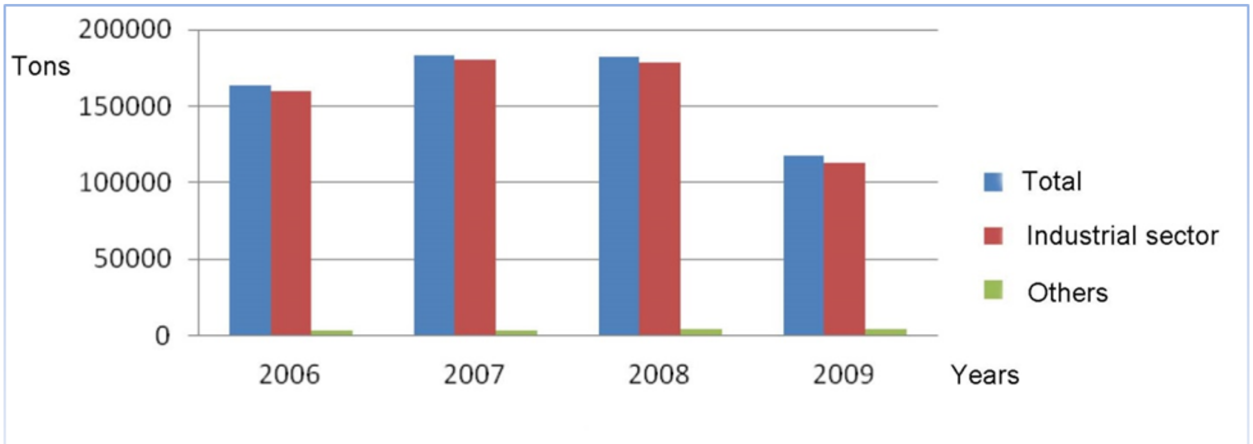


Fig. 3.86 Share of the industrial sector in capturing and neutralizing the polluting substances generated by stationary sources (Moldova)

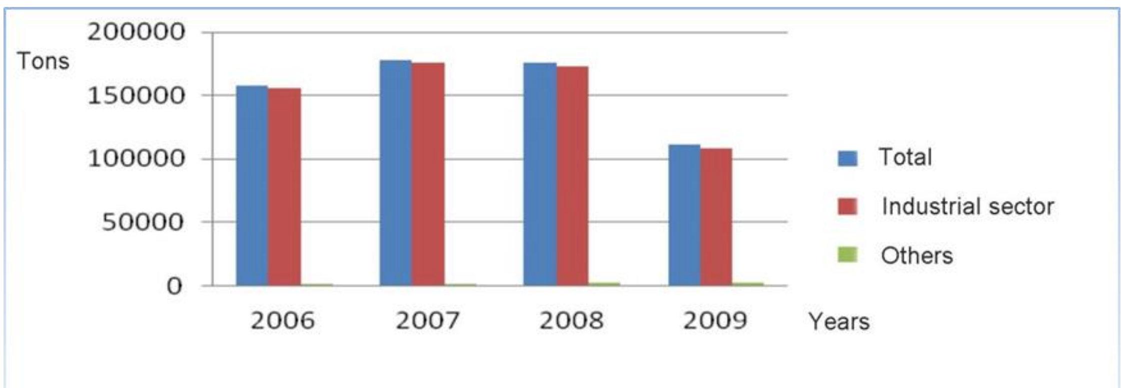


Fig. 3.87 Share of the industrial sector in using the polluting substances generated by stationary sources (Moldova)

Just as in previous years, when analyzing the polluting sources from a territorial perspective, it is noted that the main polluting sources are the enterprises from Chisinau municipality, followed by those from Balti and Rezina.

To reduce the environmental impact induced by industrial activity, the national legislative framework needs to be adjusted to the Directives of the European Union (Integrated Pollution Prevention and Control Directive). Other requirements to accomplish this include: transfer to the system of the best available techniques (BAT), investing in modernization of techniques and management, so as to optimize efficiency in the consumption of natural resources (water, energy, mineral resources), techniques for reducing emissions; improvement of the quality management system (implementation and improvement of the integrated management system according to ISO 9001 and ISO 14000 standards); development and promotion of measures for risk prevention and environmental monitoring in the zone where industrial units are located; and the development of conformity measures for the ecologization of polluted fields on industrial land.

Transportation

Currently, transportation is the most significant source of environmental pollution in the Republic of Moldova. The following transportation means are used in the territory of the Republic of Moldova: land (railroad, auto), water, and air.

In 2013 a volume of 35674,1 thousand tons of goods were transported in the Republic of Moldova. 15,2% was transported via railroad, 84.34% - auto transportation, and under 0.5% - water and air transportation together.

In 2013, 237,128.7 thousand passengers were transported in the country. The number of transported passengers by types of public transportation in 2009-2013 is presented in Table 3.16.

Table 3.16 Transportation of passengers by types of public transportation (Moldova)

Period	Total	Transported passengers, thousand passengers					
		for the following types of transportation					
		railroad	bus	water	air	trolleybus	taxi
2009	291843.3	5186.7	105805.8	118.7	459.6	176436.1	3836.4
2010	232455.2	4963.7	105984.5	118.8	649.2	116476.6	4262.4
2011	237099.6	4711.3	115270.6	122.6	700.4	112209.2	4085.5
2012	240378.7	4340.9	118090.6	115.7	673.0	113434.1	3724.4
2013	237128.7	4092.4	114717.0	116.4	655.0	113811.8	3736.1

To diminish the environmental impact of transportation, several steps must be taken to ensure environmental protection: reducing the noise and carbon dioxide emissions by using alternative fuels and new technologies in all transportation types; promoting transfer from polluting transportation means to those which use renewable energy, including transportation means that adjust to challenges such as globalization, weather changes, and fuel price. A priority for the future would be the promotion of auto standards for cars, which would be adjusted to the EU requirements (switching to the Euro system for engines and fuels; system adjustment for hybrid cars), reconfiguration of the fundamental scheme of the national road network (adjusting the road-building conditions to the weather conditions; applying requirements for biodiversity protection when building roads); development and implementation of a program to foster the renewal of the national car pool.

Extractive Industry

In the Republic of Moldova, mineral substances are extracted in solid (non-metallic substances), liquid (petrol, mineral water) and gas states (natural gas). Underground water has a special role in Moldova’s economy - it is used for the drinking water supply (mineral water is also used as drinking water), as well as for external use and therapeutic health treatment. As of 01.01.2010, 130 deposits of non-metallic mineral substances were extracted through both methods: above the ground and underground. As a result of the employment of the oil deposits in Valeni and natural gas reserves in Victorovca, 11.9 thousand tons of crude and 9.1 thousand m^3 of gas were extracted in 2010.

According to the data of the National Bureau of Statistics, during 2007-2010, about 25 thousand tons of raw materials were imported for a total amount of 11.6 million USD. The types, volumes and value of the imported mineral substances are presented in Table 3.17. The existing data show that the volume of import and the volume of extraction of local raw material in 2009 decreased as compared with the volumes registered in 2007 and 2008.

Table 3.17 Import of natural mineral products in the Republic of Moldova, 2007-2010

No.	Mineral product	2007		2008		2009		2010	
		Quantity, tons	Value, thousand USD	Quantity, tons	Value, thousand USD	Quantity, tons	Value, thousand USD	Quantity, tons	Value, thousand USD
1	Kaolinite clay	456.1	49.1	341.7	39.0	–	–	38.8	7.6
2	Bentone	156.3	73.1	184,5	88.2	254.4	128.4	324.7	149.6
3	Chalk	2987.8	234.7	3598.8	35.6	2502.2	221.8	32649.9	314.8
4	Tripoli	217.1	197.27	171.2	180.1	136.6	137.4	203.0	182.5
5	Slag wool	2010.8	2447.8	26.2	2789.8	1887.3	1538.8	2946.3	2274.2
6	Expanded clay	2108.4	1.4	10518.0	6.6	–	–	1083.5	0.8
7	Active coal	25.1	109.2	157.4	473.3	65.1	202.2	86.4	266.0
8	Perlite	1664.4	122.7	317.1	210.1	1021.5	332.1	–	–
9	Binder material	8.5	31.3	1.4	5.7	–	–	–	–

The waste management consists in the following activities: collecting, transportation, waste treatment, recovery and disposal. The special waste collection and disposal services are rendered in municipalities, in all the district centers, therefore the municipal waste management is well-organized with the support of these services that work under a contract concluded with individual generators, however, this system covers only 60 – 90% of the generators of municipal waste from the urban areas. In the rural areas, no services of waste management exist in most settlements; therefore the transportation of waste to the waste storage places is performed personally by the generators except for waste collection services established in some of the rural areas. A small part of the rural settlements, and namely those situated in the neighborhood of district centers, are serviced by special waste management entities (Chisinau, Falesti, Ungheni, etc.).

The national statistics has no data on the amounts of construction and demolition waste (CDW). In the CE study "Contractual services for construction and demolition waste management - SR1" (May 2010), a CDW generation index is used being of 500-1000 kg/capita, depending on the size of this sector in the country. The use of this index for Moldova would mean that in 2010 1,800-3,600 tons of CDW was generated, which would be an overestimation.

According to "Health without any prejudice" study (www.noharm.org) annually 15.7 thousand tons of medical waste is generated.

Persistent Organic Pollutants (POPs)

A representative analysis shows that POPs pesticides make up 20-30% of the total stock of obsolete and inhabited pesticides in Moldova. Currently, this amount is estimated at about 3 thousand tons. The studies conducted in the close vicinity of deposits show that the soil and surface water are contaminated with such substances.

Production Waste

Agriculture is the main branch of the national economy, while the food processing and beverage industry produces the biggest amounts of waste in the Republic of Moldova. More mass consumer products, including the food, are marketed, and they contribute to the production of solid household waste. According to different sources, an annual growth of 3% for agricultural products was forecasted (until 2010), while according to the Industry Development Strategy an annual growth of 10% (until 2030) is forecasted. For the produced waste, growths of 5% until 2015 and 7% until 2025 will be taken into account. [*NATIONAL WASTE MANAGEMENT STRATEGY OF THE REPUBLIC OF MOLDOVA (2013-2027). Chisinau, 2013. Http://Www.Serviciilocale.Md/Public/Files/Deseuri/2013_01_24_National_Waste_Management_Strategy_2013-27_Eng.Pdf*].

I. Deposits of ménage solid wastes

One of the environment pollution sources are the deposits of ménage solid wastes. In Year Report of the State Ecological Inspection (2012) is indicate that in the Republic of Moldova exists a large surface of ménage solid wastes deposits - 1 345,93 ha with 1 867 existing deposits. The volume of deposited ménage solid wastes is of 56 559,44 m^3, and that collected/deposited in 2011 - 4 641,95 (thousand m^3). Deposits constructed according to execution project with positive opinion of ecological state institutions are only 15, constructed in absence of execution project – 1 009 (54%) and un-authorized – 843 (44%) (Table 3.18).

So, constructed of ménage solid wastes deposits according to execution project constitute total in republic only 15 (0,8%) and 9 (1,4%) in river Prut basin. Other existing deposits were constructed in absence of execution project: 1 009 (54%) total in the republic and 304 (49%) in Prut basin; total un-authorized deposits in the republic are 843 (44%) and 201 (34%) - in Prut basin that served as source of pollution.

Table 3.18 Deposits of domestic solid wastes.

	Total surface of the deposits (ha)	Number of existing deposits (un.)	Volume of deposited ménage solid wastes (thousand m^3)	Volume of collected/ deposited ménage solid wastes in 2011 (thousand m^3)	The presence of holes Bekkari, (un.)	Deposits of domestic solid waste, no. / % of total no.		
						according to execution project with positive opinion of ecological	constructed in absence of execution project	Un-authorized
Total in Moldova	1 345.93	1 867	56 559.44	4 641.95	170	15 / 0.8%	1 009 / 54%	843 / 44%
In Prut River basin	450.3	623	10 452.65	1 589.85 34%	55	9 / 1.4%	304 / 49%	201 / 34%

Source: [*Environment protection in the Republic of Moldova: Year Report of the State Ecological Inspection – 2011; elab.: Gr. Prisacaru, V. Tapis, V. Stingaci [et al.]. - Ch.: Continental Grup, 2012. – 248 p*.].

Waste waters

- *Sustainable water management*

The 2007 Strategy of Water Supply and Sanitation of Communities sets out specific medium-term (2008-2012) and long-term (2012-2025) objectives. However, the Strategy lacks a national water action plan and lacks financing. Access to sewerage systems is increasing slowly, from about 42% in 2005 up to about 50% in 2012. With such slow progress the country will hardly meet its national MDG target of 65% of the population with access to improved sewerage set for the year 2015. The situation regarding wastewater treatment in the country is very bleak. In 2010, only 17 of 198 wastewater treatment plants (WWTPs) (9%) were in a satisfactory state, 112 (56%) require repair and 69 (35%) required full refurbishment. Most WWTPs operate de facto with mechanical treatment only. As a result, discharges from WWTPs into water bodies contain organic substances, ammonium and nitrates. A lot of industrial WWTPs are old and obsolete. Currently, a huge amount of untreated industrial wastewater is discharged into rivers. (Source: [*ENVIRONMENTAL PERFORMANCE REVIEWS. REPUBLIC OF MOLDOVA. Third Review, Synopsis. UNITED NATIONS, 2014*].

- *Waste waters - sources of pollution in the Republic of Moldova*

Total evacuation in the Republic of Moldova of wastewaters in 2012 was 681.5 mln. m^3, of this were discharged into surface water 674.9 mln. m^3, inclusive purified regulatory 113.3 mln. m^3 (16.7%), with conventional purification - 552.7 mln. m^3 (81.8%), insufficiently purified - 7.35 mln. m^3 (about 1%) and without treatment - 1.46 mln. m^3 (0.2%).

Compared with 2000 year, overall water use decreased by 7.5% from 849 up to 785.6 mln. m^3, but polluted wastewater discharges in 2012 increased by 1.1% - from 8.7 to 8.8 mln. m^3. Compared with 2005 year, polluted wastewater discharges in 2012 year decreased from 697 up to 683 mil. m^3, of about 2% (Fig. 3.88; 3.89).
http://www.statistica.md/category.php?l=ro&idc=99.
http://www.statistica.md/public/files/publicatii_electronice/Mediu/Resurse_naturale_2013.pdf].

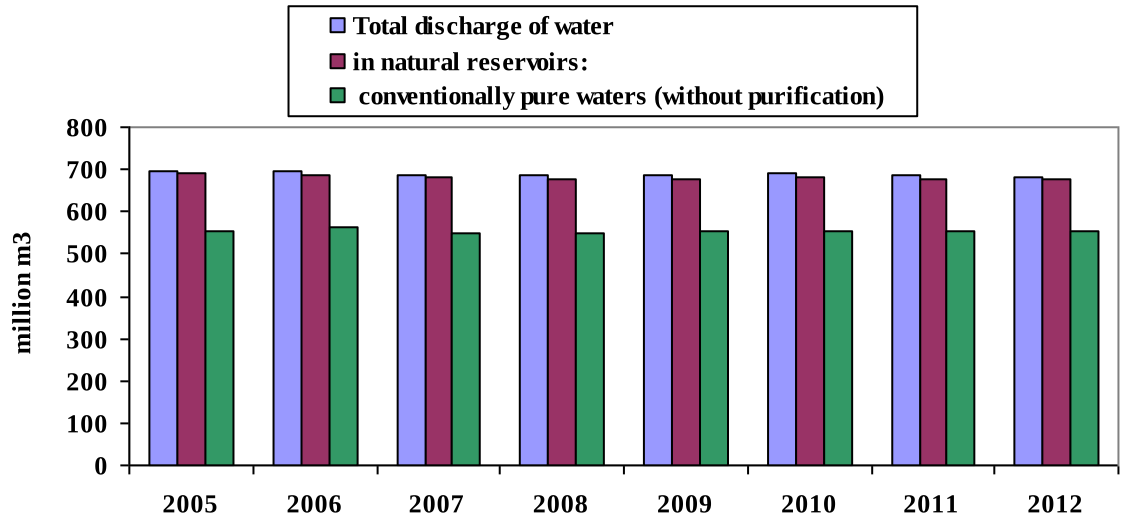


Fig. 3.88 The discharge of water in 2005-2012 years

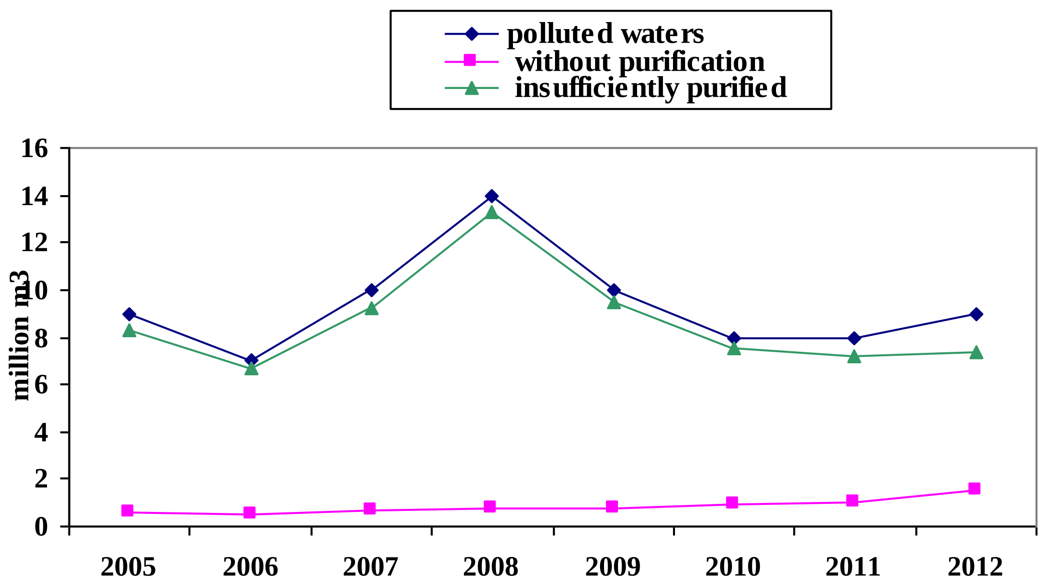


Fig. 3.89 The discharge of polluted waters in 2005-2012 years

Pollutants discharged into surface water

In conformity with Water Cadastre information (2014) total volume of waste waters discharged into surface water in 2012 contained 2,541 thousand tons of BOD total (norm 1,834 thousand tons); 2,404 thousand tons of Suspended particles (norm 1,834 thousand tons); 205,636 tons of Nitrogen – ammonium (norm 61,124 tons), 1859,710 tons of Nitrogen total (norm 61,124 tons); 109,354 tons of phosphor (norm 61,124) and surface active substances - 13,458 (norm 12,225) tons.

In Prut River and Danube basin it was discharged 0,1617 thousand tons BOD total (2,8 norms); 0,135 thousand tons of Suspended particles (2,4 norms); 37,664 tons of N-NH4+ (18 norms); 6,813 tons of phosphor (3,3 norms) and 0,87 tons of surface active substances (about 2 norms) (tables 2 and 3).

Other components (fix residue, sulfates, chlorides, nitrates, fats and oils, iron) do not exceed norms to its discharged into natural waters (Tables 3.19 and 3.20). [*Report of Water Cadastre, 2014. http://www.dbga.md/RaportCadastrulApelor2014.pdf*].

Table 3.19 The volume of discharged BOD total and Suspended particles.

	The volume of discharged pollutants, thousand tons			
	BOD total		**Suspended particles**	
	practic	**norm**	**practic**	**norm**
Total in R.M.	2,541	1,834	2,404	1,834
Total Prut River and Danube basin	0,1617	0,0565	0,135	0,057

Table 3.20 The volume of discharged N-NH4+, Phosphor and Surface active substances.

Location	**The volume of discharged pollutants, tons**					
	Nitrogen - ammonium		**Phosphor**		**Surface active substances**	
	practic	**norm**	**practic**	**norm**	**practic**	**norm**
Total in RM	205,636	61,124	109,354	61,124	13,458	12,225
Total Prut River and Danube basin	37,664	2,072	6,813	2,072	0,87	0,417

Water Quality of Prut River

In the years 2012-2013 under the Water Pollution Index (IPA), calculated after 6 chemical parameters (N-NH_4^+, NO_2^-, oil products, phenol, O_2, BOD_5), the Prut river water was clean as class II of quality (IPA <1) in most sections of control, only in sections Sirauti and Giurgiuleşti in. 2012 -

class III of quality (ie IPA = 1.12 and 1.15) and in 2013 - in sections Sirauti and Leova (ie IPA = 1.02 and 1.06), moderately polluted.
Water of Danube, downstream of the point hydrometric Giurgiuleşti, under IPA corresponded in the years 2012-2013 to class II of quality (ie IPA = 0.88 and 0.67), classifying as clean. [*Anuar. Starea calităţii apelor de suprafaţă conform indicilor hidrochimici pe teritoriul Republicii Moldova în anul 2013. Chişinău 2014.* http://www.meteo.md/monitor/anuare/2013/anuarapei_2013.pdf

Romania

At the Romanian Black Sea coast are found 8 Natura 2000 sites (marine protected areas) which shelter 7 types and 23 de subtypes of habitats and numerous species of flora and fauna. The sites are in the influences area of the Danube and land-based sources of pollution (Fig. 3.90).

Romania is a traditional oil and gas producer and was for a long time an oil exporter. Domestic production, however, is declining rapidly. The country produced 99,000 b/d of oil and 11.5 billion cu m of natural gas in 2008, covering 80% of domestic gas consumption, but only 44% of oil consumption. As a member of the European Union since 2007 with more than 500,000 b/d of oil refining capacity and a well-developed oil and gas pipeline infrastructure, Romania presents an interesting potential access point to European markets for non-EU suppliers, especially Caspian producers. Romania spent the past 20 years without a clear long-term energy strategy, other than opposing any large Russian-led project. The Romanian Energy Strategy Plan for 2007-20 does not mention any regional or European strategic objective for the energy sector.

Signs of a more structured energy strategy, however, have recently emerged. The main tenets of this strategy seem to be close cooperation with Caspian producers to allow them to access to EU markets while Romania diversifies from Russian supplies, coupled with an increased push to revive domestic oil and gas production and diversify the primary energy mix. KazMunaiGaz, the Kazakh National Oil and Gas Company, acquired Rompetrol in 2007. Rompetrol has distribution networks in 13 countries. Romania also signed a strategic partnership agreement with Azerbaijan and negotiations between Romanian authorities and SOCAR have intensified, SOCAR promising during October 2009 talks to supply Romania with 7.3 billion cu m/year of gas if Nabucco is the first-built among the competing regional pipeline projects.

SOCAR is also interested in investing in refining capacity in Romania and, although the Romanian government has privatized all refineries, it has also announced a large state subsidy for RAFO Onesti, a money-losing privately owned refinery, intensifying speculation regarding cooperation with SOCAR regarding the facility. Romania has unconditionally supported Nabucco since its inception and was not invited to be part of South Stream. It was also one of the initiators of the Pan-European Oil Pipeline (or Constanta-Trieste pipeline), shelved in September 2009 as Croatia reconsidered its energy project priorities and focused on projects along the Adriatic coast. Romania has also started negotiations to participate in the still-nascent White Stream project, strongly backed by Azerbaijan.

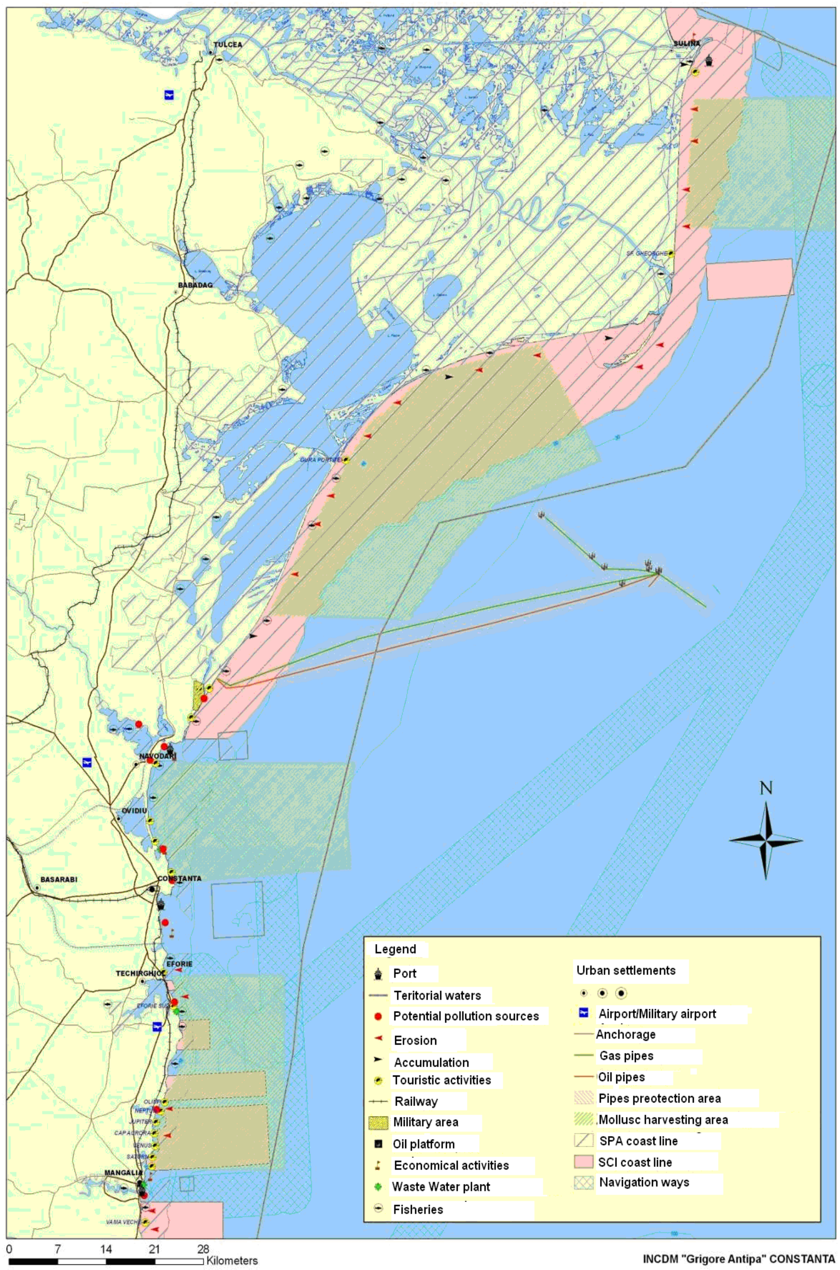


Fig. 3.90 The main activities from the Romanian coast and the overlapping with the marine protected areas *(original map)*

Romanian business leaders discussed the possibility of shipping LNG across the Black Sea during the Black Sea Energy and Economic Forum, an option also mentioned in late October by Azeri officials. But this option seems to be a long shot without switching to cheaper, quicker CNG instead. In the meantime, the Romanian government earmarked €2 billion over the next 10 years for upgrading the country's gas transmission network, connecting it to neighbouring countries, and increasing underground storage capacity. Romania, on September 3, 2009, launched its tenth oil and gas production licensing round, with permits to be awarded early-2010. The round offered 30 oil and gas exploration blocks, 11 of them offshore in the Black Sea.

A February 2009 decision by the International Court of Justice in the Hague settling competing claims by Romania and Ukraine regarding a 12,000 sq. km offshore area thought to contain as much as 100 billion cu m of gas and 73 million bbl. of oil reserves allowed opening of previously unavailable offshore blocks. The ICJ awarded 9,000 sq. km to Romania and the balance to Ukraine and both countries accepted the decision. Romania could become a bridge to Europe for Caspian production if it can separate internal politics from the management of its energy sector, improve the transparency of the exploration licensing process, and implement energy infrastructure projects geared toward helping it become a viable oil and gas transit country.

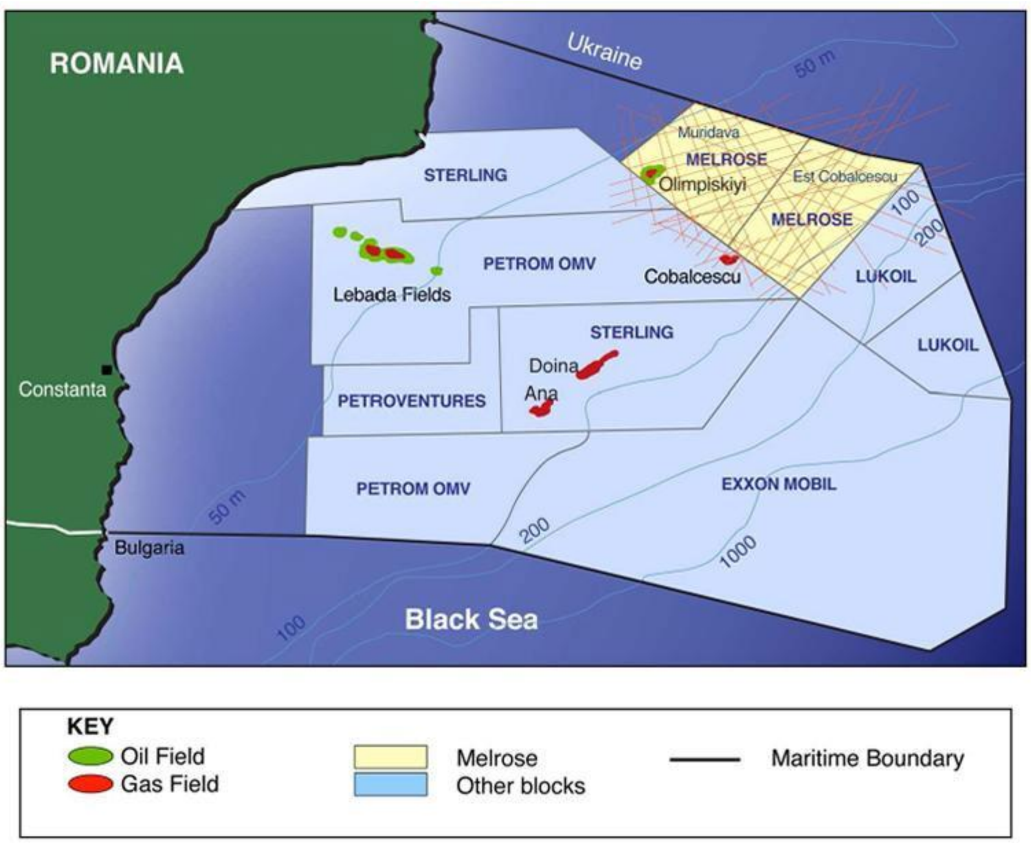


Fig. 3.91 Romania oil and gas production sites – (*http://www.roconsulboston.com/Pages/InfoPages/Government/ExxonOMVGas.html*)

Thus, apart from the major pressure exerted by the Danube, the main land-based sources identified are concentrated in the central and southern part of the littoral, an area with the main urban settlements and industrial activities. In the area Midia - Vama Veche, on an approximately 54 km are located industrial plants with different economic permanent activities as follows:

- 3 maritime ports with different industrial activities diverse (Midia, Constanta and Mangalia);
- 2 navigable channels (Danube - Black Sea and Poarta Alba - Midia) - drinking water sources;
- 3 shipyards (Midia, Constanta and Mangalia);
- 1 Refinery - Rompetrol Rafinarie;
- 2 big cities (Constanta and Mangalia) and resorts;
- 3 touristic ports;
- approx. 30 km beaches;
- wastewater treatment plants from which four with direct discharge in the Black Sea - Rompetrol Rafinare, Constanta North, Constanta South, Eforie South and Mangalia.

Temporarily, there are activities for the protection and rehabilitation of the coastal zone, exploration of the natural sources (oil and gas), tourism (in the summer).

The significant land-based point sources in the Romanian coastal zone are (Fig. 3.92):

- The main tributaries:
    - The Danube River which transports important loads of pollutants from the whole catchment area;
    - The channel Danube – Black Sea;
- The Ports of Constanta, Midia and Mangalia
- Municipal sources with direct discharge into the Black Sea - WWTPs Constanta Nord, Constanta Sud, Eforie Sud and Mangalia
- Industrial sources with direct discharge into the Black Sea - Rompetrol Rafinare

The main discharge is from the WWTP Constanta South, the biggest from the Romanian littoral (Fig. 3.92 and Fig. 3.93).

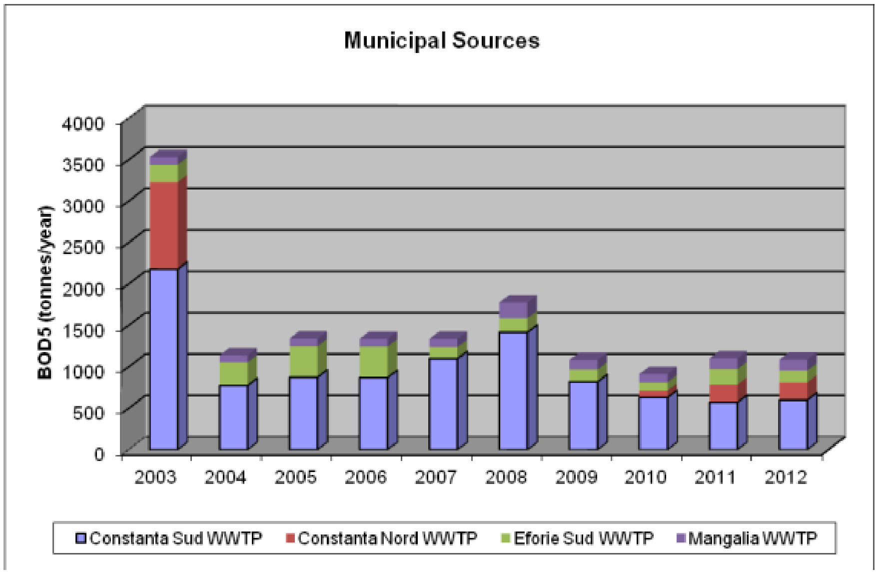


Fig. 3.92 Annual BOD_5 discharges of the Romanian WWTPs

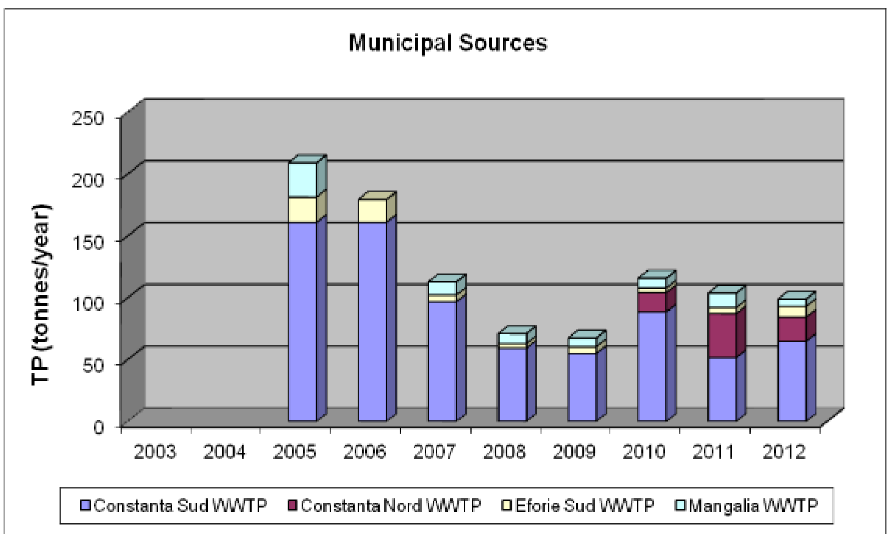


Fig. 3.93 Annual TP discharges of the Romanian WWTPs

The municipal sources reported by Romania to the Black Sea Commission as Hot Spots are four WWTPs (Table 3.21).

Table 3.21 Municipal sources reported by Romania to the Black Sea Commission as Hot Spots

1	Constanta Sud WWTP
2	Constanta Nord WWTP
3	Eforie Sud WWTP
4	Mangalia WWTP

Romania identified as Hot Spots and reported to the Black Sea Commission two industrial sources: Rompetrol Refinery and Constanta Port. However, all others are in the process to be revised and assessed as hot spots (Fig. 3.94).

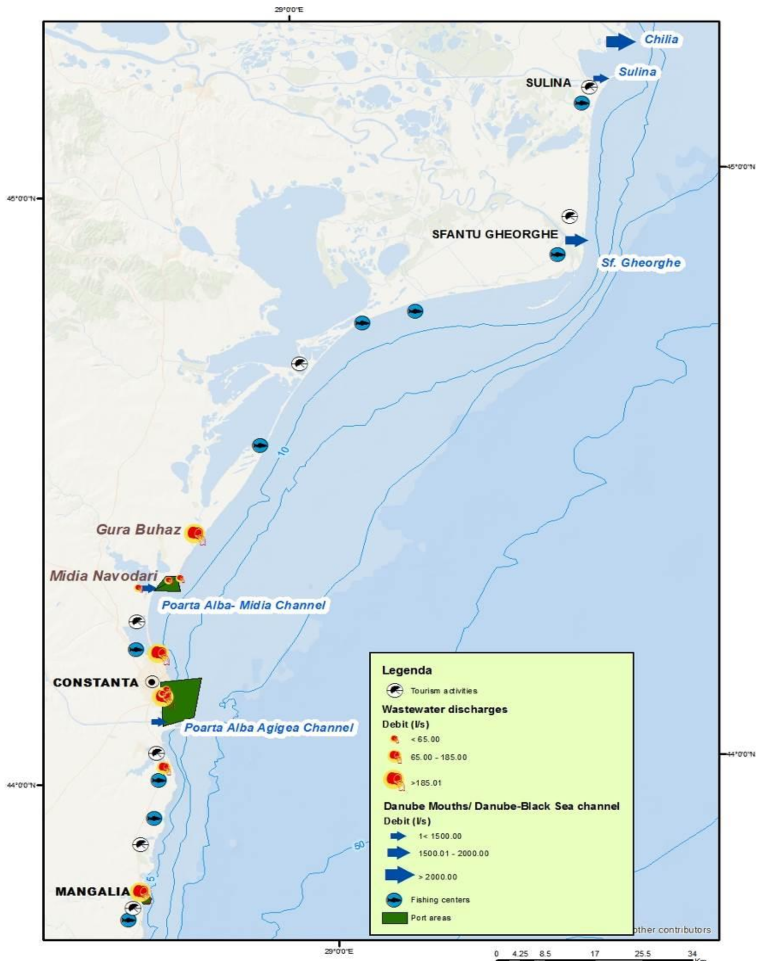


Fig. 3.94 The main land based pollution sources at the Romanian Black Sea coast

A significant way of transport and discharge of the pollutants in the marine environment are natural tributaries, which may embed transboundary effects of the anthropogenic impact. The Romanian Black Sea coast is not enriched with natural tributaries, the main being: the Danube (with its three branches Chilia, Sulina and Sfantul Gheorghe) and the Channel Danube - Black Sea (Boicenco et al., 2012).

I. The Danube

The Danube River basin covers about 10% of the continent. With a length of 2780 km, catchment area of over 801,463 km^2 and annual average flow of about 6500 m^3/s, the Danube, after the Volga, is the second longest river in Europe. 97.4% of Romania is located in the Danube river basin, which represents 29% of the Danube basin being the country with the largest area in the Danube Basin. Also, 37.7% of the length of the Danube is in Romania.

Due to the physico-geographical distribution and character of the hydrological regime, the Danube is divided into three sections: the upper Danube (source - Vienna), the middle Danube (Vienna - Iron Gates) and the lower Danube (Iron Gates - Black Sea). The inferior lower Danube forms the border state with Serbia and Bulgaria to Romania.

The lower Danube is characterized by a highly complex consisting of several sectors with specific characters. Important tributaries of the Danube are represented by Balkan rivers Timok, Lom, Ogosta, Iscar, Vit, Osam and Yantra on the right shore and Jiu, Olt, Vedea and Arges, Siret and Prut, on the left one.

The Danube River is characterized by a high degree of planning, due to hydraulic works carried out, due to land use for which they were created. The most important uses of the Danube are: power generation, agriculture (irrigation), navigation, urbanization etc. All these uses are making as inevitable, the Danube as a natural receptor of pollutants.

The organic substances pollution come from discharges of wastewater from point and diffuses sources, especially agglomerations, industrial and agricultural sources. Lack of or insufficient wastewater treatment leads to pollution of surface waters with organic substances, which once reached surface waters begin to degrade and consume oxygen. Pollution by organic substances produces a significant impact on the aquatic ecosystems by changing species composition, species biodiversity decline and reducing the abundance or fishing mortality under hypoxia (River Basin Management Plan Dobrogea, 2009).

Data reported to the Black Sea Commission shows that, between 2000-2013, at Reni station, the measured average organic matter intake (expressed as BOD_5 - biological oxygen demand) between 256.8 kt/year in a great year drought (2003) and 621.1 kt / year in 2006 with very high flow rates indicating a correlation BOD_5 - flow (r = 0.54) very good. It is noted that although 2010 has historical maximum flow for the period 2000-2013, BOD_5 intake is lower than in 2006 (a year with high flow) indicating a better management of discharges and pollution by organic substances (Fig. 3.95).

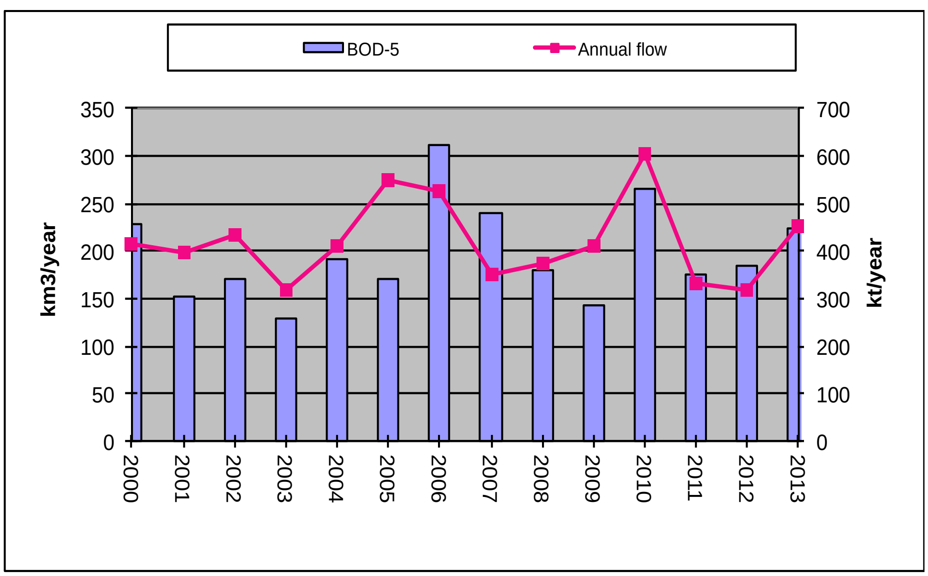


Fig. 3.95 The Danube's flow and BOD_5 discharge (Reni), 2000 - 2013

Another important issue in the water management from the Danube basin is the nutrients pollution (nitrogen and phosphorus) (Fig. 3.96 and 3.97). As for organic matter, the nutrient discharges is due to point sources (urban wastewater, industrial and agricultural untreated or insufficiently treated waters), diffuse sources (especially agriculture: farming, use of fertilizers) in the upper river basin countries and malfunctioning sewage treatment plants in central and Eastern Europe and the atmospheric pathway (for nitrogen). Nutrients lead to enhanced water eutrophication, which determines the change of the species composition, decreased biodiversity and reduce water use. It is noted that in the Danube Delta and rivers mouths, the collector of 801,463 km^2, covering all or part of the territory of 19 countries, the Danube contribute substantially with nutrients.

Data reported to the Black Sea Commission shows that, between 1995-2013, at Reni the average load of total nitrogen (TN) was between 258.0 kt/year in a very dry year (2012) and 695.1 kt/year in 2010, the historic highest flow year, indicating a very good correlation TN - flow (r = 0.72). It should be noted that no significant reductions were observed in the total nitrogen concentrations that ranged from 1.23 to 2.48 mg/L, but only the fluctuations of the flow

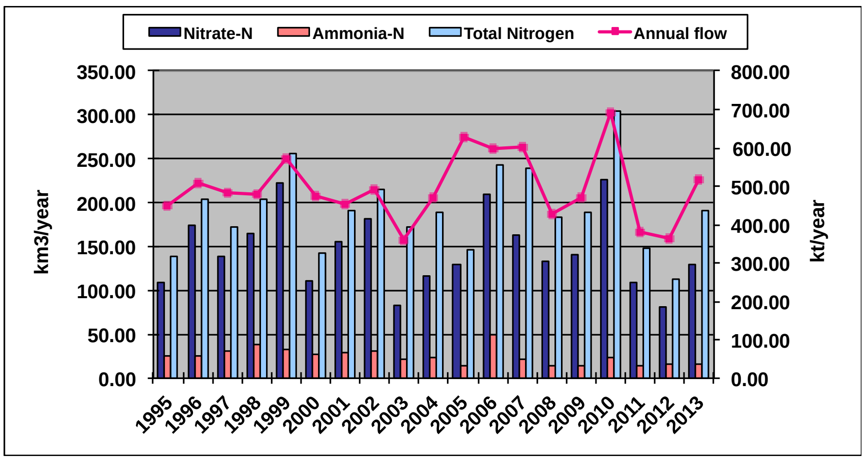


Fig. 3.96 The Danube's nitrogen loads (inorganic forms and total) - 1995 - 2013

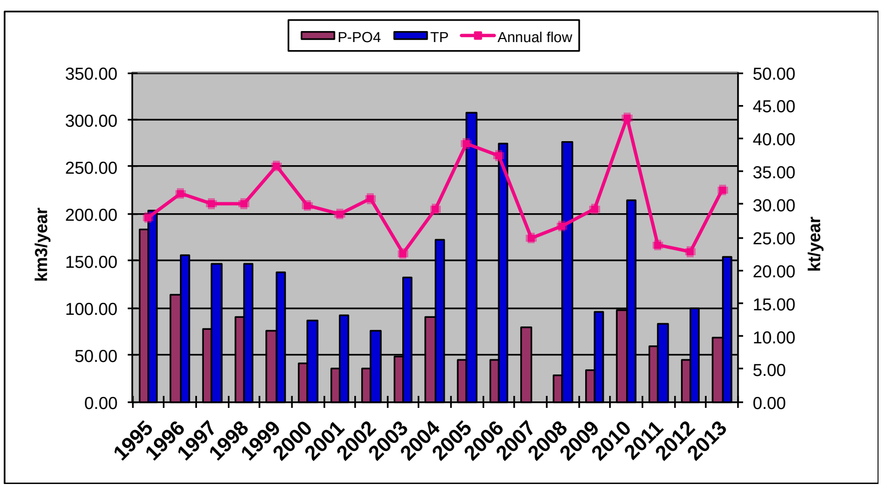


Fig. 3.97 The Danube's phosphorus loads (inorganic form and total) – 1995 - 2013

For the total phosphorus (TP), data reported to the Black Sea Commission shows that, between 1995 to 2013, at the station Reni were measured average discharges between 10.78 to 43.83 kt/year with a good correlation TP - flow (r = 0.53). The lack of correlation flow - phosphates shows the effectiveness of the phosphates management in the Danube basin which led to lower average annual concentrations from 0.13 mgP-PO4/L (1995) to 0.02 mgP-PO4/L (average annual concentration frequent after 2000). The pollution with priority and hazardous substances is coming from the wastewater discharges from point sources and diffuse emission sources containing non-synthetic pollutants (heavy metals) and/or synthetic (organic micro pollutants). It is noted that the monitoring data show that both inbound and round until it flows into the Black Sea, the Danube contains dangerous substances, which led to the evaluation of such bodies as being at risk in terms of achieving good chemical status in 2015.

The river load of heavy metals varies according to different metal. Thus, Pb and Cu occurred very good negative correlation (r = - 0.81, and r = - 0.71) indicating decreased concentrations. Although still lead concentrations exceeded the maximum permissible values in NTPA 001-2002 (0.2 mg/L) were significant decreased from 23.98 mg/L (1997) to 1.72 mg/L in 2013 (Fig. 3.98).

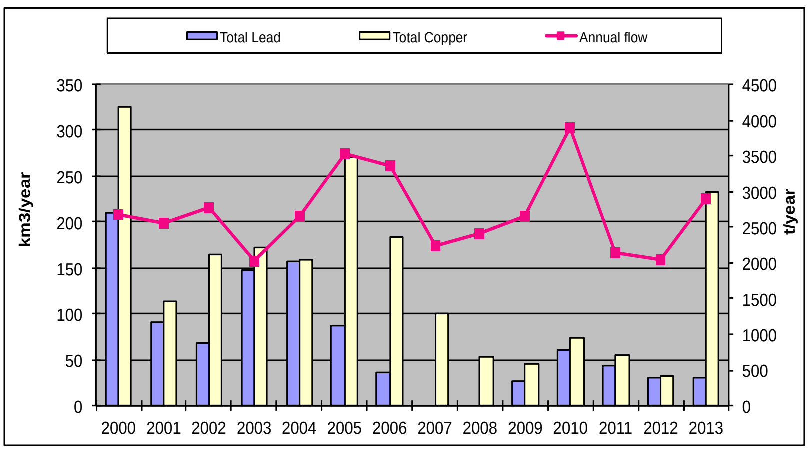


Fig. 3.98 The Danube's total lead and copper loads (inorganic form and total) - 1995 - 2013

The comparative analysis of the Danube and land-based pollution sources flows shows that, the aggregate flows of the municipal and industrial sources represent 0.04% of the total discharged into the Black Sea while Danube's flow, 99.96%. However, although the discharges are significantly different flow dependent, it is very important that quantifying the effects of the local municipal and industrial sources on the Romanian coastal zone.

II. The Channel Danube – Black Sea

The Danube - Black Sea and the Poarta Alba - Midia Navodari channels by flow throughput in the sluicing water contributes to the Black Sea (Constanta and Midia port waters) loading non-synthetic substances and compounds/synthetic coming from the Danube basin plus the local anthropogenic contribution. The Danube-Black Sea Channel communicates with the port of Constanta via lock Agigea located 1.9km from the port of Constanta (south) and Poarta Alba -

Midia Navodari Channel communicates with the lock Midia Navodari located 1.5 km from the port of Midia.

Although have many uses to the main (navigation) is to note that the two channels are the source of drinking waters and industrial water supply of cities and industries in the area. Water quality of the channel is adequate Danube's water quality plus the impact of the local sources. The main potential sources of water pollution in the channel are: the Nuclear Power Plant which can pollute water thermal, chemical and radioactive; domestic sewage treatment plants in Medgidia, Poarta Alba; storm sewers, which can pollute water chemical, biological, transport fleet, fleet technical and port facilities; pipelines transporting oil products.

In 2009, with the initial assessment of marine water quality evaluation was carried out channel as an essential part of the pressures on the marine environment as follows:

The loads of the non-synthetic substances and compounds (heavy metals) brought by channels was calculated (by multiplying the average annual flow and annual average concentration) (Table 3.22):

Table 3.22 Heavy metals loads discharged in the channel Danube - Black Sea, 2007-2011

Parameter	Annual discharge				
	2007 (t/y)	2008 (t/y)	2009 (t/y)	2010 (t/y)	2011 (t/an) (t/y)
Cd	0.1272	0.0195	0.0124	0.0137	0.0125
Ni	0.2408	0.2751	0.2168	0.1786	0.1766
Pb	0.2245	0.3993	0.2385	0.2647	0.3007
Hg	0.009	0.0113	0.0069	0.0062	0.0057
Cu	0.4386	0.4689	0.5375	0.4842	0.3938
Zn	0.4164	0.6785	0.9376	0.5925	0.4206
As	0.1093	0.1521	0.1552	0.1860	0.1530
Cr	0.4269	0.4221	0.4025	0.3157	0.3237

The Polynuclear Aromatic Hydrocarbons (PAHs) taken into consideration in the initial assessment (made in 2009) included: benzo-b-fluoranthene, benzo-k-fluoranthene, benzo - g, h, i-perylene, indeno 1,2,3-c, d-pyrene, benzo-a-anthracene, benzo-a-pyrene, fluoranthene, naphthalene, phenanthrene and anthracene.

The analyses indicated the absence in the samples of the following parameters: benzo-b-fluoranthene, benzo-k-fluoranthene, benzo, g, h, i-perylene, indeno 1,2,3-c, d-pyrene, benzo-a-anthracene, benzo-a-pyrene and benzo-a-phenanthrene and therefore these substances have not been included in the monitoring programs for 2010-2011. Also, fluoranthene, naphthalene and anthracene were not included in the monitoring program for 2010-2011 since the concentrations of these substances did not exceed 80% of standard quality. The loads carried by channels to the Black Sea are shown in Table 3.23.

Table 3.23 PAHs discharge from channels into Black Sea (2009)

Parameter	Discharge for 2009 (t/year)
benzo-b- fluoranthene	absent
benzo-k- fluoranthene	absent
benzo-g,h,i- perylene	absent
indeno 1,2,3-c,d- pyrene	absent
benzo-a- anthracene	absent
benzo-a- pyrene	absent
fluoranthene	0.0013
naphthalene	0.0014
phenanthrene	absent
anthracene	0,0039

Polychlorinated Biphenyls

In performing screening were considered: PCB 28, PCB 52, PCB 101, PCB 118, PCB 138, PCB 153, PCB 180 and sum of PCB. The results indicated their lack from the samples analysed for monitoring both sections evaluated and therefore these substances have not been including in the monitoring programs 2010-2011.

Organochlorine Pesticides

In the category of the organochlorine pesticides included in the screening conducted in 2009 were included: p, p'-DDT, alachlor, aldrin, dieldrin, endrin, isodrin, lindane, alpha-HCH and beta-HCH. In the laboratory tests were not found all parameters in samples taken in the section located, except lindane and p, p'-DDT. The loads carried, due to reduced flow generated by operations sluicing are very small (Table 3.24).

Table 3.24 Pesticides discharge from channels into Black Sea (2009)

Parameter	Discharge for 2009 (t/year)
Lindan	0.000007
p,p'-DDT	0.000003

Currently, the completion in August 2014 of the project "Modernization of water quality management of waterways, by installing automatic stations for water quality monitoring", funded by the Sectorial Operational Programme-Transport 2007-2013, the risks of pollution will be reduced by monitoring the channel water quality of the 12 automated stations located at points with high risk of developing water pollution; development of software applications for data collection equipment and making an alarm system "on-line" if the limits set by law are exceeded; acquisition of a test van and equip it with the necessary technical equipment and operative interventions at any point along the channels, in the event of accidental pollution, to sampling for analysis and physico-chemical.

III. Municipal sources - WWTPs

The efficient treatment of the wastewaters discharged into the Black Sea was a priority measure in the National Action Plan for the Environmental Protection, and Constanta area received almost one third of the funds allocated by ISPA program nationally. Currently, the European funding and co-financing of the local operator RAJA and Constanta County Council, all treatment plants in the Romanian Black Sea coast meet the European standards.

1. *WWTP Constanta North*

It is a completely restored WWTP, by demolition of the old station and extension by filling the lake Tabacarie. The new capacity is 1920 L/s for a population equivalent of 255,000 PE and provides domestic and industrial wastewater treatment to the north of the city of Constanta and Mamaia (~ 40%, the remaining 60% being treated in the WWTP Constanta Sud). The station is equipped with the latest technology, with extended aeration, including biological nitrogen and phosphorus removal, stabilization and aerobic sludge dewatering, the most modern treatment plant in Romania. The installations are fully covered and the sludge is pumped through a pipe with a length of 8 km, avoiding the emissions during its transportation. The approximately 60 tons of sludge produced daily reaches Poiana landfill where sludge is dried and then stored at landfill Luminita (35 km north of Constanta). After rehabilitation, the discharge of suspended solids and BOD5 decreased significantly (Fig.3.99).

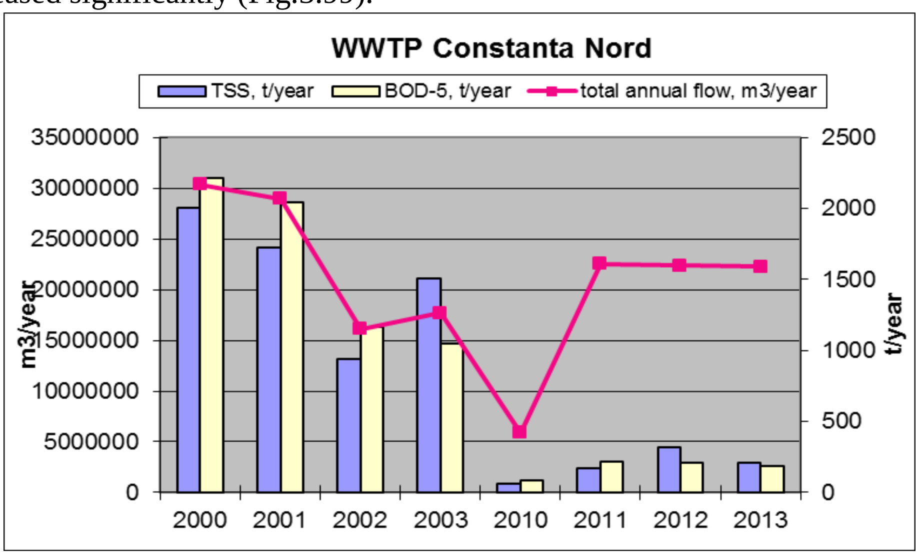


Fig. 3.99 TSS and BOD $_5$ discharges - WWTP Constanta North, 2000-2013

2. ***WWTP Constanta South (municipal and industrial)***

It is the largest treatment plant from the Romanian Black Sea coast treating wastewater mechanically and biologically before discharge into the Black Sea. With a capacity of 3200L / s, this station is to retrieve and purify municipal wastewater, industrial and rain in most of Constanta city (60%). Their evacuation is gravitational in the Constanta port waters, berths 84 and 86. The station was restored in 1999-2001 (water line and sludge line). In 2013 the station's spillways and outlet pipes were rehabilitated. New pumps were installed leading to the elimination of pollution caused by uncontrolled discharge port of Constanta South basin. Currently, the station is subject to modernization through an investment of 4,011,091 euros (POS) for removing nitrogen and phosphorus and microbial disinfection with UV rays.

However, it is observed in recent years (2012-2013), an increase (relative to annual average flows) the quantities of suspended solids and BOD_5 (Fig. 3.100), inorganic nitrogen forms (Fig. 3.101) discharged into the Black Sea, a situation which justifies the need to modernize the station.

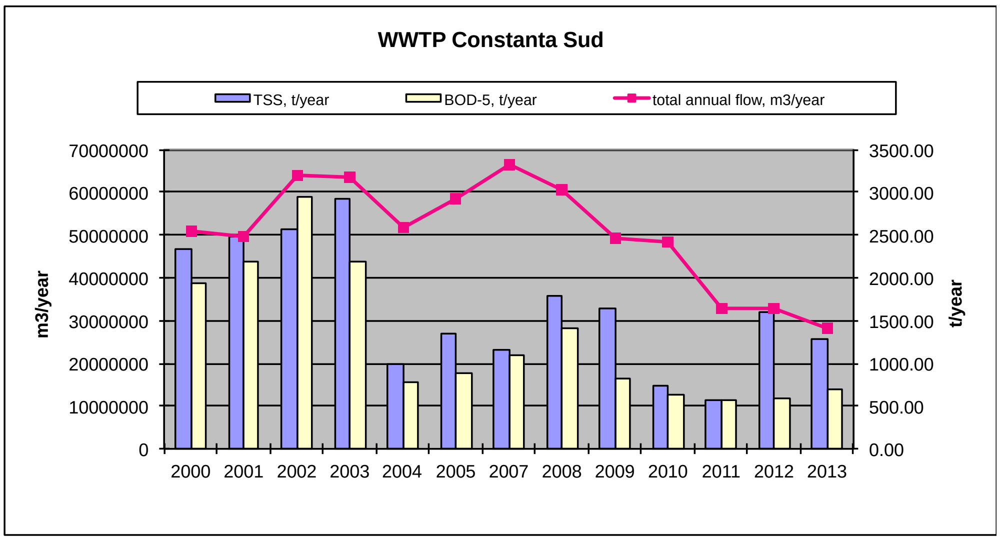


Fig. 3.100 TSS and BOD $_5$ discharges - WWTP Constanta South, 2000-2013

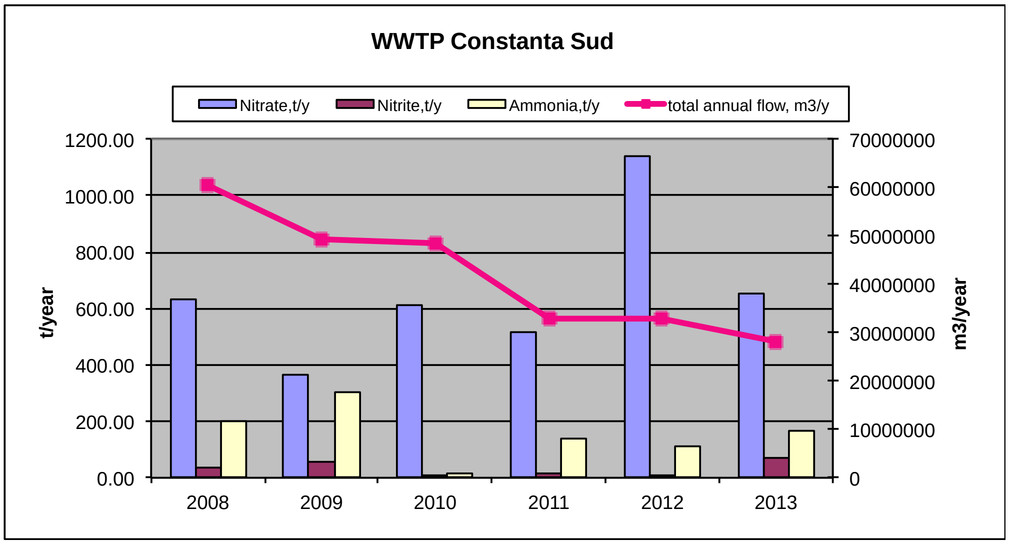


Fig. 3.101 Inorganic nitrogen discharges - WWTP Constanta Sud, 2008-2013

3. ***WWTP Eforie South***

The WWTP Eforie Sud is located between Tuzla and Lake Techirghiol, at a distance of about 22 km from the town of Constanta. The treatment plant receives wastewater from agglomerations Costinesti, Schitu, Tuzla, Eforie, Techirghiol and Agigea and serves a large number of people, especially in the summer (140,000 PE). The station operates optimally, ensuring environmental conditions imposed by norms from Romanian and European Community.

The WWTP was rehabilitated and constructed as a station with tertiary treatment, sludge stabilization for operation under load which aims to: biodegradation of organic carbon; nitrification and denitrification; phosphorus removal, so to comply the effluent from the treatment plant with the provisions of regulations for quality, stabilization of sludge from the process, until the final disposal of environmental conditions; stabilized sludge dewatering for final disposal; sludge transport to final storage location; treatment and odour removal to reduce specific pollutant degradation of organic substances produced in treatment plants, taking into account the closure of premises or coverage targets basins.

WWTP Eforie Sud has a maximum capacity of 745 L/s. In the nearly two years of work, executed by German consortium Concrete & ROHRBAU CF Thymiana GmbH & Co., the whole objective was built from scratch on the old site and equipped with the most modern technologies. The old station was demolished almost entirely to increase technical capacity of the wastewater collection, it was introduced the tertiary treatment, including biological nitrogen and phosphorus removal, stabilization and aerobic sludge dewatering, so, at the end of cycle sewage, effluent quality complies with European environmental standards.

By entering the tertiary wastewater treatment, Eforie South WWTP has become one of the most modern treatment plants in Romania. Water from the treatment plant is discharged into the

Black Sea through a pipeline of over two kilometres. Station conforms to European Union treated water quality, protecting the coastal environment conditions contributing to health, by improving the quality of bathing water and creates conditions for flying the "*Blue Flag*" beaches of Eforie. Recent data (2013) show a significant decrease in suspended solids and BOD5 content uncorrelated with the flow remained fairly constant since 2007 (Fig. 3.102).

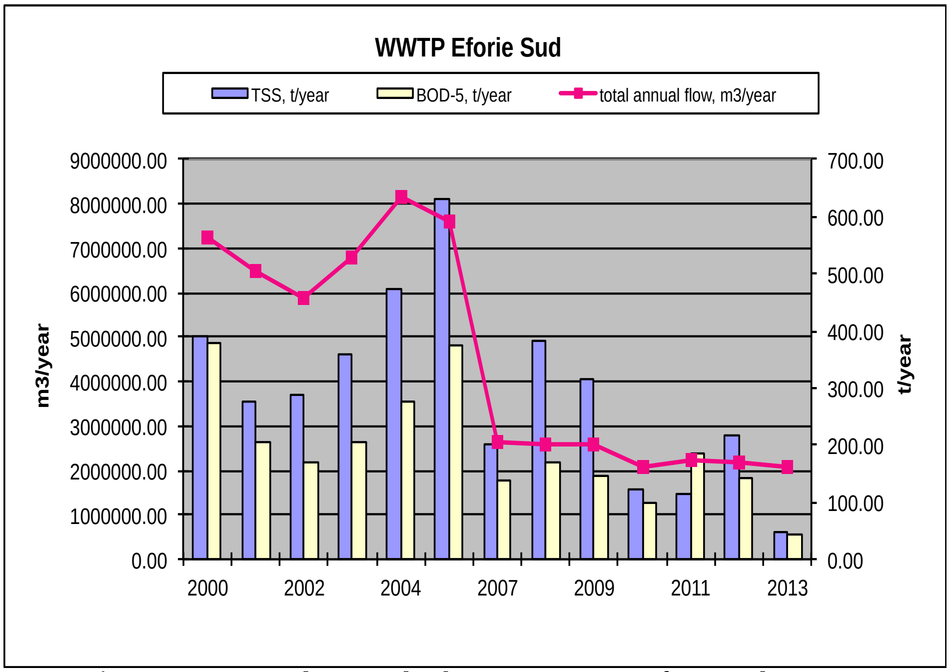


Fig. 3.102 TSS and BOD_5 discharges - WWTP Eforie Sud, 2000-2013

4. ***WWTP Mangalia***

The WWTP Mangalia serves Mangalia and tourist resorts in the area, and is located in the south of the city. The treatment plant design capacity is 900 L/s and treats wastewater mechanically and biologically. The receiver of the effluent treatment plant is the Black Sea area, downstream Mangalia port, near the station, the treated wastewater is discharged through a pipe of diameter 800 mm at 2-3 m from the shore. The station was modernized in time through more investment. Thus, within 2001-2002 was modernized by rehabilitating second line sludge, sludge recirculation station and deposit of mud, and many other large works of modernization. By upgrading station was aligned with European environmental standards and has increased wastewater treatment capacity from 500 L/s to 900 L/s. The station serves in the winter a population of 45,000 inhabitants, and during the summer season, more than 100,000 inhabitants. In 2013 was also ended the investment "Mangalia WWTP construction - tertiary", which involved rehabilitation and modernization of existing wastewater treatment plant by introducing the tertiary stage.

Recent data (2013) highlights significant increases for key parameters monitored: the content of suspended solids and BOD5 (Fig. 3.103), total phosphorus and total nitrogen.

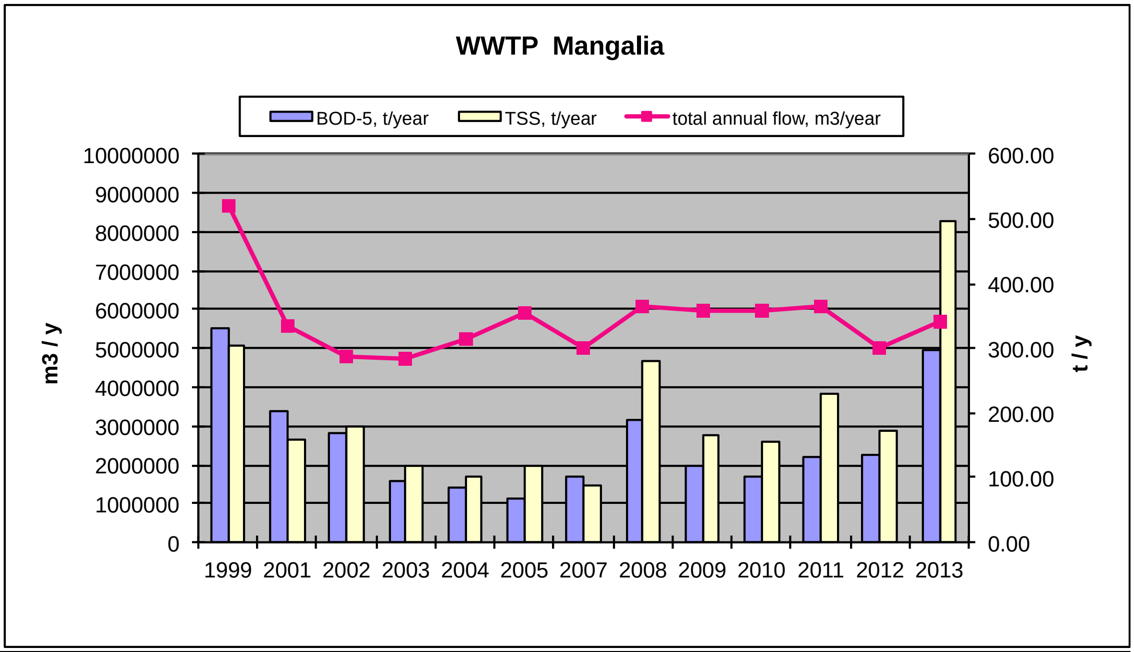


Fig. 3.103 TSS and BOD_5 discharges - WWTP Mangalia, 1999-2013

II. Industrial sources

1. Rompetrol Rafinare

Rompetrol Refinery, a member of the Rompetrol Group, operates the most modern refinery in Romania. The company processes a wide variety of crude oils with high sulphur content. The crude oil is achieved by Midia port, located near the industrial platform that can receive ships of up to 24,000 dwt or through Constanta port through a 40-kilometre pipeline. The refinery has a marine terminal, railway and vehicle loading/unloading products.

In 2006, Ecomaster - Ecological Services, a company of Rompetrol Group, has completed the modernization project of Wastewater Treatment Plant of the refinery. The station has a water treatment capacity of 1.2 mln m^3/month, and the project received a total budget of 6.3 million. By upgrading the wastewater treatment plant the pollutants are removed at a rate of 96% compared to 70% previously. For some pollutants, improvements are significant and have led to a reduction in environmental impact as downstream of the WWTP.

Collects and treats industrial and domestic waters from Petromidia, Rompetrol Petrochemicals, Midia Thermal Power Plant, the results of Petromar activities and domestic wastewaters of Navodari town. The project included, along with mechanical and chemical treatment, biological treatment stage with two, special equipment made within the treatment plant, followed by a tertiary stage in biological ponds. The treated waters are discharged into Garla Buhaz, which is the point of the marine water monitoring.

Data on the station discharges highlights significant decrease in suspended solids and BOD5 after 2007 (Fig. 3.104).

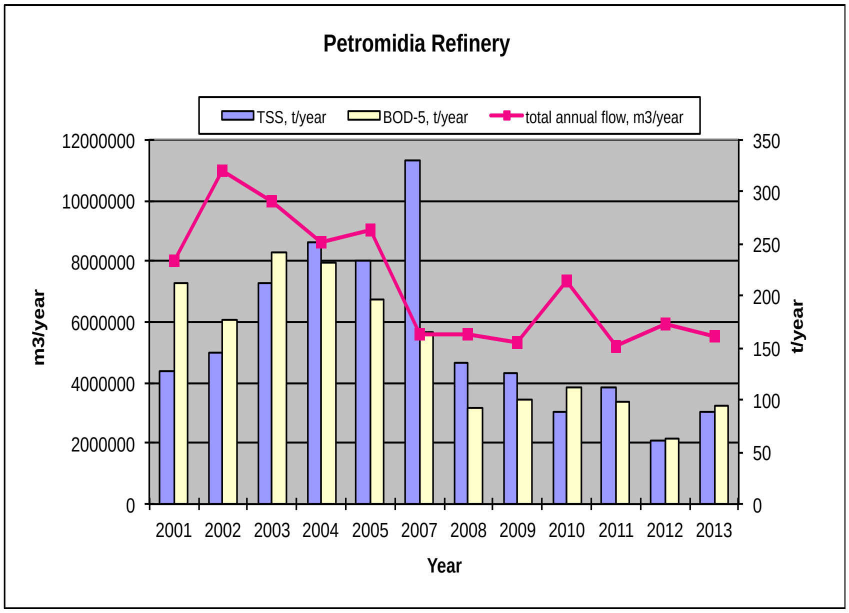


Fig. 3.104 TSS and BOD_5 discharges - Rompetrol Refinery, 2001-2013

The annual input of total petroleum hydrocarbons showed a significant decrease after 2008, recording slight increases in 2012-2013 due to the increase of the company turnover (Fig. 3.105).

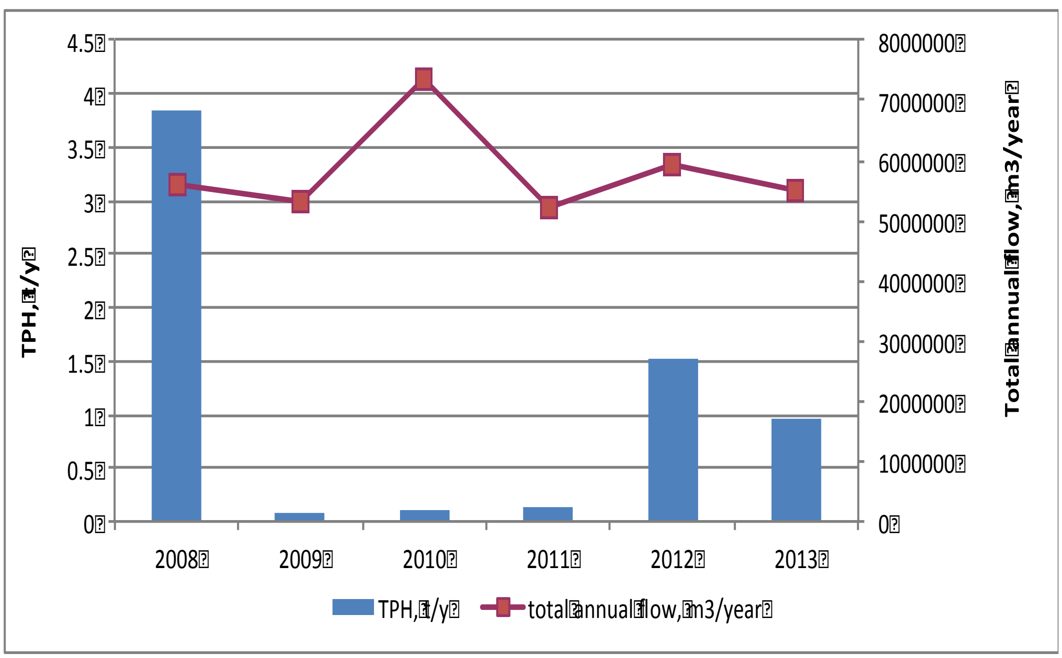


Fig. 3.105 Total petroleum hydrocarbons discharges - Rompetrol Refinery, 2008-2013

2. *Constanta Port*

Through the port sewage, the wastewaters from different activities are constantly pumping to the WWTP Constanta Sud while bilge water sand hydrocarbon residues are treated in the own WWTP with mechanical and biological levels, type BIOCLEANER (Siemens) located in the berth 79. The station started to operate in summer 2007 as the result of an investment of 7.6 million euro. This WWTP targets oil wastewaters and rainwater from the activity of the company "Oil Terminal" and oil residues from ships. It has a capacity of 814000 cubic meters/year. Biological water treatment system includes low-density separator materials, such as sand and activated carbon filters.

In addition to the wastewater discharged from the WWTP Constanta Sud and those discharged from the port's WWTP, at 1.9 km downstream is the Agigea lock where the Danube-Black Sea channel flows in the port of Constanta bringing ships transiting the channel (Fig. 3.106).

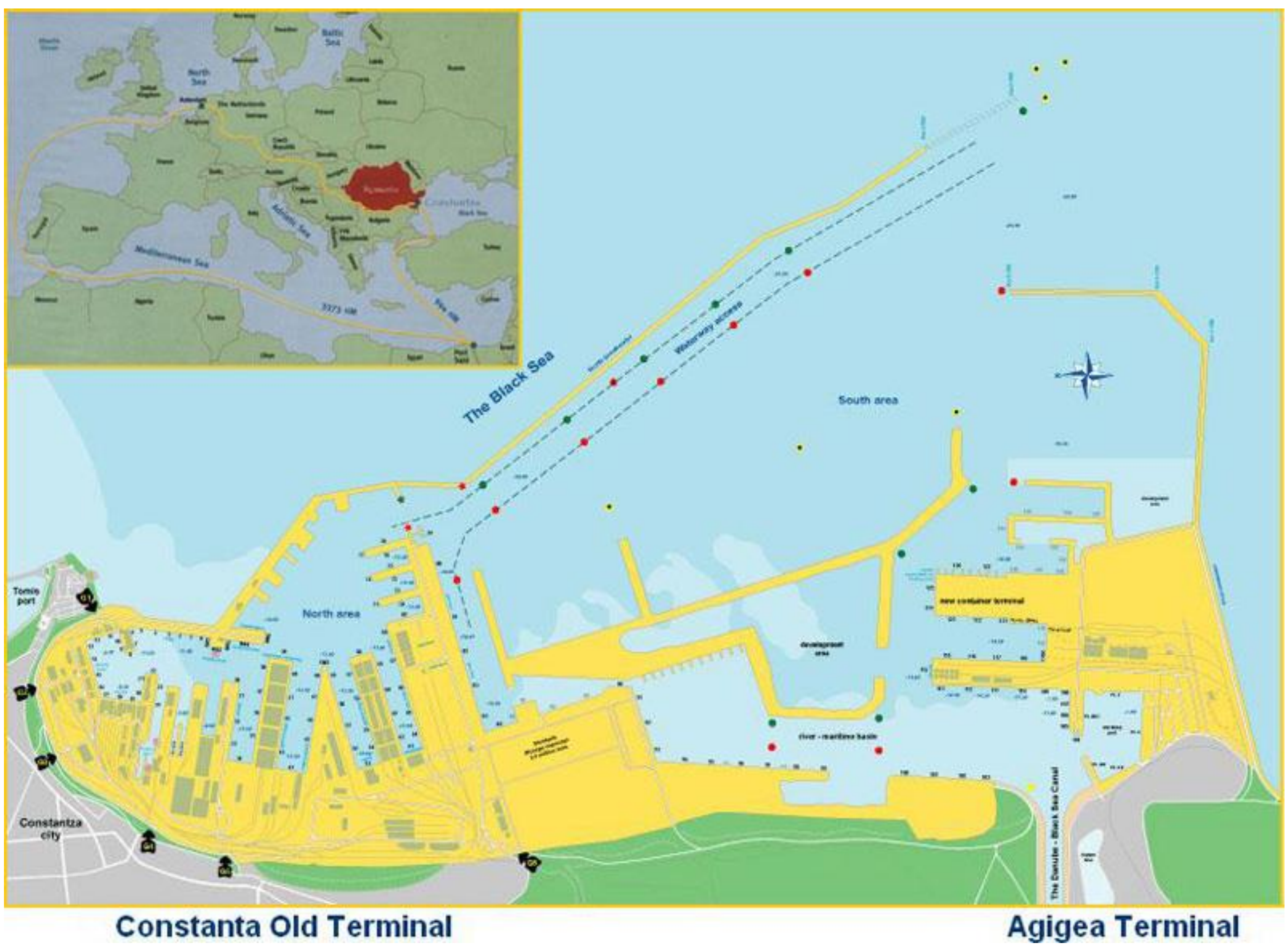


Fig. 3.106 Map of the Constanta Port

Data reported from the port's WWTP, reported to the Black Sea Commission shows a significant discharge of the total suspended solids content after 2010 (Fig. 3.107).

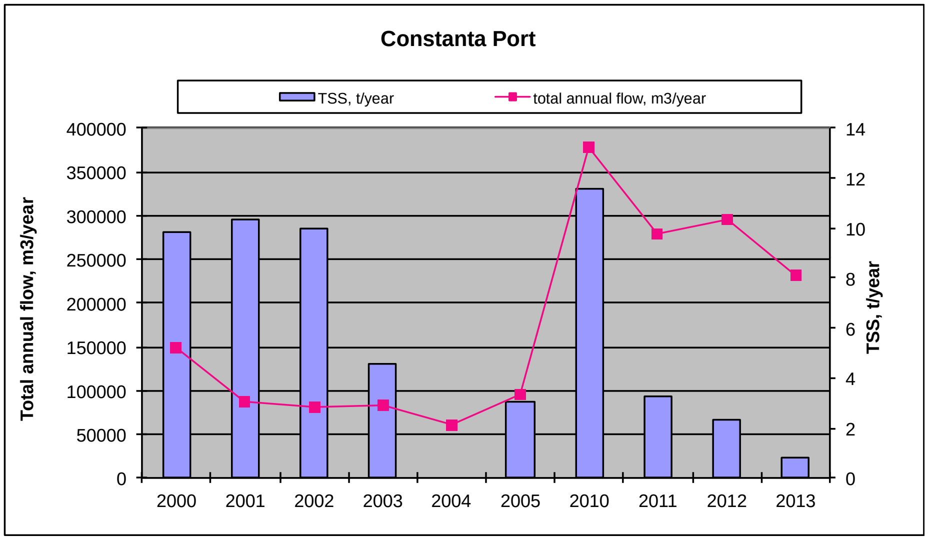


Fig. 3.107 TSS discharges - Constanta Port, 2000-2013

3. Midia Port

The Midia Port is located on the Black Sea coast, at approximately 13.5 nautical miles N from Constanta. It was projected and built to facilitate the access to the industrial and petrochemical centre named today Rompetrol Rafinare. The dams have a total length of 6.96m. The port covers 834 ha surface, from which 234 on land and a total length of 2.24 km. At 1.5 km downstream of Midia port it is located the Navodari lock, where the fluvial ships transit the channel together with the freshwater and pollutants load (Fig. 3.108).

In the port there are 11 berths operated by different agents (Rompetrol Logistics, Midia international, Global Operation, Petroserv Constanta), 3 berths of the shipyard (2 x 1 Holding) and a GPL terminal (SC Octogon Gas&Logistics SRL). Thus, the main goods are oil and products, GPL, cereals and animals etc. (Table 3.25).

Table 3.25 Main goods operated in the Midia Port

Berth	Length (m)	Depth (m)	Good type
1 - 4	532.0	9.0	Oil
5 - 8	637.6	9.0	Animals
9	204.0	9.0	Oil products
10 - 11	191.3	9.0	General goods
3 berths shipyard		Maintenance - building ship	

Fig. 3.108 The map of the Midia Port

4. Mangalia Port

The Mangalia Port is a maritime commercial port, on the Western Black Sea coast, at approx. 20 nautical miles of Constanta Port, in the neighbourhood of the Mangalia city and shipyard Daewoo Mangalia Heavy Industries (Fig. 3.109). It has a total surface of 142.2 ha, 114.7 ha being the surface of the port basin. The dams have a total length of 2.74 km. It has four berths (2 operational) with a total length of 540m and 9m depth.

Agents from the Mangalia port use 2 berths for general goods and other activities (Table 3.26). The discharge pipe of the WWTP Mangalia is located into the basin of the port.

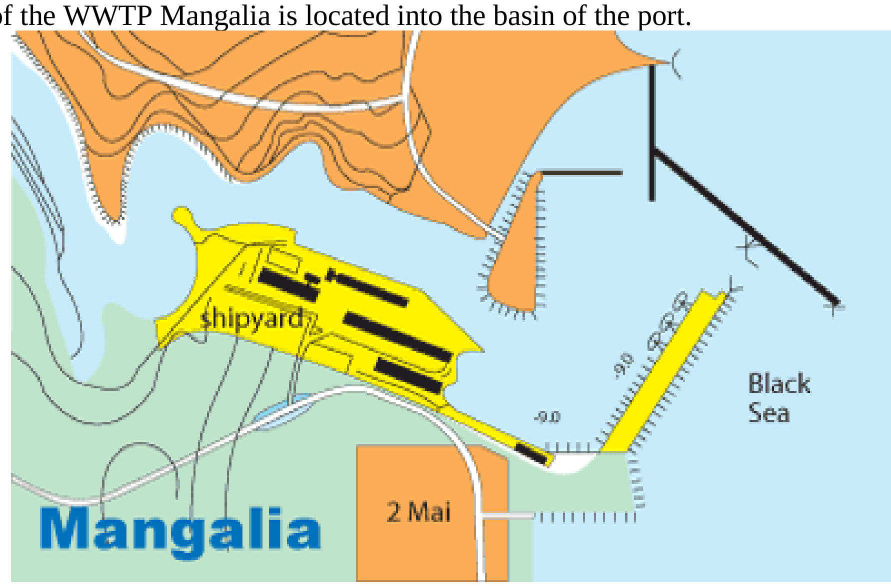


Fig. 3.109 The map of the Mangalia Port

Table 3.26 The main goods operated in the Mangalia Port

Berth	Length (m)	Depth (m)	No.	Location
General goods	419	9.0	2	Berth 1, 2
Berth Technical ships	105	5.5	1	Berth 4
Berth for connection	95	5.5 - 9.0	1	Berth 3

Turkey

The area of the Black Sea region of Turkey is about 141,000 km^2 or about 18% of the total surface area of Turkey. Industrial development, supported by the government and private enterprise, is mostly concentrated in the mid-Black Sea coast of Turkey (Bakan & Buyukgungor, 2000).

Various environmental pollution researches were performed through the Black Sea coast of Turkey indicating the importance of land-based pollution loads to the Black Sea (Bakan & Büyükgüngör, 2000; Avaz, et.al. 2008); eutrophication problem related to nutrient loads, heavy metal pollution at different matrixes such as sediments, mussels (Çevik, et.al. 2008; Ergül, et.al. 2008; Bakan & Arıman, 2004; Bakan & Özkoç, 2007; Topcuoğlu, et.al. 2003; Ünlü & Alpar, 2006; Akbal, et.al. 2011a; Cüce & Bakan,2011; Küçük & Bakan, 2013).

It is very important to continue investigation and assessment of the impact of the Black Sea climate change, pollution, eutrophication and other human activities on fish stocks and fishing, as well as impact of fishing on the ecosystem state, and to elaborate measures to protect species and habitats.

Marine Pollution: Marine pollution along the Turkish shoreline is mainly due to major land-based sources such as untreated wastewater from domestic and industrial settlements, pollutants brought from inland areas by rivers, coastal agricultural practices, tourism activities, extensive concentrations of secondary, holiday homes, port and marina establishments, and to some extent, mariculture facilities. Additionally, trans-boundary pollution sources from neighbouring countries (such the pollutants brought by the Danube River); the litter brought in by sea currents, maritime transport and yachting are also important marine sources of pollution.

The annual pollutant discharges of rivers of Black Sea coast of Turkey were calculated by multiplying the concentrations measured by the volume of water discharged by each source annually in order to assess the contribution of each source to the pollution of the Black Sea. Annual discharges of pollutants by each river and stream are given in Table 3.26. Among the rivers and streams the Kızılırmak and Yesilırmak rivers are important riverine sources of most of the conventional pollutants, because these rivers have the highest annual water discharge into the Black Sea. Annually, 1,306 tons of NH_4^+-N, 14,085 tons of NO_3^--N, 193 tons of NO_2^--N, 25,798 tons of TP, 18,805 tons of surfactants, 4,770 tons of Pb, 1,118 tons of Cu, 330 tons of Cr, and 121 tons of Cd are discharged from the mid-Black Sea coast of Turkey into the Black Sea. As it can be seen, annual fluxes of TP, surfactants, Pb and Cu were higher when compared to the fluxes reported in the study of Bakan and Büyükgüngör (2000) and Altas and Büyükgüngör (2007) (Akbal, et.al, 2011b).

Annual loads of all pollutants flowing into the Black Sea showed strong correlation with discharge. Among the rivers and streams the Kızılırmak and Yesilırmak rivers are important riverine sources of most of the conventional pollutants, because these rivers have the highest annual water discharge. The domestic and industrial discharges are important sources of marine pollution in major cities along the Black Sea coast of Turkey. TOC concentration in the coastal waters was very variable, the highest concentrations were observed at Bafra and Kurupelit shores. The determination of heavy metals especially at offshore sampling points means that the Black Sea is seriously exposed to pollution-originating marine activities (Büyükgüngör, et.al, 2013) (Table 3.27).

Table 3.27 Annual fluxes of the rivers along the mid-Black Sea coast of Turkey *(Büyükgüngör, et.al, 2013)*

Pollutant	Yesilırmak	Abdal	Mert	Kürtün	Engiz	Kızılırmak	Period
NH_4-N (ty^{-1})	295	1.7	774	20.7	64.3	150	2007-2008
	2894	-	1178	55	-	6139	1995-1996
NO_3-N (ty^{-1})	2049	34	368	50	65	11519	2007-2008
	5813	-	1694	231	-	7765	1995-1996
NO_2-N (ty^{-1})	27.4	0.4	20.1	4.1	2.3	139	2007-2008
	211	-	384	10	-	141	1995-1996
TP (ty^{-1})	500	2.7	1000	25.7	163	24107	2007-2008
	1126.7	-	473.7	45.8	-	147.2	1995-1996
Surfactants (ty^{-1})	3024	57.6	1221	96.4	307.8	14099	2007-2008
	1758.9	-	970.5	524.8	-	1613.9	1995-1996
Cd (ty^{-1})	10.9	0.3	14	0.85	2.9	92	2007-2008
	1505.3	-	2.1	98.8	-	1234.2	2000
Cu (ty^{-1})	56.6	0.8	43	2.8	47	968	2007-2008
	-	-	-	-	-	-	2000
Pb (ty^{-1})	350	9.7	523	10.3	23.7	3853	2007-2008
	-	-	1.2	-	-	722.3	2000
Cr (ty^{-1})	119	0.63	9.8	0.95	10.4	189	2007-2008
	2549.2		22.6	19.2		427.1	2000

Within the scope of Monitoring the Black Sea Project in 2010, it was observed that pollution continued in the regions with river estuaries. Throughout Black Sea, while Yenice (Filyos) is one of the most important polluting elements, the regions where Sakarya River, Kızılırmak-Yesilırmak rivers, and Samsun metropolitan area are located, regions affected by the industry; such as Zonguldak, and regions close to metropolitan areas such as Ordu and Trabzon, displayed higher nitrogen and phosphate levels (Sur, H. İ., et al, 2010). The total organic carbon levels in sea floor surface sediments are rather high in İğneada, Zonguldak, and Sinop, when compared to the others. The levels are low at the stations between Samsun and Ordu (Sur, H. İ., et al, 2010). The cadmium and lead levels in the red mullet samples, trawled in our shores in the off-shores of Trakya in Western Black Sea, are way over the acceptable levels specified in the Fishery Products Monitoring Regulations (Sur, H. İ., et al, 2010). In the Black Sea, particularly in regions close to the estuaries it is observed that the industrial/domestic inputs are transported to the rivers, and the metals are enriched and accumulated in sea floor sediments due to anthropogenic and natural effects. The petroleum based pollution detected in Black Sea sediments is extremely high in the sediments sampled from the coasts of Zonguldak, Samsun, Bartın, and Trabzon. Among these, Zonguldak region, due to its high levels of oil based pollution in its sediments, is the most striking one (Sur, H. İ., et al, 2010) (Avaz et al., 2013).

The municipal Sources of Turkey identified as Hot Spots and reported to the Black sea Commission are WWTPs and marine disposals as for Table 3.28. The biggest discharge is coming from the main source, Samsun WWTP (Fig. 3.110 and Fig. 3.111) (Avaz et al., 2013).

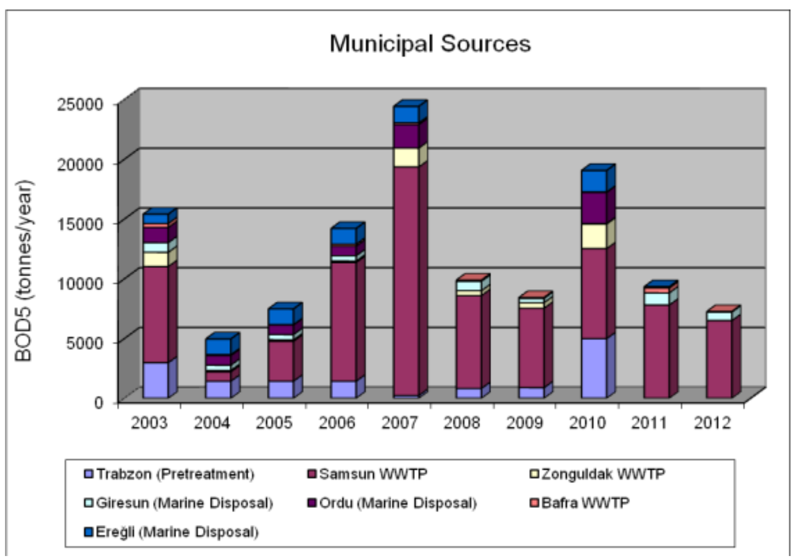


Fig. 3.110 Annual BOD_5 discharges from land based pollution sources, Black Sea - Turkey *(Avaz et al., 2013)*

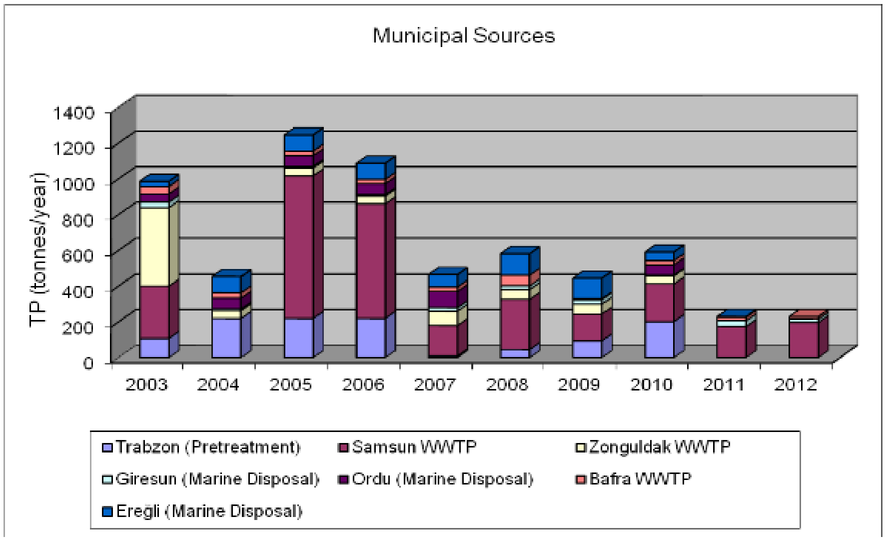


Fig. 3.111 Annual TP discharges from land based pollution sources, Black Sea - Turkey *(Avaz et al., 2013)*

Table 3.28 Turkey's municipal sources reported as Hot Spots

1	Trabzon (Pretreatment Plant)
2	Samsun WWTP
3	Zonguldak WWTP
4	Giresun (Marine Disposal)
5	Ordu (Marine Disposal)_
6	Bafra WWTP
7	Ereğli (Marine Disposal)

In the area there also discharged insufficiently treated or even untreated waters (Fig. 3.112).

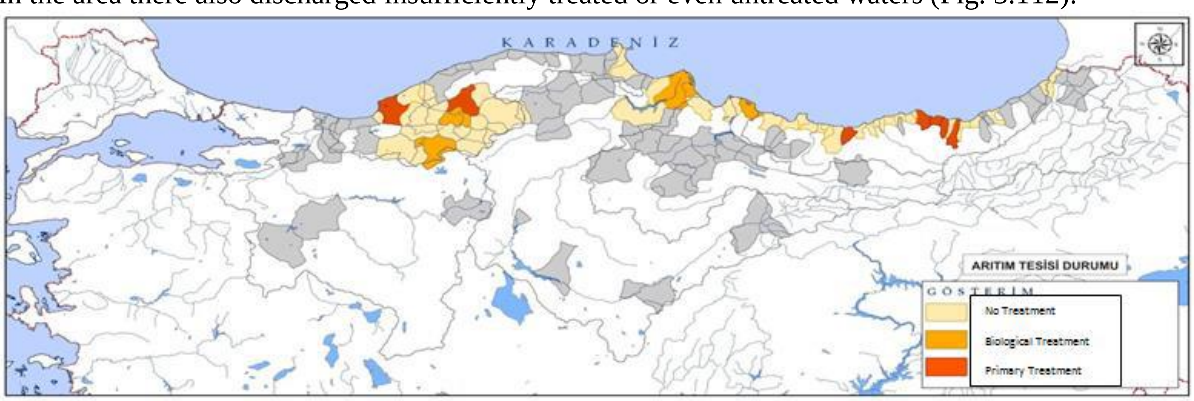


Fig. 3.112 Urban Wastewater Treatment Plants Distribution along Black Sea Coastal Settlements of Turkey *(Avaz et al., 2013)*

The industrial sources of Turkey identified as Hot Spots are: Murgul ETI Copper, TOROS Agricultural Ind. Samsun and Samsun ETI Copper (Avaz et al., 2013). Agricultural activities constitute the most significant source of pollutants carried to the sea by rivers and streams. In Turkey, 90 % of the tobacco and sunflower seed production, 80 % of the cotton and corn cultivation output and 70 % of rice cultivation take place in the coastal provinces.

In the Black Sea, the pollution that is brought from several countries (including Turkey) by large rivers is the most dominant source. Wastes from 16 countries flow into the Black Sea and 160 million people live in its catchment basin. The Danube River alone discharges 60 tons of mercury, 1,000 tons of chromium, 4,500 tons of lead and 50,000 tons of oil annually. Pollutants brought by the Danube also affect the Sea of Marmara and even the Aegean Sea. The sewage born bacteria can survive longer in the Black Sea due to relatively lower solar radiation, water temperature and salinity. The sea is rich in plankton and in fish biomass.

On the other hand however, maritime traffic through the Straits and the Sea of Marmara and the Black Sea is much heavier through the connections between the Danube and the Rhine, and the ports of Rotterdam and Constanta. While on the other hand, the increase in the volume of Caspian oil loaded from Russian terminals also impact significantly on the congestion of tanker traffic through the Straits.

Air and soil pollution. Information on air quality is limited, because particulate matter and SO_2 are usually the only parameters that are monitored on a regular basis. With the reductions in atmospheric emissions from the heating of buildings in last decades, air pollution emanating from motor vehicles was reduced due to the introduction of LPG as the motor fuel and to more extensive use of unleaded petrol. In this period, new regulations were imposed relating to the quality of fuel that can be used for heating and transportation. For example, the permitted sulphur content of diesel fuel was to be lowered to 0.05 % by 2004 from the value of 0.7 % in 1997. The end of 2004 ran all vehicles run on unleaded petrol.

One of the two main factors behind soil pollution in Turkey is the use of synthetic compounds and chemicals in so-called “modern” agriculture, and the wastes produced by these practices. Chemical fertilisers, herbicides and insecticides, hormones used for nourishment, heavy metals and hydrocarbons that remain in the soil after agricultural production, lead to significant incidences of pollution, especially in the case of irrigated agriculture, which threaten human and animal health. The use of such agrochemicals has accelerated rapidly and often in an uncontrolled manner over the last 40 years. The second important factor behind soil pollution is the domestic and industrial wastewater.

Submarine cables and pipeline routes. In 1998, Russia and Turkey signed an intergovernmental agreement for the sale of 565bcf a year of Russian natural gas. In order to implement the agreement, the Blue Stream Pipeline Company - an equal partnership between ENI and Gazprom - was formed to operate a pipeline between the two countries via the Black Sea. The pipeline consists of three main parts. The route comprises a 222-mile section in Russia from Izobilnoye to Dzhugba on the Black Sea Coast (the Russian onshore section), a 235-mile section on the bottom of the Black Sea connecting Dzhugba to Samsun on the Turkish coast (submarine section), and a further 300-mile link from Samsun to Ankara (Turkish onshore section). The linking of the pipeline sections also involved shore approach works at the Russian and Turkish landfalls. There are emergency shutdown valves at the interfaces. Pre-trenches were excavated at a water depth of 10m, using onshore excavators and dredgers. Pipe joints of 12.2m for the shore pull-in were coated with 45mm of concrete. At the Russian side the Castoro Otto, minus stinger, pulled the W2 line ashore first, then the E1 via a 300 t return sheave installed on the beach. It then proceeded to the Turkish side.

In October 2002, construction on the pipeline was completed and natural gas supplies through Blue Stream began in February 2003. The flow of natural gas will gradually reach 16 billion cubic metres in 2007 in accordance with the Natural Gas Purchase Sale Agreement. At full capacity the pipeline will carry 16 billion cubic metres of natural gas from Russia to Turkey (ESaTDOR, 2013). Blue Stream is a major trans-Black Sea gas pipeline that carries natural gas from Russia into Turkey. Preating at full capacity delivers 16 bcm per year. The pipleline was built with the intent of diversifying Russian gas delivery routes to Turkey and avoiding third countries. It is planned to build the second leg of pipeline to allow expanding Russian gas export to the south (via Samsun-Ceyhan gas pipeline further to Israeil Lebanon).

Ukraine

Out of 100 top land-based sources of Ukraine, 13 large industrial enterprises are located in the Black Sea administrative units (oblasts), however, none of them is on the list of the Black Sea Hot Spots indicated in BSIMAP. Among municipal sources of pollution, most important contributors are the large cities along the Ukrainian coast.

There are four large rivers in Ukraine, flowing into the Black Sea (Danube, Dniester, Dnieper and Southern Bug). Among rivers, the most important contributors to the pollution/eutrophication of the Black Sea are the large rivers Dnieper (with Bug), Dniester and Danube (the branch Chilia). The catchment area of these three rivers is about 1,400,000 km^2 and average annual river flow is 222 km3/yr (Table 3.29) (Avaz et al., 2013).

Table 3.29 Average data on rivers discharging into Black Sea from Ukraine

River	Catchment area (thousands m^2)	Average annual river flow (km^3/yr)
Danube	817.0	166.65
Dnieper	504.0	43.50
Dniester	72.1	9.68
Southern Bug	63.7	2.2
Total	**1,456.8**	**222.03**

The average input of nutrients (tonnes/year) in the Black Sea from Ukrainian rivers showed each contribution (Fig. 3.113 and Fig. 3.114).

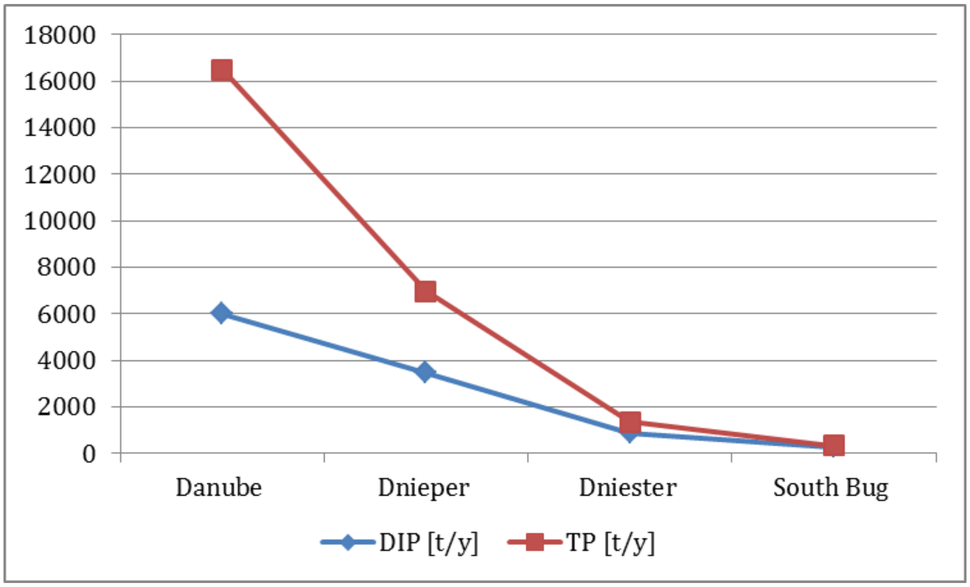


Fig. 3.113 Average input of phosphorus (tonnes/year) in the Black Sea from Ukrainian rivers *(after Avaz et al., 2013)*

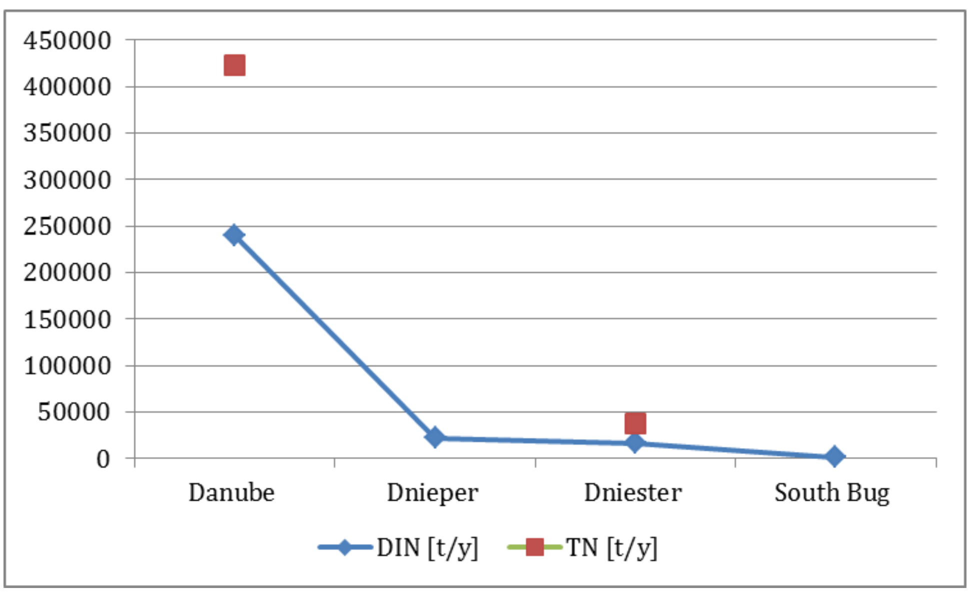


Fig. 3.114 Average input of nitrogen (tonnes/year) in the Black Sea from Ukrainian rivers *(after Avaz et al., 2013)*

Among point sources of pollution there are 10 official hot spots, being reported to the Black Sea Commission as follows (Table 3.30))(Avaz et al., 2013).

Table 3.30 Ukraine point sources of pollution at the Black sea reported as Hot Spots

	Name	Type
1	Pivdenni	municipal WWTP
2	Pivnichni	municipal WWTP
3	Balaklava	municipal WWTP
4	Yevpatoriya	municipal WWTP
6	Sevastopol	municipal WWTP
5	Yalta	municipal WWTP
7	Gurzuf	municipal WWTP
8	Port Yuzhni	municipal industrial WWTP
9	Illichevsk	municipal WWTP
10	Krasnoperekopsk, bromide	industrial WWTP

The biggest discharge is coming from Sevastopol WWTP (Fig. 3.115).

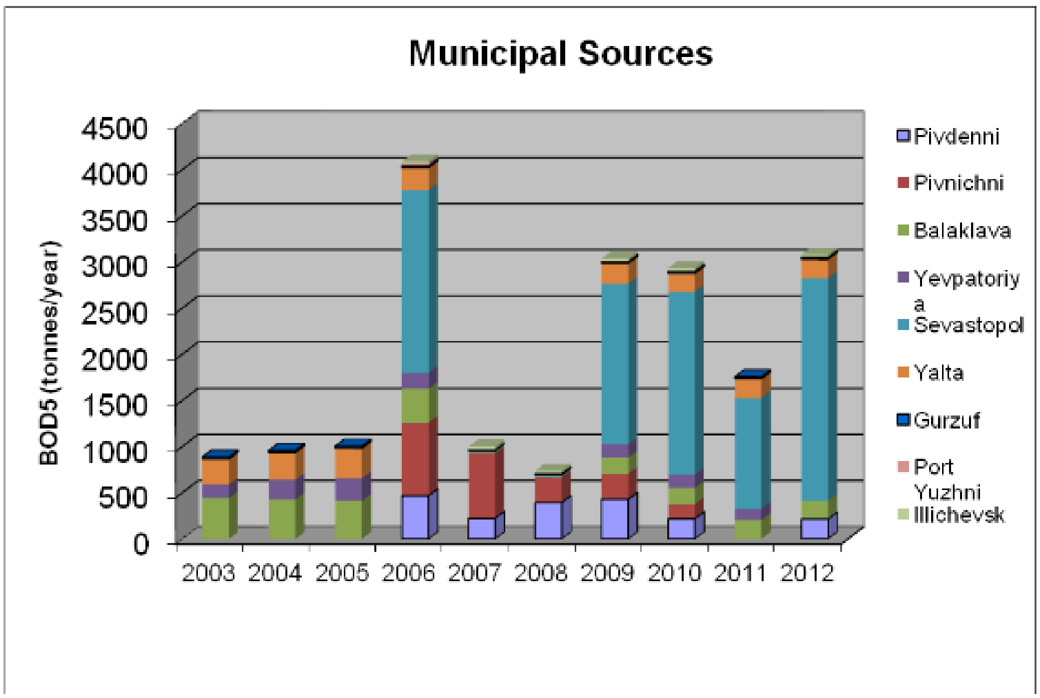


Fig. 3.115 Annual BOD_5 discharge from Ukraine's municipal sources *(Avaz et al., 2013)*

Ukraine reports to the Black Sea Commission one industrial source as Hot Spot at the Black Sea littoral named Krasnoperekopsk, bromide industry (Avaz et al., 2013).

Conclusions. The (sub)regional assessment of the land-based sources of pollution done for four riparian countries of the Black Sea (Bulgaria, Romania, Turkey and Ukraine) showed that, generally, there are three important sources which could influence different the ecological status of the Black Sea, first changing its chemical status. First are rivers which dominate the Romanian and Ukraine coasts and have a significant influence on theirs coasts. Additionally, they may have cumulative effects due to transboundary pollution on the Romanian coast. Second are municipal sources, mainly WWTPs direct discharging into the Black Sea, in different development levels. Thus, there are still insufficient treated and/or untreated waters discharged which influence also its health status, at least at local level. Third are the industrial sources most of them port activities, refineries and heavy metals industry. As hot spots are reported to the Black Sea Commission only eight sources wich demonstrate either the industry is not to developed or the industrial sources assessment need to be revised.

One of the main future concenrn in term of marine based sources is coming from the off shore activities and pipelines. This is developing in the Western part of the Black Sea and need to be well monitored.

3.6. Interaction between the coastal zone and maritime zone

3.6.1. Maritime transport routes

It the post-war period, Black Sea traffic was dominated by the interests of the Soviet Union, which possessed nearly 50% of the Pontic coast. Turkey, a NATO member since 1952, holding one-third of it, targeted its traffic to its Aegean and Mediterranean ports (Urucu, 1999).

The Soviet Union used to participate in world trade largely through the Black Sea harbours, through Odessa in the main. It also had strong trading ties, with Bulgaria in particular; sizeable cabotage traffic with the Black Sea ports of its own republics was also going on. The extension and equipment of its Pontic ports, as well as their modernization focused preferentially on Odessa or the military naval bases. The ports located on the eastern, Caucasian, side (largely of local importance at the time) would grow into tourist towns and economic centers of some administrative political units of the Caucasus region.

The Black Sea traffic served basically the export and import of its riverine countries (Fig. 3.116). The structure of transported goods was an accurate reflection of each country's import and export structure. Transit traffic from the Black Sea basin's limitrophe regions (Middle East, Central Asia) to Central and Western Europe held a small share in the activities of the respective ports.

Ever since the seventh decade, Romania has been trying to widen the geographical area of its external trade relations. The port of Constanta has become a major maritime gateway for international traffic. By the end of the 1990s, port facilities allowed for traffic over 80 mil.t/year.

At the same time a port at the Danube-Black Sea Canal, Constanta represented a transit point for remoter geographical regions, with richer complementary resources (Fig. 3.117).

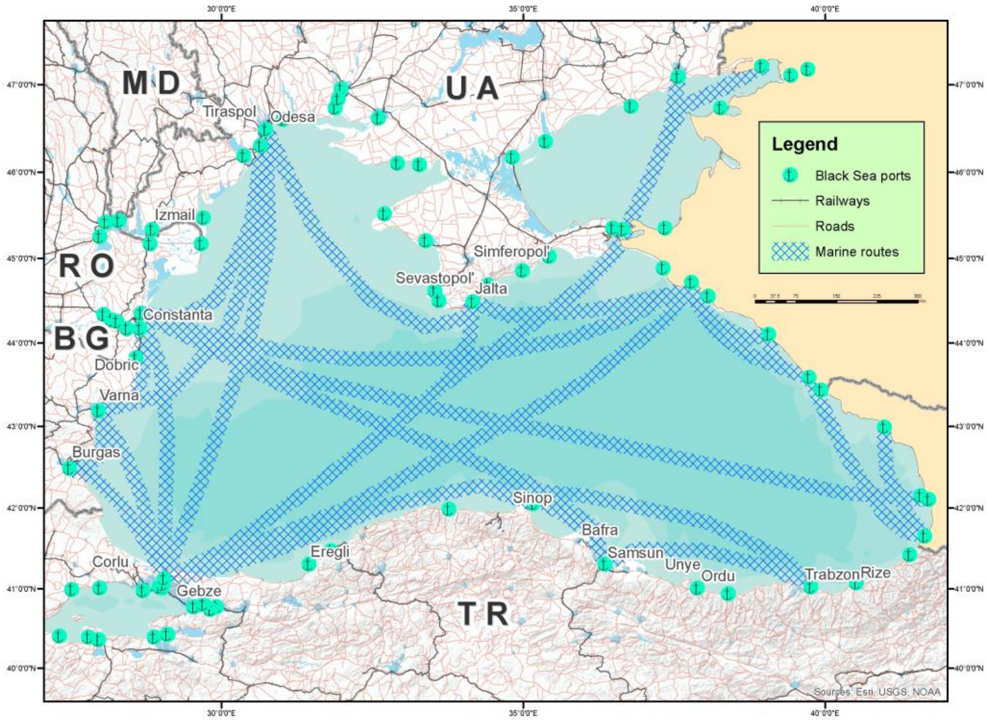


Fig. 3.116 Black Sea ports and maritime routes *(original map)*

The Danube - Black Sea Canal

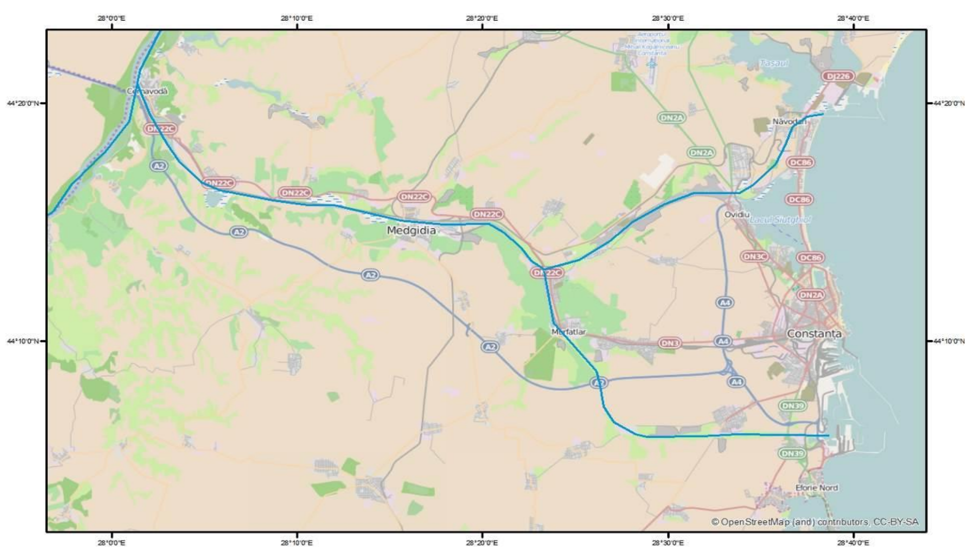


Fig. 3.117 The Danube - Black Sea Canal *(original map)*

After 1990, the Black Sea countries have been experiencing radical changes which affected also the volume and structure of the Pontic traffic. But for the Turkish ports, all the others have registered massive decreases in trading volumes, particularly those located on the west side of the sea, traffic volumes dropping sharply and suddenly within a span of several years. While the 1988-1989 Constanta harbor traffic turnover was 62 million tons, the steep decline in 1990 reduced it by half, a situation that continued for another three years.

After a first episode of decline caused by the confusion of transition, the port traffic of the former 'socialist' states recorded a timid comeback. The eastern and north-western ports appear to have fresh opportunities of development. For countries like Georgia and the Ukraine, which turned independent after 1991 when the Soviet Union fell apart, and even for Russia, these harbor have remained the principal, if not the only gateway to the word. They are striving hard to regain as much as possible of the role played in the Black Sea traffic during Soviet times. After 1990, apart from a decrease in traffic volume and structure due to the economic difficulties of riverine countries in transition to the market economy, both the geographical area and the direction of shipments suffered radical changes. While cabotage traffic among the former Soviet ports decreased, the trade record of the eastern and southern ports registered increases. Profiting by the situation, Turkey's interest in the Black Sea ports was rekindled by a greater transit offer from the Middle East and the Persian Gulf area that combines land traffic up to Turkey's Pontic ports, with maritime transport on the Black Sea up to the European ports on the western and north-western side and farther on to Central and Western Europe. Bilateral agreements provide for a ferry-boat maritime line between Constanta and Samsun, but actual implementation depends on the two countries' goods offer. Besides, lots of taxes might diminish atractivity or make the projects uninteresting economically.

In a similar situation is the Constanta (Romania) - Poti line, which presents real advantages in connecting the Caucasian areas to the European Pontic zones. Port capacity is another factor discriminating the Pontic ports. While Constanta and Odessa have it in excess, the Caucasian ports lack much of it, so they cannot increase port traffic volume or diversify its structure. The new geopolitical situation seems to benefit the port of Novorossiysk, which is expected to become Russia’s main Black Sea harbor and, in this way, compensate for losing other major ports to the Ukraine.

Currently, the number of vessels transiting the Black Sea exceeds 50,000 per year.

Some of the most economically important ports in the Black Sea (from project partner countries) are the following:

Bulgaria

Port of Varna is the largest seaport complex in Bulgaria. Located on the Black Sea’s west coast on Varna Bay, along Lake Varna and Lake Beloslav, it also comprises the outlying port of Balchik. It has a significant further development potential with 44 km of sheltered inland waterfront on the lakes alone, easily accessible by road and railroad and adjacent to Varna International Airport. There are two anchorages at Varna roadstead: summer and winter. If violent northeasterly wind and wave conditions make the anchorages hazardous, a foul weather anchorage is available west of the 70 m (230 ft) high Cape Kaliakra 26 nautical miles (48 km) east-northeast of Varna.

Two inland canals connect the sea and Port of Varna East with Lake Varna, Lake Beloslav and Port of Varna West: Channel 1 with draft 11.5 m and Channel 2 with draft 11.0 m. The canals form an island, on which a deepwater oil terminal, among other port facilities, is currently located. The depths of the ship berths and the approaches allow the handling of vessels of capacity up to 50,000 gross tonnes. In view of the stated safe canal depths, only vessels of draft less than 9.9 m (32½ ft) and airdraft up to 46 m (146 ft) are allowed to Varna West. Vessels with load over 200 m, beam over 26 m, or over 20,000 gross tonnes are required to pass the channels during daylight hours only. The largest vessel handled (as of 2006) is the Norwegian Dream cruise ship (220 m in length, 50,700 gross tonnes).

Port of Varna offers full service: loading, discharging, stevedoring, freight forwarding, storage and various intermodal services. For its approximately 40 berths, it operates 65 electric cranes and about 400 other pieces of ship, landside and warehouse port facilities. The port open-air storage area is 454,000 m^2 (4,890,000 ft2) and the warehouses 76,000 m2 (820,000 ft2). It has a well-forked railway and road network. The existing port facilities allow the handling of practically all kinds of solid bulk, break-bulk, containerized and some liquid-bulk cargoes.

Principal exports include urea, soda ash, cement, clinker, silica, fertilisers, grain, containers and ro-ro. Principal imports are coal, metals, ores and ore concentrates, oil, phosphates, timber, molasses, containers and ro-ro.

Since 2006, Port of Varna serves as a hub for BP and German wind turbine manufacturer Saga. In 2008, the port posted a 57% growth in overall tonnage handled, and at times in late summer it was stretched beyond capacity, due to redirected cargo from striking ports in the region and the year's record export of wheat from northeastern Bulgaria (http://www.port-varna.bg).

Bourgas

In June 2011 the Council of Ministers of Bulgaria awarded the 35 year concession for Port Terminal Burgas East to BMF Port Burgas EAD, established by “Navigation Maritime Bulgare” AD (NAVIBULGAR©) in 2011.

Port Terminal Burgas East is situated in the Gulf of Burgas at Bulgaria’s Black Sea coast. Covering an area of approximately 42 hectares and offering nearly 1.6 kilometers of combined deep-sea berths, Port Terminal Burgas East is one of the largest port terminals on the Black Sea, offering unique potential for cargo handling and storage. With a water depth of up to 15.50 meters, the Terminal is capable to receiving the world’s largest vessels providing its client with excellent opportunities to capitalize on economies of scale.

Under the concession, Port terminal Burgas East shall be further developed into a modern and multifunctional deep-sea terminal, capable of handling and storing various types of cargo including general cargo, dry bulk, liquid bulk and containers (http://www.navbul.com/en).

Moldova

Giurgiulesti

Landlocked Moldova obtained the area where the port is located through a 1999 land swap with Ukraine. Moldova gained thereby access to international waters. The small port is owned by Netherlands-based EASEUR Holding (80%) and the European Bank for Reconstruction and

Development (EBRD) with 20% (http://www.bne.eu/content/landlocked-moldova-gets-international-port]. Today, Giurgiulesti has terminals for oil products, grain and vegetable oil, and a small container terminal that opened in 2012. Giurgiulesti International Free Ports' entire territory has a status of a free economic zone until 2030. Due to its location on the Lower Danube with available water depths of up to 7 m, GIFP is capable of receiving both inland and sea going vessels. Against this background GIFP serves its client as:

- the only direct sea/river-borne transshipment and distribution point to and from the Republic of Moldova
- a regional logistics hub on the border of the EU with access to road, rail, river, sea, and
- an excellent location for business development, because of its strategic location, tri-modal transport infrastructure, low cost environment and a unique customs and tax regime.

Romania

Constanta

The Port of Constanta is located at the crossroads of the trade routes linking the markets of the landlocked European countries to Transcaucasus, Central Asia and the Far East. The port has excellent connections with the Central and Eastern European countries through the Corridor IV (rail and road), Corridor VII - Danube (inland waterway), to which it is linked by the Danube-Black Sea Canal, and Corridor IX (road), which passes through Bucharest. The two satellite ports Midia and Mangalia that are located not far from Constanta Port are part of the Romanian maritime port system under the coordination of Maritime Ports Administration SA Constanta. Constanta Port is both a maritime and a river port. Daily, more than 200 river vessels are in the port for cargo loading or unloading or waiting to be operated. Facilities offered by the port allow accommodation of any type of river vessel.

The connection of the port with the Danube River is made through the Danube-Black Sea Canal, which represents one of the main strengths of Constanta Port. Due to low costs and important cargo volumes that can be carried, the Danube is one of the most advantageous modes of transport, an efficient alternative to the European rail and road congested transport.

The Port of Constanta is located on the Western coast of the Black Sea, at 179 NM from the Bosphorus Strait and 85 NM from the Sulina Branch, through which the Danube flows into the sea. It covers 3,926 ha of which 1,313 ha is land and the rest of 2,613 ha is water. The two breakwaters located northwards and southwards shelter the port, creating the safest conditions for port activities. The present length of the North breakwater is 8,344 m and the South breakwater is 5,560 m. Constanta Port has a handling capacity of over 100 million tons per year and 156 berths, of which 140 berths are operational. The total quay length is 29.83 km, and the depths range between 8 and 19 meters.

These characteristics are comparable with those offered by the most important European and international ports, allowing the accommodation of tankers with capacity of 165,000 dwt and bulkcarriers of 220,000 dwt.

Currently, there are several projects in progress, in order to build new facilities for cargo handling and to improve the transport connections between Constantza Port and its hinterland. These projects are mainly located in the South part of the port.
(http://www.portofconstantza.com/apmc/i.do?lan=en).

Mangalia

The Port of Mangalia is situated on the Black Sea, close to the Southern border with Bulgaria, and over 260 km N of Istanbul. It has an area of 142.19 ha, of which 27.47 ha is land and 114.72 ha is water. The N and S breakwaters have a total length of 2.74 km. There are 4 berths (2 operational berths) with a total length of 540 m. The maximum depth is 9 m. (http://www.portofconstantza.com/apmc/i.do?lan=en).

Starting with 1997, Daewoo-Mangalia Heavy Industries, a joint venture between worlwide well known shipbuilding leader Daewoo Shipbuilding & Marine Engineering in Korea and “2 Mai“ Mangalia Shipyard in Romania has been one of the most competitive shipbilding, conversion & repair shipyard in the Black Sea area. Since its inception, Daewoo-Mangalia Heavy Industries has had a unique potential in the field of shipbuilding, conversion & repair business, due to its favorable geographical location, best facilities, advanced Daewoo technology, large investment program and highly qualified Romanian and Korean experts (http://www.dmhi.ct.ro/introduction.htm).

Turkey

Samsun

Samsun is the largest port city of the Turkish Black Sea coast. In the early 20th century, the Central Bank of the Republic of Turkey funded the building of a port. Before the building of the port, ships had to anchor to deliver goods approximately 1 mile or more from shore. Trade and transportation was focused around a road to and from Sivas. The privately operated port fronting the city centre handles freight, including RORO ferries to Novorossiysk, whereas fishing boats land their catches in a separate harbour slightly further east. A ship building yard is under construction at the eastern city limit. Road and rail freight connections with central Anatolia can be used to send inland both the agricultural produce of the surrounding well rained upon and fertile land, and also imports from overseas.

A grain silo belonging to TMO (Turkish Grain Board) of 30.000 tons capacity is available. The port has a ship –to-shore bridge system to serve the railways-maritime-highway combined transport among North European, Commonwealth Independent States (CIS) and Middle East countries. It has 184.5 m long, 26.5 m width and 7.4 m depth. Capacity of this system is available for the vessels of 12.000 dead weight tons. For future traffic demands, it is possible to upgrade this system up to 3 or 5 lines. The Free Trade Zone is near the port. It covers an area of 71.000 sqm and it has been rendering service since the end of 1998.
(http://ports.com/turkey/port-of-samsun/).

Trabzon

Trabzon is also an important port on the Black Sea, situated as it is right on the north-south and east-west trade axis. Trabzon, continued to defend its geopolitical and eco-strategic position throughout history, and became one of the main ports of call on the historic Silk Road as well.

Trabzon is particularly important for Turkey’s fishing sector. In the Black Sea where 75% of Turkey’s fish production takes place, fishing is one of the main sources of income for the population and Trabzon accounts for 20% of total fish production. There are a large number of biggish fishing vessels and hundreds of small fishing boats in the province.

The port serves export, import cargoes and transit traffic to Iran and also Ro-Ro lines between Turkey and Ukraine/Russia. It has an ideal location both for the trade with the countries having a coast on the Black Sea. On the other hand, it is ideally located for the cargoes destined to the Middle East from the continental Europe through Rhine-Main-Danube canal and Black Sea.The port is protected by two breakwaters, 3132 m. and 1580 m. long. The width at the entrance is 225 m (http://www.kultur.gov.tr/EN,33572/the-economy-and-trade-in-trabzon.html).

Ukraine

Odessa

The Port of Odessa or Odessa Marine Trade Port (OMTP) - located near Odessa - is the largest Ukrainian seaport and one of the largest ports in the Black Sea basin, with a total annual traffic capacity of 40 million tonnes (15 million tonnes dry bulk and 25 million tonnes liquid bulk). The port has an immediate access to railways allowing quick transfer of cargo from sea routes to ground transportation. Along with its younger satellite ports of Illichivsk (1958) and Southern (1973) port of Odessa is a major freight and passenger transportation hub of Ukraine.

The oil and gas terminal of the OMTP is the biggest one in Ukraine and sometimes is referred to as the OMTP Oil District. It has six berths with a total storage capacity of 671,000 m^3. The oil district allows to receive tankers with load capabilities from 1,000 to 100,000 tons. The terminal was opened on May 13, 2005 and has a storage area of 51,500 m^2. The terminal has two warehouses with a total area of 2,363.8 m2 (25,444 sq ft) including 60.3 m^2 (649 sq ft) for valuable cargo. Warehouses work around the clock and equipped with rack systems designed for storage of goods. A warehouse ramp allows the simultaneous staging of nine vehicles.

The Port of Odessa has one of the largest passenger terminals in the Black Sea basin; it handled around 4 million passengers in 2007
(http://www.port.odessa.ua/index.php/ua).

Mariupol

Mariupol Port is situated in northwestern part of Taganrog Bay of the Azov Sea, 14 miles from the entry into the Bay. The Commercial Port of Mariupol is one of the oldest ports of Ukraine, was opened in 1889. It is the port with old good traditions.

Today the Port of Mariupol is reckoned among three largest ports of Ukraine. The capacities of the Port give the possibility to handle more than 12 million tons of cargoes per year. The berths of the Port are capable to offer services for vessels with length up to 240 m., draught 8 t. It is the largest Port by its capacity and development in the Azov Sea. The most advantageous position of the Port in the Azov Sea is defined by the fact that it is on the crossing of transport ways connecting Europe and Asia. It is situated in the center of the largest industrial region of Ukraine and it is called by right “Sea gates of Donbass“.

The Port is connected by railway and motorway, air and river communications with foreign countries. The Port takes one of the leading places among the ports of Ukraine in handling international and cabotage cargoes, ensuring transit shipments of diverse cargoes, containers and packages (http://www.marine.odessa.ua/uni/index/mariupol).

3.6.2 Submarine cable and pipeline routes

Submarine cables

Various submarine cables pass through the Black Sea as shown at the following Figure 3.118.

Black Sea Fiber Optic Cable System (BSFOCS) is a 1,300 km (808 mi) submarine telecommunications cable system linking three countries bordering the Black Sea (Fig. 3.119). It went into operation in September 2001, and has a total capacity of 20 Gbit/s along 2 fiber pairs.

It has landing points in:

1. Varna, Bulgaria
2. Odessa, Ukraine
3. Novorossiysk, Russia

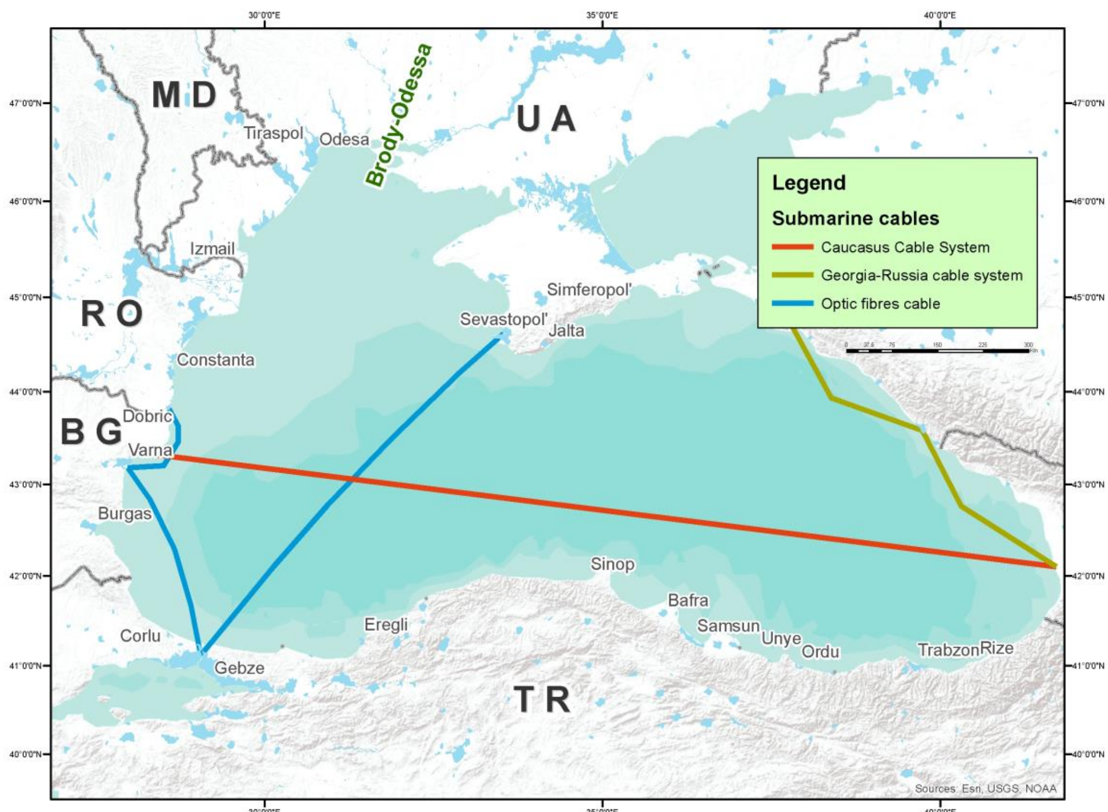


Fig. 3.118 Submarine cables at the Black Sea *(original map)*

Fig. 3.119 Black Sea Fibre Optic Cable System*(http://en.wikipedia.org/wiki/BSFOCS)*

Marine hydrocarbon (oil and gas) extraction

Shows of oil and gas have been observed on the shores of the Black Sea since antiquity, with the first commercial (onshore) production beginning in the 1850's in Romania. Romanian offshore fields are located in the central part of its continental shelf. On-going exploration campaigns show that the whole area could host huge gas reserve. Recent discoveries are located in a disputed zone between Romania and Bulgaria.

The Black Sea energy landscape is going to change dramatically over the next 5-10 years, as the region's nations pursue aspirations not only to become transport hubs for oil and natural gas supplies moving into Europe but also to boost their own hydrocarbon output. Divergent or even conflicting paths, however, still need to come together if the region is to reach its full potential, Black Sea events having ripple effects on Southeast Europe, Russia, the Caspian Sea, Middle East, and ultimately the European consuming markets. The Nabucco pipeline project is just the visible part of the energy game emerging in the region.

Bulgaria

Bulgaria, the other EU member in the Black Sea region, imports more than 85% of its gas and 95% of its oil from Russia. Bulgaria and Slovakia were the worst hit states during the January 2009 gas crisis in Europe. Domestic oil and gas production remains marginal. The 2002 Energy Strategy of Bulgaria document says the country should become the energy center for the Balkans. Domestic politics, however, have prevented updating this strategy to account for new energy trends and the country's 2007 integration into the EU.

Previous governments strongly supported Russian-backed projects such as the South Stream gas pipeline and Bourgas-Alexandroupolis oil pipeline, while also participating in competing projects such as Nabucco or the AMBO (Bourgas-Vlora) oil pipeline. The government installed in July 2009 started to back away from these projects, only to restate interest in October 2009.

A new draft of the national energy strategy document met with resistance from interests concerned it will create energy production overcapacity and encourage corruption in state-owned energy companies. A report published in September 2009 by the Center for the Study of Democracy says the energy sector “remains one of the least transparent and of highest corruption-risk sectors in Bulgaria”.

The report recommends, among other things, revising the new national energy strategy draft, energy supply diversification in the nuclear sector, and improvements in gas storage facilities and the gas transmission network, as well as more transparency and openness in general.

Bulgaria is well-positioned to become an energy hub for the Balkans, and the region has a promising potential for oil and gas infrastructure projects, but the country has to define both its Balkan cooperation projects and how it will reconcile this Balkan-focused strategy with participation in wider-reaching energy projects.

Romania

Romania is a traditional oil and gas producer and was for a long time an oil exporter. Domestic production, however, is declining rapidly. The country produced 99,000 b/d of oil and 11.5 billion cu m of natural gas in 2008, covering 80% of domestic gas consumption, but only 44% of oil consumption. As a member of the European Union since 2007 with more than 500,000 b/d of oil refining capacity and a well-developed oil and gas pipeline infrastructure, Romania presents an interesting potential access point to European markets for non-EU suppliers, especially Caspian producers. Romania spent the past 20 years without a clear long-term energy strategy, other than opposing any large Russian-led project. The Romanian Energy Strategy Plan for 2007-20 does not mention any regional or European strategic objective for the energy sector.

Signs of a more structured energy strategy, however, have recently emerged. The main tenets of this strategy seem to be close cooperation with Caspian producers to allow them to access to EU markets while Romania diversifies from Russian supplies, coupled with an increased push to revive domestic oil and gas production and diversify the primary energy mix. KazMunaiGaz, the Kazakh national oil and Gas Company, acquired Rompetrol in 2007. Rompetrol has distribution networks in 13 countries. Romania also signed a strategic partnership agreement with Azerbaijan and negotiations between Romanian authorities and SOCAR have intensified, SOCAR promising during October 2009 talks to supply Romania with 7.3 billion cu m/year of gas if Nabucco is the first-built among the competing regional pipeline projects.

SOCAR is also interested in investing in refining capacity in Romania and, although the Romanian government has privatized all refineries, it has also announced a large state subsidy for RAFO Onesti, a money-losing privately owned refinery, intensifying speculation regarding cooperation with SOCAR regarding the facility.

Romania has unconditionally supported Nabucco since its inception and was not invited to be part of South Stream. It was also one of the initiators of the Pan-European Oil Pipeline (or Constanta-Trieste pipeline), shelved in September 2009 as Croatia reconsidered its energy project priorities and focused on projects along the Adriatic coast. Romania has also started negotiations to participate in the still-nascent White Stream project, strongly backed by Azerbaijan.

Romanian business leaders discussed the possibility of shipping LNG across the Black Sea during the Black Sea Energy and Economic Forum, an option also mentioned in late October by Azeri officials. But this option seems to be a long shot without switching to cheaper, quicker CNG instead . In the meantime, the Romanian government earmarked €2 billion over the next 10 years for upgrading the country's gas transmission network, connecting it to neighboring countries, and increasing underground storage capacity.

Romania on September 3, 2009, launched its tenth oil and gas production licensing round, with permits to be awarded early-2010. The round offered 30 oil and gas exploration blocks, 11 of them offshore in the Black Sea.

A February 2009 decision by the International Court of Justice in the Hague settling competing claims by Romania and Ukraine regarding a 12,000 sq.km offshore area thought to contain as much as 100 billion cu m of gas and 73 million bbl of oil reserves allowed opening of previously unavailable offshore blocks. The ICJ awarded 9,000 sq.km to Romania and the balance to Ukraine and both countries accepted the decision.

Romania could become a bridge to Europe for Caspian production if it can separate internal politics from the management of its energy sector, improve the transparency of the exploration licensing process, and implement energy infrastructure projects geared toward helping it become a viable oil and gas transit country.

Turkey

Turkey's growing economy depends on imports for almost 95% of oil consumption and almost 90% of gas consumption. Turkey's pipeline and LNG terminal infrastructure, however, allow it the most diversified range of oil and gas imports in the Black Sea region, accessing supplies from the Middle East, Caspian Sea, Russia, and Africa.

Turkey's energy strategy centers on four main axes:

• Becoming the main energy transit hub between oil and gas producing regions and European markets.
• Diversifying oil and gas import sources.
• Diversifying its energy mix.
• Dramatically increasing domestic oil and gas production.

Turkey lies in the transit routes from Caspian, Russian, and Middle East producers to the European markets. Besides its existing oil and gas pipelines and LNG terminals, Turkey has been involved since the beginning in the Nabucco project and in 2009 joined the South Stream project. Turkey officially approved laying South Stream in its territorial waters and began preliminary route survey work Oct. 20, 2009. Turkey and Russia have also discussed a potential Blue Stream 2 gas pipeline in the Black Sea to Samsun.

Turkey also has two oil pipeline projects - Trans-Anatolia (or Samsun-Ceyhan) and Trans-Thrace-competing against the AMBO and Bourgas-Alexandroupolis pipelines to bypass the Bosporus. The Trans-Thrace pipeline, promoted by local Tun Oil, is dormant, while the Trans-Anatolia pipeline, promoted initially by Italy's Eni and Turkey's Calik Holding, received a boost

Oct. 19, 2009, when Russia joined Italy and Turkey in signing a joint agreement for building the pipeline. Russian companies Transneft and Rosneft have cosigned with Eni and Calik Holding a memorandum of understanding for construction of the pipeline. On Oct. 27 Russia and Turkey also signed an agreement to build a refinery on the Samsun-Ceyhan pipeline.

Turkey's state Turkish Petroleum Corp. is a shareholder in the Azeri-Chirag-Guneshli and Shah Deniz fields in Azerbaijan and has exploration and production interests in other countries in the region, such as Turkmenistan, Syria, Iraq, Egypt, and Georgia. Turkey is also using its historical and cultural ties to the Middle East region to try to secure gas supplies for the planned pipelines, holding 2009 discussions with Iraq, Iran, and Qatar to secure gas for Nabucco.

Turkey has also improved its relations with Armenia, which is starting to be viewed by some as an alternative to Georgia as a transit route from the Caspian Sea. The move angered Azerbaijan, which has a long-term conflict with Armenia, prompting Azeri threats in October 2009 to avoid Turkey as a transit country for gas from the Shah Deniz 2 project and instead study an LNG or CNG route to the western coast of the Black Sea.

Turkey is actively diversifying its energy mix, having ratified the Kyoto protocol and adopted laws encouraging investment in renewable energy production. Renewable sources, mostly hydro, already meet 20% of Turkey's primary energy needs and Turkey has three nuclear plants planned.

TPAO is leading Turkish efforts to increase domestic production of oil and gas, particularly from the Black Sea. In 2006 TPAO initiated a $350 million joint venture with Petrobras covering two offshore Black Sea blocks and has also actively explored the area on its own.

Its other major Black Sea exploration partner since 2008 is ExxonMobil. TPAO’s CEO stated as recently as October 2009 that 10 promising areas in the Black Sea could contain recoverable reserves of up to 10 billion bbl oil and 1.5-2 trillion cu m gas, enough to allow Turkey to cover its domestic consumption and become an oil and gas exporter.

TPAO started gas production in the Black Sea in 2007 but still has a lot of work to do to prove reserves of the most promising prospects and finance exploration and development, needing at least $100 billion and advanced deep water technology. TPAO does not expect production from these fields before 2020.

Ukraine

Ukraine remains the main transit country for Russian oil and gas exports to Europe through the pipeline infrastructure developed by the former Soviet Union. About 22% of total Russian oil exports cross or are consumed in Ukraine. The natural gas percentage is even higher at more than 80% (Fig. 3.120). Although Ukraine has stepped up exploration efforts, its oil and gas production have remained flat for the last decade, covering slightly more than 20% of domestic oil consumption and almost 30% of gas consumption

Ukraine's strategic goals include retaining its position as the main energy transit hub for exports to Europe, decreasing its dependence on Russian oil and gas by increasing domestic production, and diversifying its import sources by directly importing Caspian oil and gas.

The country, however, faces a number of obstacles in reaching these objectives. Economic and financial woes coupled with domestic political strife and deteriorating relationships with Russia endanger Ukraine's status as the main Russian export transit country. The Soviet-era oil and gas pipeline infrastructure is old and deteriorating rapidly, and Ukraine cannot afford to maintain and upgrade it. National oil and gas company Naftogaz is technically bankrupt and cannot support development of domestic oil and gas.

Pipeline projects initiated by Ukraine to diversify oil and gas imports, such as the White Stream (Georgia-Ukraine-EU) gas pipeline and the extension of the Odessa- Brody oil pipeline to the Baltic Sea port of Gdansk (Poland), have stopped moving forward.

Ukrtransnafta, operator of the Ukrainian oil pipeline system, stopped Russian oil shipments in the Odessa-Brody pipeline in October 2009 for several weeks—forcing Lukoil's Black Sea Odessa refinery to halt activity—and reversed its flow to import oil directly from Azerbaijan instead. SOCAR, the Azeri National Oil and Gas Company, opened an office in Kyiv on Oct. 12 and has confirmed negotiations to buy another Black Sea refinery in Ukraine, the Kherson refinery.

These actions worsened Russian-Ukrainian relationships, already strained by nearly continuous natural gas import volume and transit fee disagreements. Russia and Ukraine signed a new gas supply contract after the winter 2008-09 supply crisis, but in October 2009 Ukraine announced a desire to reopen negotiations in an effort to reduce contracted volumes to 33 billion cu m/year in 2010 from 42 billion cu m/year in 2009.

Ukraine also seeks to renegotiate gas transit fees, considering Naftogaz's current annual transit revenue of roughly $2.5 billion to be less than adequate. Gazprom is strongly opposed to reopening the contract and the Ukrainian government has warned that, although it will not disrupt gas transit to Europe during winter 2009-10, it cannot guarantee transit for 2010-11 without a new contract.

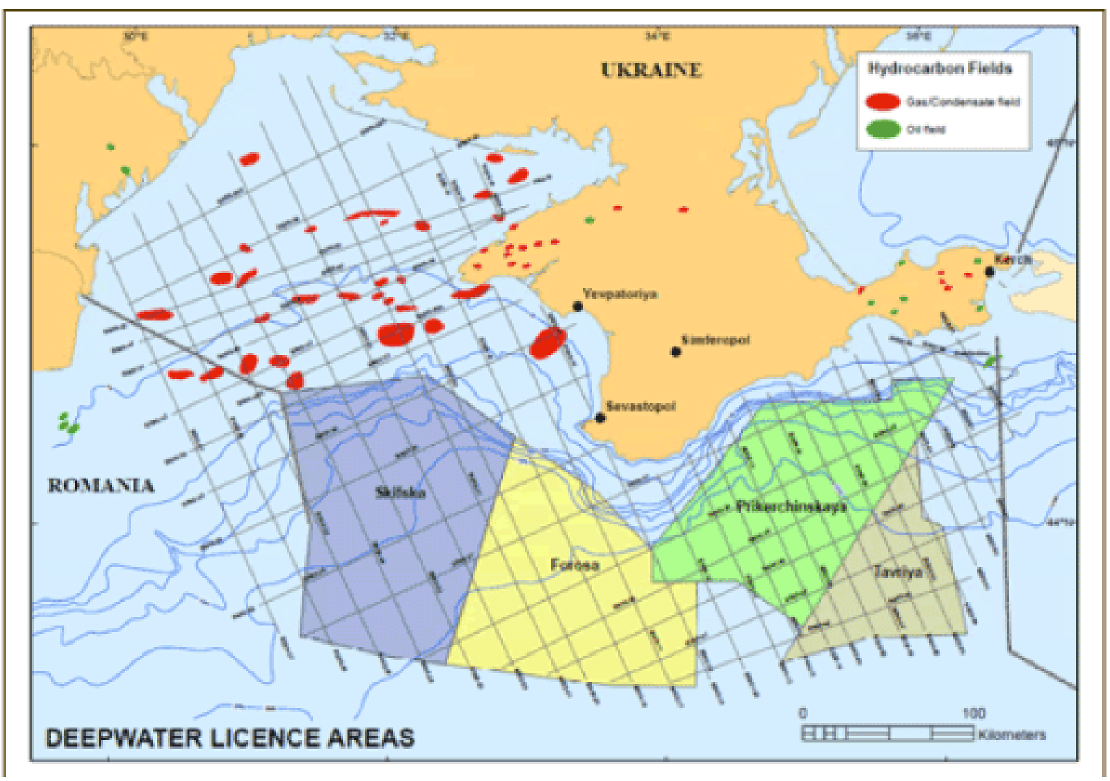


Fig. 3.120 Ukrainian Black Sea oil and gas resources
(*http://yalibnan.com/wp-content/uploads/2014/05/Crimea-black-sea-resources.gif*)

The Caspian Oil Transit

The present Pontic traffic should be judged also in the light of the recent interest shown by the EU countries for the Caspian Sea and Central Asia oil (Fig. 3.121). Under the TRACECA programme, the Black Sea stands the chance of becoming part of the oil traffic route to the West-European markets. This implies either increasing tanker capacity, or the construction of underwater pipe lines, or both ways, concomitantly or successively. This is the case of Novorossiysk and of the Georgian ports of Poti and Batumi as future relay-ports in the oil transport from the Caspian Sea to the European Union.

Increased tanker traffic has objective limitations, namely, the Straits are not sufficiently deep and wide and oil transport poses ecological risks. Therefore, no larger than 250,000 tdw carriers are accepted. Moreover, heavy traffic of all kinds of vessels also puts annual numerical transport restrictions.

Because of the great many accidents in the Straits with inherent ecological risk, tanker traffic through the Bosphorus ought to be seriously monitored. The building of pipe lines under the Black Sea has both economic and ecological advantages. They are to be linked with pipe lines on land from remoter oil regions to supply consumers in Europe. If the new high-capacity pipe lines from Baku and Tenghiz to the Black Sea are commissioned in 1998-1999, then the capacity of oil tankers could be increased, too. Ultimately, an optimum solution is certain to be found and implemented.

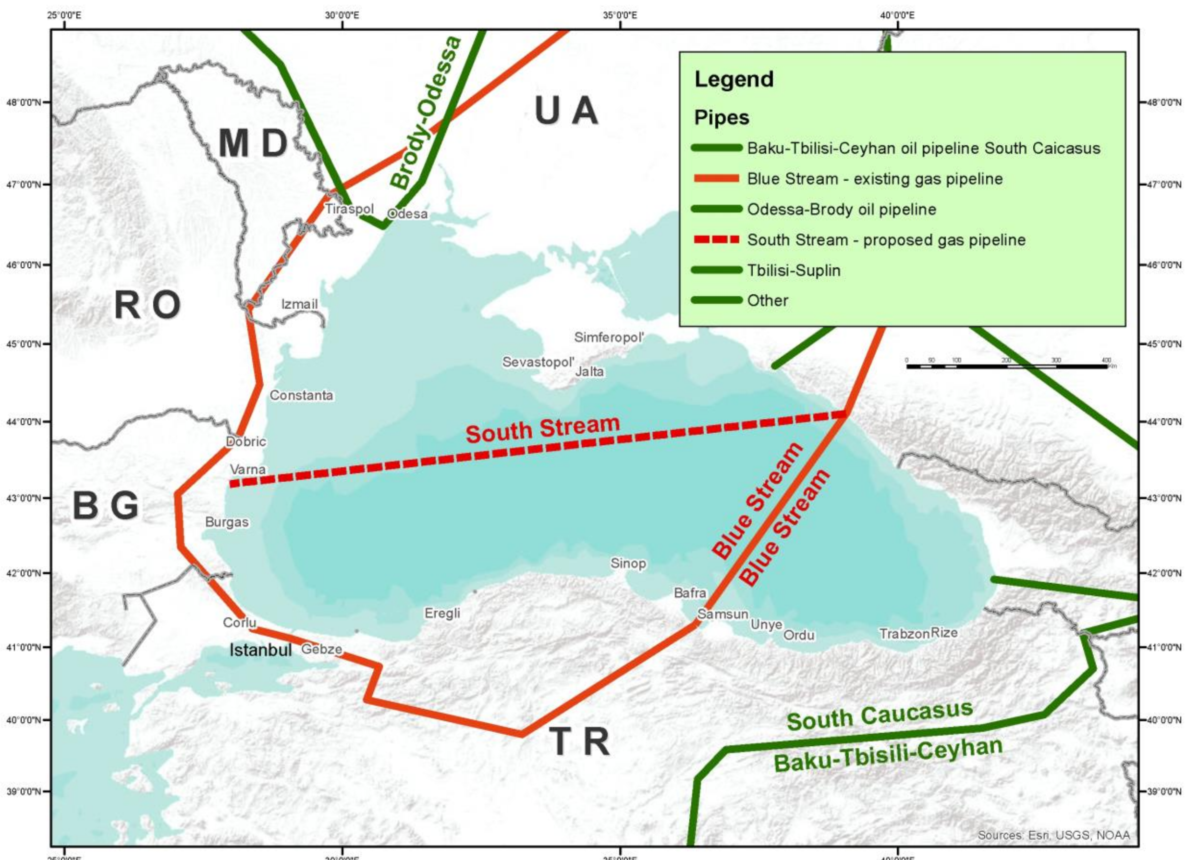


Fig. 3.121 Black Sea region. Oil transport routes *(original map)*

Transiting the Caspian Sea oil might boost port activities and, in many cases, the oil processing industry as well, especially on the western coast, where big refineries are in place. It is particularly the case of Constant port, which is both a gateway towards Europe and a terminal of two European transport priority corridors (IV and VII) of which VII represents Constanta-Rotterdam fluviatile waterway; at the same time, Constanta is the centre of oil industry, having huge oil refinery capacities.

The greater interest shown by Europe's big consumer market for the oil reserves found east of the Black Sea could mean not only the prospective integration of oil traffic into short-and medium-term development programmes (see TRACECA), but also the global integration of the Black Sea into the EU's medium and long-term regional development programmes.

In the course of centuries, Europe has been discovering the worth of the Black Sea. This time, one would expect that its interest be not momentous and limited to one aspect alone, but all-embracing, and materialised into an integrating programme. In the future, Pontus Euxinus could become a factor of cohesion and stability in a complex area plagued by turmoil.

Only one gas pipeline exists at the moment at the Black Sea since 2004, named ad “Blue Stream” and which connects Russia and Turkey directly through an underwater offshore pipeline of 396 km long (Table 3.31). It is considered yet one of the deepest pipelines in the world. It is laid in depths as low as 2.2 km which exceeds the average depths of well-known subsea pipelines.

Table 3.31 Existing submarine gas pipeline at the Black Sea

Linking	**Gas pipeline name**	**Capacity (Gm^3/yr)**	**In service since**	**Underwater (Km)**
Russia–Turkey	Blue Stream	15	2004	396

The Blue Stream gas pipeline cost was of US$3.2 billion, including US$1.7 billion for its submarine segment. The construction costs are passed on to gas consumers, as has been the case with Blue Stream in Turkey. Amongst other values, the Blue Stream pipeline aim was to bring gas from the Caspian area to Europe.

The recent introduction of the Turkish Stream (Turk Stream) pipeline project (2nd March, 2015) aimed as an a alternative gas supply route to the cancelled South Stream pipeline project, looks like a revival of the latter in most respects. Countries that were to be a part of the route of South Stream, are presently drafting plans that have as a basic parameter the introduction of the Turkish Stream and consequent spurs of it to shift gas into Central Europe.

Pipelines in the region (existing and proposed)

The Druzhba pipeline is the world’s longest oil pipeline with 4000 km length reaching Ukraine, Hungary, Poland and Germany. Pipeline was built in 1964 and currently has a capacity of 60 - million tons per year. There are two project proposals with regard to the further extension of the Druzhba pipeline: extension of the northern branch of pipeline to the German North Sea port of Wilhelmshaven and extension of the pipeline to pass through Hungary and Croatia for reaching Adriatic Sea.

The Baku - Tbilisi - Ceyhan pipeline is a 1,768 km long crude oil pipeline from the Azeri - Chirag - Guneshli oil field in the Caspian Sea to the Mediterranean Sea. It connects Baku, the capital of Azerbaijan; Tbilisi, the capital of Georgia; and Ceyhan, a port on the south - eastern Mediterranean coast of Turkey, hence its name. It is operational from 10 May 2006 and is projected to transport 1 million barrels per day.

The Odessa – Brody pipeline (also known as Sarmati a pipeline) is a crude oil pipeline between the Ukrainian cities Odessa at the Black Sea, and Brody near the Ukrainian - Polish border (674 km). There are plans to expand the pipeline to Płock, and furthermore to Gdańsk in Poland.

Blue Stream is a major trans - Black Sea gas pipeline (Fig. 3.122) that carries natural gas from Russia into Turkey. Operating at full capacity delivers 16 bcm per year. The pipeline was built with the intent of diversifying Russian gas delivery routes to Turkey and avoiding third countries. It is planned to build the second leg of pipeline to allow expanding Russian gas export to the south (via Samsun - Ceyhan gas pipeline further to Israel and Lebanon).

South Caucasus Gas Pipeline (Baku – Tbilisi - Erzurum route) is to transport natural gas from the Shah Deniz gas field in the Azerbaijan sector of the Caspian Sea to Turkey. First deliveries of gas started in December 2006. The pipeline is being constructed in the same corridor as the Baku – Tbilisi - Ceyhan oil pipeline in order to minimize the environmental and social impact. The pipeline is 692 – km - long and the annual capacity will be up to 16 bcm, with the potential of being connected to Turkmen and Kazakh producers through the planned Trans - Caspian Pipeline. The first aim of pipeline is to supply Georgia and Turkey. In longer perspective South Caucasus pipeline will supply Europe with Caspian natural gas, including Iran and Turkmenistan, through the planned NABUCCO project, Turkey - Greece and Greece - Italy pipelines.

NABUCCO is a gas pipeline project connecting the Caspian region, Middle East and Egypt via Turkey, Bulgaria, Romania, and Hungary with Austria and further on with the Central and Western European gas markets. The pipeline planned length is 3.900 km and the transport capacity of pipeline will be 31 bcm per year. Another proposed route aiming at the transportation of natural gas from Kazakhstan and Turkmenistan to Central Europe is expansion of Central Asian – Centre gas pipeline, which runs from Turkmenistan via Uzbekistan and Kazakhstan to Russia.

Bourgas-Alexandropoulos oil pipeline (279 km) is a project for transportation of Russian and Caspian oil from the Bulgarian Black Sea port of Bourgas to the Greek Aegean port of Alexandroupoli. It would be an alternative route for Russian oil for bypassing the Bosporus and the Dardanelles. However, in June 2010 it was announced that Bulgaria will not participate in the project to due strong opposition of local population of Bourgas and an environmental impact assessment is needed before making a final decision about the project.

The Pan - European Oil Pipeline is a proposed oil pipeline from Constanta in Romania via Serbia and Croatia to Rijeka and from there through Slovenia to Trieste in Italy (1,856 km). The aim of the pipeline is to bypass Turkish straits in the transportation of Russian and Caspian oil to Central Europe. In Trieste the pipeline will be connected with the Transalpine Pipeline, running to Austria and Germany [10].

Trans - Caspian Pipe line project is a proposed submarine pipeline between city of Turkmenbashy in Turkmenistan and Baku in Azerbaijan and considered as a part of the South Caucasus pipeline and NABUCCO project. Along with South Caucasus and Trans - Caucasus pipelines the Iran - Turkey gas pipeline with extension of 2.577 km is the third essential branch of the NABUCCO project. The construction of pipeline was completed in 2001. In Erzurum the Iran - Turkey pipeline is linked to the South Caucasus pipeline.

Iran - Armenia gas pipeline is a 140 km pipeline between two countries running from Tabriz to Iran - Armenia border. The initial capacity of the pipeline is 1.1 bcm annually, which will be increased up to 2.3 bcm by 2019. The Armenian side plans to lay some more 197 km of the pipe in order to reach the planned amount. The pipeline operation started on December 2006 and was officially inaugurated on 19 March 2007.

AMBO (Trans - Balkan pipeline) project is planned oil pipeline from Bulgarian Black Sea port Bourgas via Former Yugoslav Republic of Macedonia (FYROM) to Albanian Adriatic port Vlore. The 894 - km pipeline is expected to transport 750 000 barrels of oil per day. Trilateral convention on the AMBO project was signed on 31 January 2007.

Fig. 3.122 Map of pipelines in the Black Sea region (existing and proposed)

3.6.3. Fishing areas

According with GFCM provisions, the Mediterranean and Black Sea Statistical Area comprises all the marine waters bounded, to the west, by a line running from a point on the coast of Morocco at

5°36'W longitude, thence due north to the coast of Spain (isthmus of Punta Marroqui) and, to the southeast, by the northern entrance to the Suez Canal. Marine waters include brackishwaters, lagoons and all other areas where fish and other organisms of marine origin are predominant.

Subarea 37.4 comprises the Sea of Marmara, the Black Sea and the Sea of Azov (Fig. 3.123).

- Marmara Sea (Division 37.4.1)
- Black Sea (Division 37.4.2)
- Azov Sea (Division 37.4.3)

In 1989 the Black Sea Subarea 37.4 was subdivided into three divisions on the basis of the following considerations:

1) The species found in the Sea of Marmara are not found in the Black Sea proper. It is misleading for scientific analysis to mix fauna of the Marmara Sea with the Black Sea.

2) Because of the damming of the rivers flowing into the Sea of Azov, salinity had increased markedly. Species composition of the fauna had changed and it was deemed important to monitor the changes in the Sea of Azov.

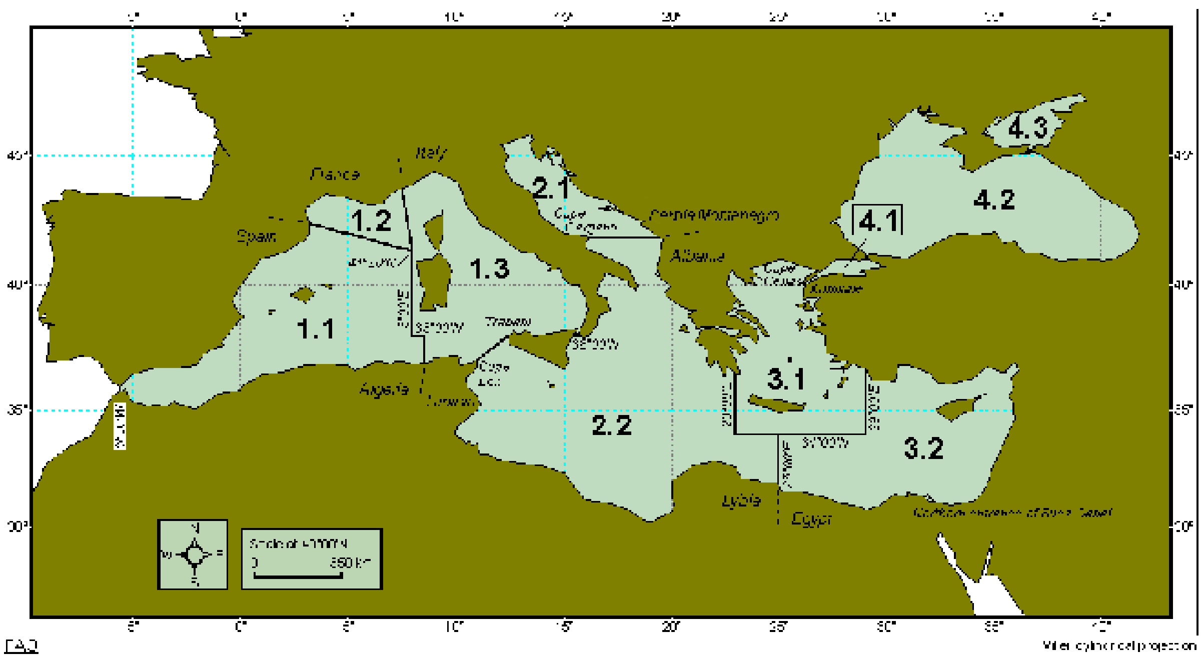


Fig. 3.123 Map of Black Sea (Subarea 37.4)
(source: http://www.fao.org/fishery/area/Area37/en)

Bulgaria

Bulgarian fishing fleet was state owned and operated before 1989. According to the regulations of Government of Bulgaria, fishing operations can only be carried out by the national fleet, with exports being minimal (Duzgunes, 2008) (Fig. 3.124). To meet domestic demand, the Bulgarian national fleet significantly over-fished the Black Sea, and the populations of mackerel, turbot, sprat and anchovies were dramatically declined due to pollution and invasive species. Privatization of the fishing fleet has started in 1989 has caused a decline in the total catch from the Black Sea. Private companies became fully functional by 1999 and the total catch figures rose, but the total catch has significantly declined from 15,419 t in 2002 to 5,434 t in 2005. In case of marine capture fish, production was 9,653 t in 2002 and declined to 3,408 t in 2005. The GoB imposed quotas to prevent over fishing i.e. a quota of 50 t for turbot was set in 2003, but it was not met (40.8 t produced) and decreased to 30 t in 2007. The number of fish farms grew significantly from 127 in 2003 to 204 in 2005 (15.8 million total fingerlings, 2,898 t total fish to 26.2 million fingerlings, 4,165 t total fish, respectively) producing carp (118 farms, 1,313 t), sturgeon (4 farms), game fish (1 farm), trout (59 farms, 1,549 t), polyculture farms (8 farms) and mussel (15 farms, 171 t). Fish consumption per capita is 4.2 kg in 2005.

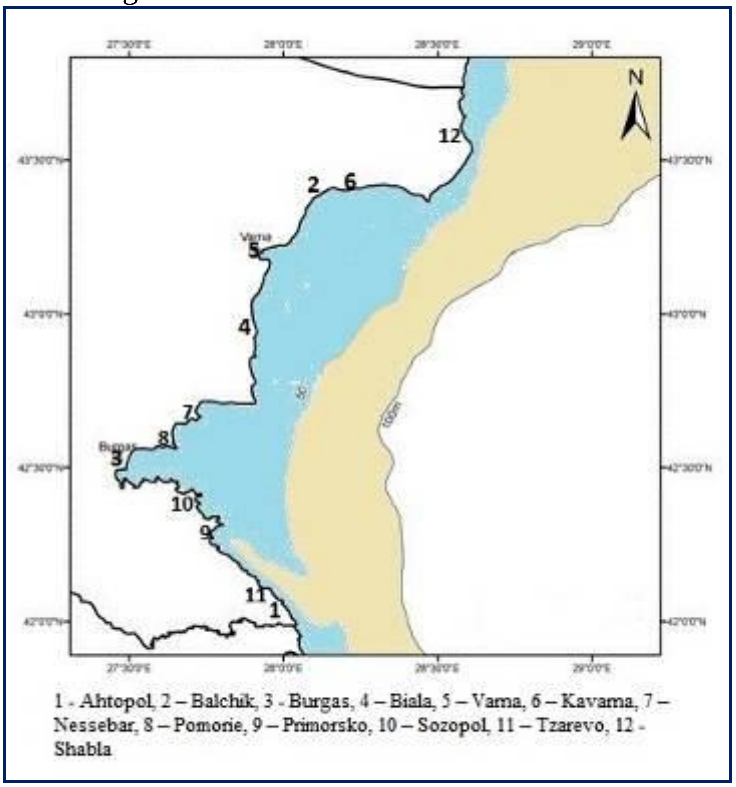


Fig. 3.124 Geographical fishing stations and fishery activity in the Bulgarian sector

Physical losses in Black Sea shelf result from commercial fishing. Fishing with bottom gear (trolling) leads to seabed abrasion, and in particular the vulnerable biogenic substrates (Fig. 3.125). The trawl pressure measured by the ratio between the total length of trawl routes in an area and the area of the zone, allowing to distinguish areas of strong, moderate and weak pressure. Over 50% of the area of the seabed up to 100 m depth in 2011 is under significant pressure from abrasion as a result of intensive fishing. Bottom below 100 m depth is not affected. There are pressures from abrasion due to fishing on the main types of substrates - sand, mussel banks on shelf sediment muds of the upper and lower circalittoral and mixed phaseolin shelf sediments. From the bottom substrates, the biogenic mussel banks are characterized by the highest sensitivity to abrasion, because the habitat-forming species *Mytilus galloprovincialis* and the associated typical representatives of the epifaunal community i.e. develop on the seabed surface and fall under the direct physical impact on the bottom towed fishing gears.

Romania

Romania completed negotiations with EU in the area of fisheries in June 2001, accepting the entire "acquis communautaire" without requesting any derogation or transition periods. Romania is member country of EU since 2007. Fisheries have traditionally been managed by direct restrictions, including seasonal and area closures, minimum mesh size, and access limitations.

In recent years, licensing and individual quota system were introduced as effort-control measures, in order to bring fishing effort more in line with the available resources. Licenses relate to a specific group of species or gear type, and usually delineate the fishing area (Fig. 3.125).

In the Romanian marine shallow coastline, the fisheries are characterized by the activity being carried-out mainly during the first four/seven months of the fishing season (March-October), when the main commercial fish species reach the coastal area for spawning and feeding. During the past years, marine fisheries in the Romanian Black Sea area were restricted to practicing stationary fishing, in the shallow coastal area, using fixed gear such as: uncovered *pound nets, gill nets, longlines, beach seines, cages/traps and handlines.* Fishing is practiced along the Romanian coast using four fishing ports (Sulina, Cape Midia, Constanta and Mangalia) and other 18 small fishing stations, located between *Sulina - Vama Veche*. The fishing depths range between 2 - 20 m and sometimes up to 60 m, when practicing specialized turbot, shad or dogfish fisheries (Nicolaev et al., 2013).

The fishing effort in 2012 continues the trend of reduction reported since 2000. Thus, in 2012, in the case of active fishing (using the mid-water trawl), only one vessel was active and in passive fishing 157 crafts, namely 34 boats (below 6 m), 121 boats (6-12 m), one vessel (12-18 m) and one vessel (18-24 m) were active. In fishing with fixed gear, practiced along the Romanian coast, were used: 22 pound nets, 3,415 turbot gillnets, 585 shad gillnets, 118 goby gillnets, 3 beach seines, 40 mullet gillnets, 160 dogfish gillnets, 252 long liners, 441 cages and 262 handlines;

After a decreasing trend during 2002-2012, 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, and 835 t, in 2012.

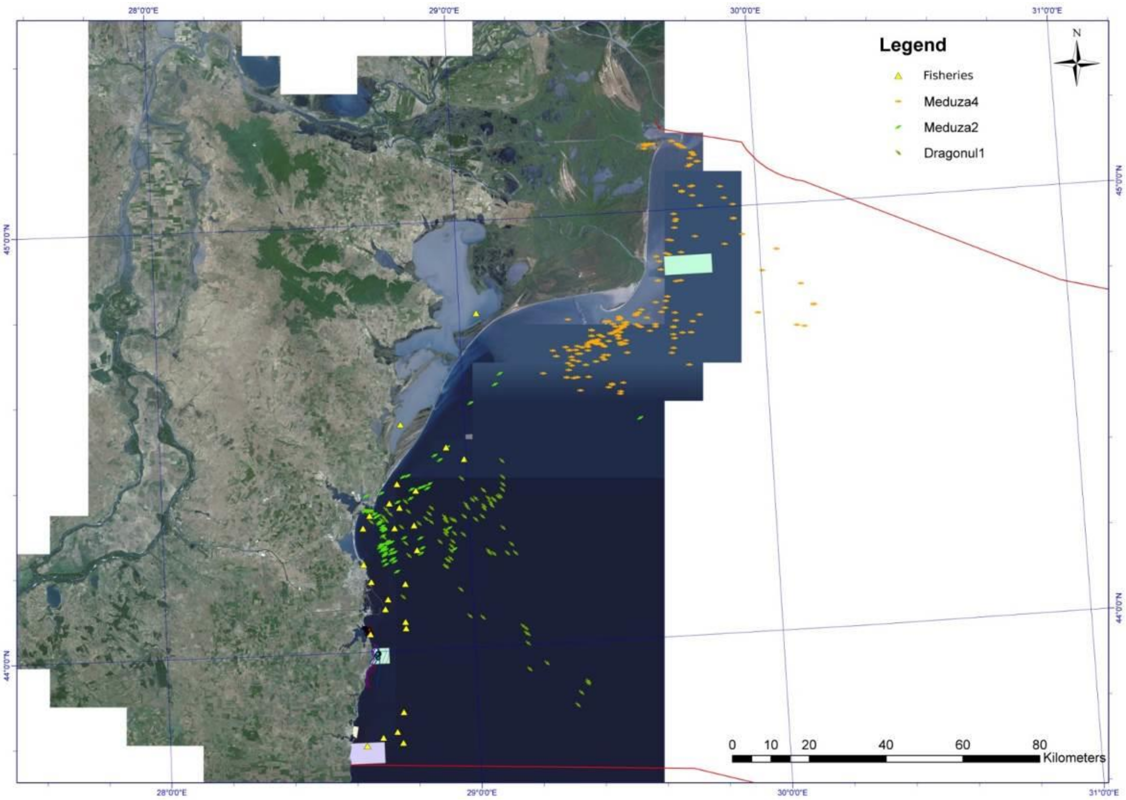


Fig. 3.125 Fishing stations and fishery activity in the Romanian sector

Ukraine

In 1995, Ukraine established its Exclusive Economic Zone (EEZ) in the Black Sea, on the basis of the UNCLOS (Duzgunes, 2008). Biological resources in the Azov Sea form a common resource for the two countries on the basis of the Agreement with the Russian Federation (1993). In 1999, Ukraine ratified the United Nations Convention on the Law of the Sea of 10 December 1982 and in 2002 ratified the Agreement relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (Global Forum on Oceans, Coasts, and Island, 2008). Current problems in Ukrainian fisheries are connected with the general crisis in the economy of the country, following the transition from a centrally-planned to a market economy. The major problems are high costs for supplies of materials and machinery, high credit costs, taxation policy, extremely strict taxation, wrong privatization legislation, absence of circulating assets in enterprises and laws concerning fisheries and aquaculture, criminalization of fisheries business, and shadow turnover of the greater part of the capital. Formation of a competitive environment is still at an early stage. Government support for fisheries as it exists in many countries has not yet been established in Ukraine. Ukraine has no wholesale markets for fish products, so expenses for sale of fish products in the domestic market approach half of total commercial costs. In 1995, Ukraine introduced obligatory certification of canned products, and in 1998 certification became obligatory for smoked, cured and salted fish.

The State Register of Ukraine is responsible for technical surveillance and classification of marine vessels. As fisheries legislation is still developing, private investment in the fisheries sector in Ukraine has been limited.

For ship owners and leasers operating on the high seas, the primary problem is to provide the vessels with the circulating capital for fisheries. Bank credit in Ukraine is very expensive, so the main source of circulating capital is the fish caught.

Until the mid-1990s, Ukraine applied Soviet standards for fish products, their processing, storage, packaging and sale. Starting from 1992, Ukraine has been developing and adopting new standards for fish products, including those aimed at satisfying EU requirements.

Turkey

Turkey is the most important country as to realize maximum fish production from the Black Sea, having a wide range of fisheries infrastructure and legal framework, and long fishing tradition in the region (Duzgunes, 2008). The Ministry of Agriculture and Rural Affairs (MARA) is the main state organization responsible for fisheries (including aquaculture) administration, regulation, protection, promotion and technical assistance (The Ministry of Agriculture and Rural Affairs, 2008). All activities in fisheries and aquaculture are based on the Fisheries Law No. 1380, enacted in 1971. With this law, and its related bureaucracy, definitions were codified. Based on this law, regulations and circulars are prepared to regulate fisheries. The Fisheries Law No. 1380 of 1971 as amended by law 3288 of 1986. According to Laws 1380 and 3288 and Continental Waters Law No. 2674 of 1982, foreigners are not allowed to take part in commercial fishing activities. In accordance with the laws, every year commercial fisheries and sport fishing circulars are published and announced in the official journal about the restrictions for stock control. MARA undertakes its duties in fisheries management through four General Directorates, as well as the District and 81Provincial Directorates.

Control Sections of 81 Provincial Directorates of MARA are responsible for implementing fishing According to the Fisheries Law of 1971 and 1986, licensing both fishermen and their vessels has become compulsory. During the fishing season fishermen can fish in all waters any species by any amount with fewer exceptions as closed areas and gear type in the specific areas which are identified in the annual circular.

Trawling is not allowed in the area within three miles off the coast. Fleet capacity was frozen by not permitting to construct and license new vessels over 12 m in 1991. In 1997, all licensing was stopped for new fishing vessels. However, limited numbers of licenses were granted to fishing vessels for short periods in 1994, 1997 and 2001. No vessel entry into the fleet has been allowed since 2002. New entries are only allowed when a vessel is exiting the fleet. In such cases maximum 20% increase in length is tolerated. Both in case of modification and replacement of vessels, engine power or tonnage are disregarded.

Effective control of fishing effort might be achieved by a development of the current system for licensing of fishermen and boats. Licenses might specify not only a simple permission to fish but also more detailed control measures such as the gear to be used, the areas and periods to be fished, or even the ports at which fish should be landed.

The registration of fishing vessels and fishermen has been conducted in accordance with the FAO standards by Provincial Directorates. The MARA is currently founding a central registry system of vessels at the General Directorate of Protection and Control in Ankara collaborating with Under Secretariat of Maritime Affairs (The General Directorate of Protection and Control, 2008).

The Government of Turkey has improved hygienic conditions in processing plants, raw material and the marketing to improve the quality of fish and fishery products, in line with the EU regulations.

3.6.4 Sea farming sites

Despite the opportunities offered by marine aquaculture, this sector remains undeveloped in the Black Sea: the aquaculture production in 2013 was approx. 200 t in Bulgaria (consisting from different fish species and mussels); in Ukraine it increased from 171 to in 2010, 553 to in 2012 and 927 to in 2013. The total production of the Turkish marine aquaculture sector increased in 2013 to 233,400 to in the Black Sea (trout and sea bass). Since 2007, the European Commission ensured financial support for the Black Sea subgroup of the Scientific Technical Economic Committee for Fisheries (STECF), which provided recommendations for the annual TAC regulation of Romanian and Bulgarian fisheries in Community waters (Nicolaev, 2014).

Bulgaria

Bulgaria has a system of protected areas/aquatories as part of the regional and European network, in accordance with international agreements, to which the State is a party and in accordance with the requirements of Annex IV of the Water Framework Directive. The network includes all drinking water, bathing water and waters for fish and shellfish breeding.

There are designated areas for protection of economically important fish species and other aquatic organisms in accordance with art. 119a, item 4 of the Water Act, such as the areas along the coast: Naturally inhabited by fish species; Breeding areas for shellfish. The zones can be seen on figures below (Fig. 3.126, Fig. 3.127):

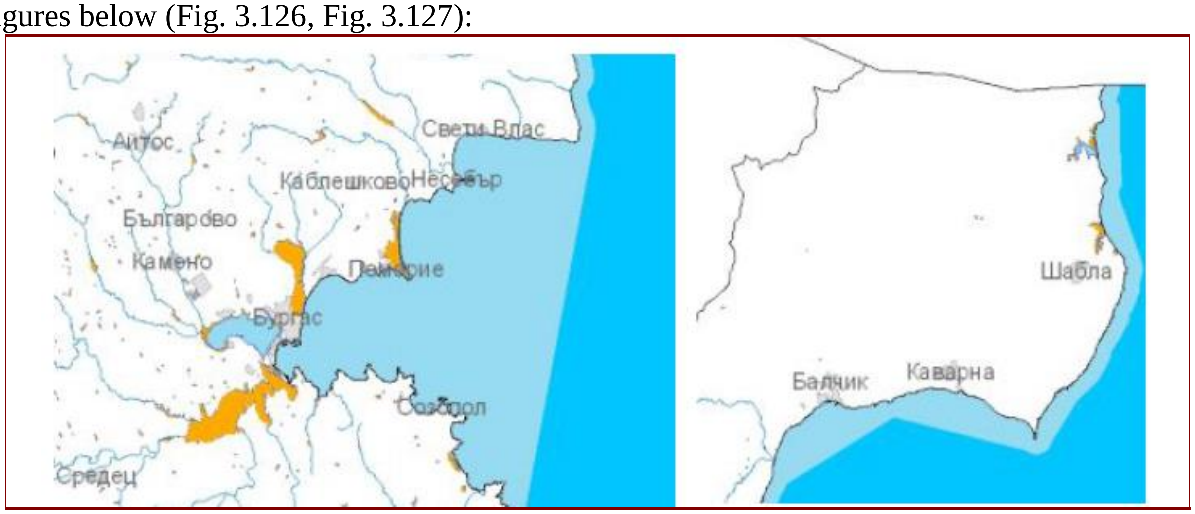


Fig. 3.126 Waters, providing conditions for life and breeding of carp fish (in orange): Water Management Plan in the Black Sea region, BSBD

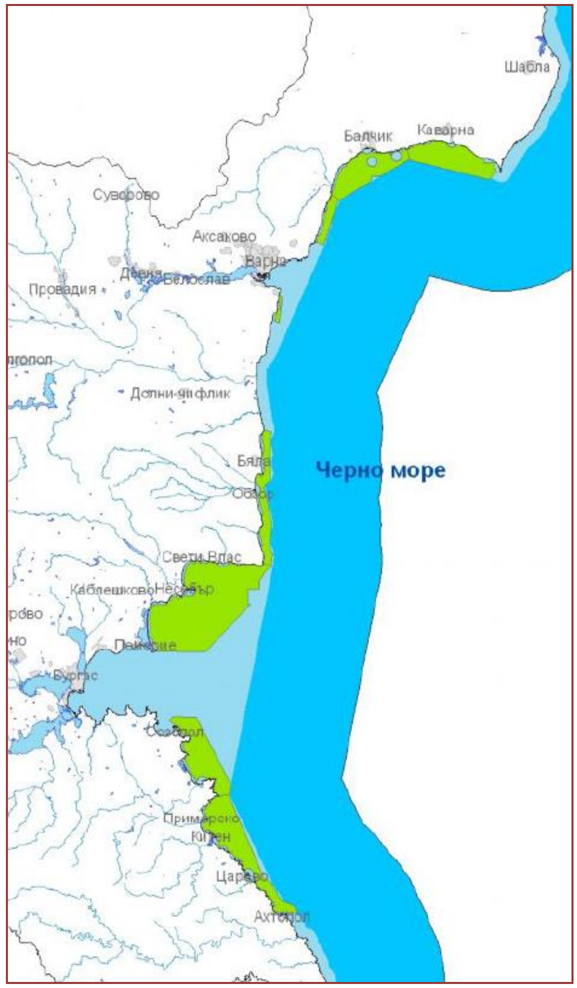


Fig. 3.127 Waters, providing conditions for life and breeding of shellfish (in green): Water Management Plan in the Black Sea region, BSBD

Marine aquaculture facilities include Black Sea mussel farms and farms for production of kelp algae. In 2012, on a total of 388 farms, 347 were for freshwater aquaculture and 41 for marine aquaculture, only 10% of the total number of farms. The main type of marine species cultivated was the black mussel (*Mytilus galloprovincialis*), which represented 746.6 tons of catches, or about 9.9% of the total aquaculture production.

Most of the mussel farms are built next to Kavarna and Kranevo in the Northern part of the Bulgarian Black sea coast and between Sozopol and Primorsko in the Southern part. Their locations Contribution of fishing activities to national economy.

Romania

The fisheries sector includes aquaculture, marine and inland fishing activities, as well as the related processing and marketing activities. Romania's main fishery production component is represented by aquaculture, followed by the inland fisheries (Fig. 3.128). The fisheries activities along the coastline of the Black Sea remain limited compared to the inland fisheries. Most of the areas set up for aquaculture are not appropriate for this activity, especially as they have not been adapted to the requirements of an efficient production process. In the past years, cages, located in lakes, have started to be used for the rearing of valuable species, such as sturgeons. There is also increasing interest for the deveopment of recirculating systems, a farm for turbot rearing being under development close to Constanta with marine water.

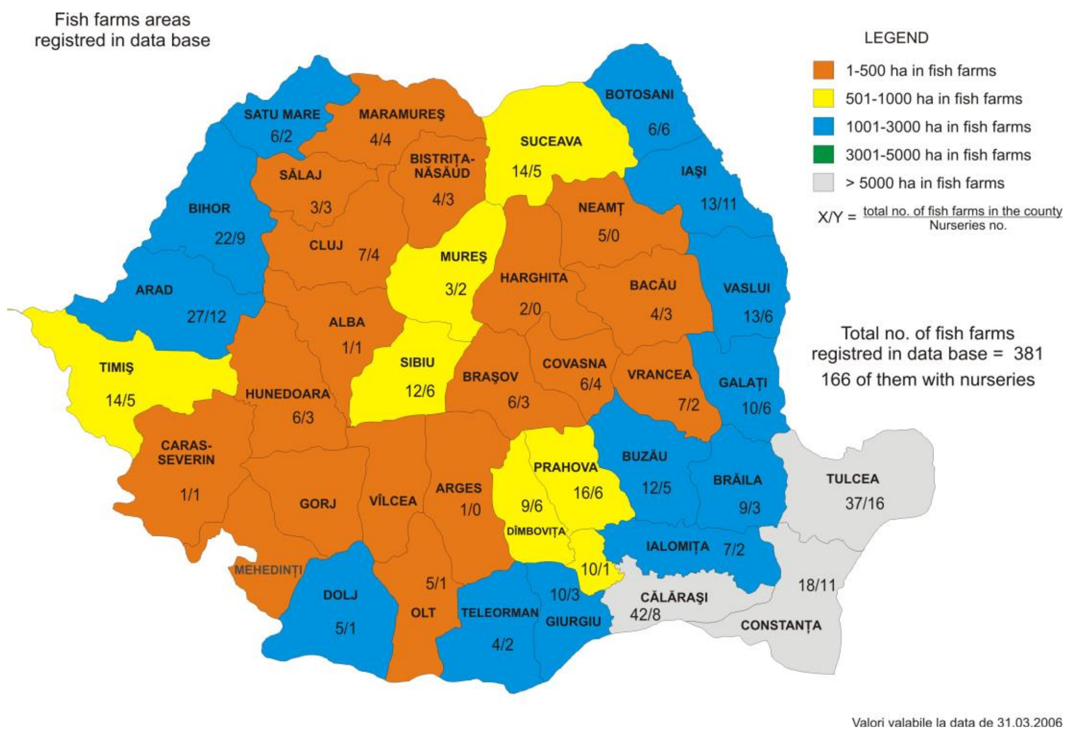


Fig. 3.128 Distribution of the Romanian fish farms
(fish farms/nurseries/each county - registered in the official data base - Romanian NAFA, 2006)

Currently, marine aquaculture in Romania is at its beginnings, a single mussel farm being registered (*Mytillus galloprovincialis*), despite the fact that certain studies suggest that there is interest and there are possibilities for developing this sector. With the view to practicing marine aquaculture, as well as exploiting natural marine mollusc stocks, the implementation of the 79/923/EEC Directive, on the shellfish water quality, was carried out, by identifying four areas suitable for their culture and exploitation (Annex 2 - Areas recommended for rearing and catching molluscs at the Romanian Black Sea) (according to GD no. 467/2006 on the modification of the Technical Regulation on Mollusc Water Quality, approved by GD 201/2002 (Fig. 3.129).

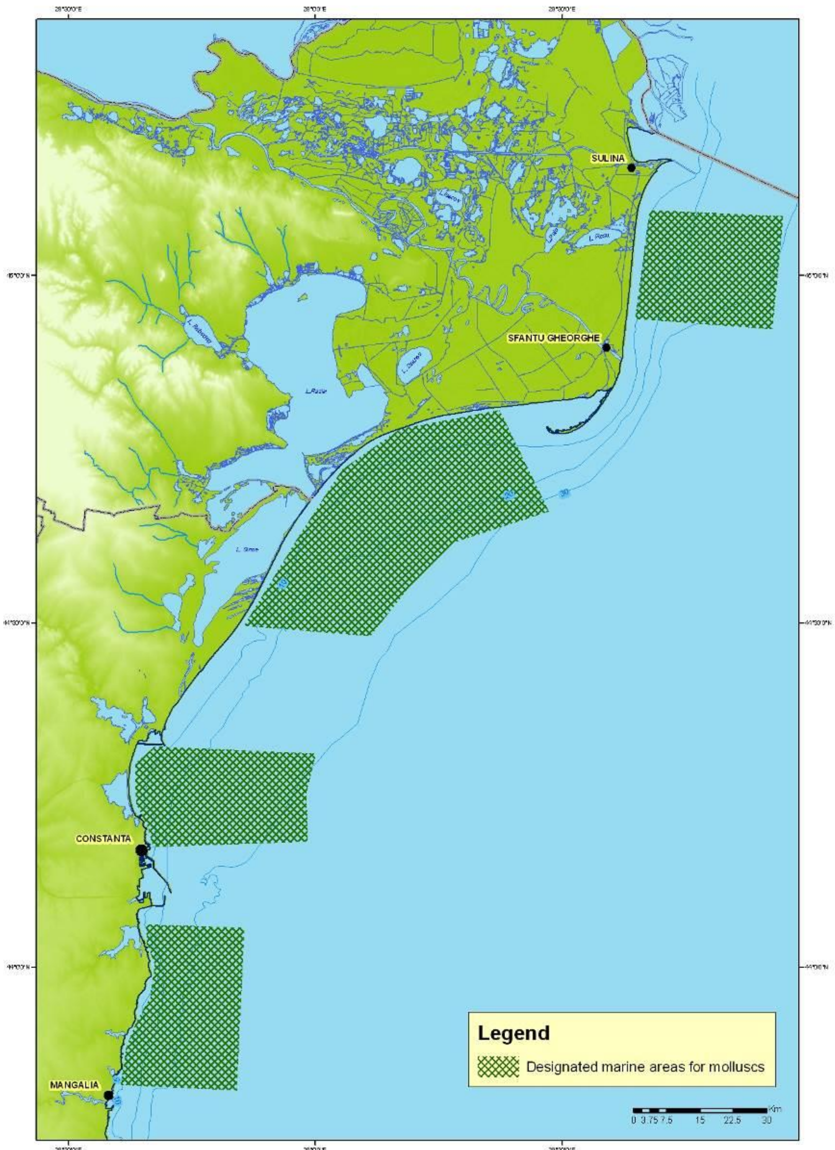


Fig. 3.129 Areas recommended for mollusk rearing and catching at the Romanian Black Sea *(original map)*

Ukraine: the sector is not developed.

***Moldova*:** the sector is not developed.

Turkey

The important species for Black Sea aquaculture include the Black Sea trout, turbot, flounder, sturgeon, European sea bass and mussel (GFCM, 2013)

The Black Sea trout (*Salmo trutta labrax*, Pallas, 1814), also called Black Sea salmon, is one of the best studied species. Some important projects have been implemented for this species:

- Appraisal of the sturgeon and sea trout fisheries and proposals for a rehabilitation programme (1989) (FAO/TCP Project);
- Determination of bio - ecological characteristics and culture possibilities of the Black Sea trout (*Salmo trutta*, Pallas,1814) (1998 - 2002);
- Culture of Black Sea trout and its use of releasing (2002 -2007);
- Detecting genetical structure of brown trout (*Salmo trutta*) population in Turkey (2003 -2007);
- Introduction of the Black Sea trout (*Salmo trutta labrax* Pallas, 1814) in the private sector (2007-2009);
- Determination of nutritional requirements for the Black Sea trout (*Salmo trutta labrax*) (2010 - 2013).

In this region, the Black Sea trout is farmed in open – flow - system ponds. At CFRI the recirculation system for raising trout is used also for the European seabass (*Dicentrarchus labrax*).

Turbot

The capture fisheries of turbot (*Psetta maxima*) in the Black Sea is declining. The first study on turbot "Fish Culture Development in the Black Sea" dates back to 1997 and was carried out by CFRI in collaboration with the Japanese International Cooperation Agency (JICA). This is still the ost important research and development project on aquaculture in Turkey. The project led to important developments in the aquaculture of this species by the private sector. Turbot seeds were transferred to a number of farms located in the Aegean Sea in collaboration of JICA and the Mediterranean Research Institute. Training on turbot farming was delivered to the private sector and academic institutions. Turbot is normally reared in open-flow system tanks, whilst cage systems, commonly used in the Black Sea, are not suitable for this species.

Flounder

CFRI has been undertaking studies on flounder such as "Investigation on bio-ecological properties and aquaculture possibilities of flounder (*Platichthys flesus luscus*, Pallas, 1811)". The study includes the following activities: identification of bio-ecological and genetic characteristics of flounder; adaptation to the hatchery environment; the identification and development of juveniles; and recruitment and cultivation techniques. At CFRI flounder is farmed in open-flow systems of tanks.

Sturgeon

The number of sturgeons species had decreased to four (*Huso huso*, *Acipenser gueldenstaedtii, Acipenser stellatus, and Acipenser sturio*) by the end of the 1980s (Edwards and Doroshov, 1989)

Since 2000 CFRI has been working with the Universities of Istanbul and Sinop to reconstitute sturgeon broodstocks. Concurrently studies on the Black Sea sturgeon populations, habitats, genetic structure, and protection have been carried out. Awareness campaigns on the protection of sturgeon were also launched. As a result, at present four species of sturgeon including *H. huso, A. gueldenstaedtii, A. stellatus* and *A. baerii* can be found in Turkey.

Fishing quotas for each species in terms of fish size have been in place since 1996, and five countries riparian to the Black Sea have banned open - sea fishing of sturgeon. Activities of stock enhancement of sturgeon have been performed in Turkey: the FAO project "Recovery of sturgeon population in Turkey: habitat assessment and restocking" (TCP/TUR/3202 - D) was implemented in 2008 -2010. Within this project, one kg of *A. gueldndseadtii* and one kg of *A. stellatus* fertilized eggs were imported from Krasnodar (Russian Federation) and hatched in the hatchery in Amasya city in Turkey. Sturgeons were farmed using the open - flow systems in ponds.

Mussel: Within a cooperation framework between CFRI and the Institute for Marine Resources and Ecosystem Studies (IMARES), a preliminary study on "Black Sea Mussel Farming" is planned to be carried out.

3.6.5 Nature conservation sites

A natural protected area is "a land, underwater or underground area, with a legally set perimeter and a special protection and conservation regime, where plant and animal species, geographical, landscape, geological, paleontological, speological or any other type of feature or item, with a special ecological, scientific or cultural value, are present".

The aims and management regime of natural protected areas comprised in the national natural protected area network in Romania (as defined in compliance with the IUCN - International Union for the Conservation of Nature - terms of reference) are the following:

- **scientific reserves:** only scientific activities are allowed herein, with the consent of the competent scientific body. These reserves correspond to IUCN (International Union for the Conservation of Nature) Category I - "Strict natural reserve: protected area managed mainly for scientific purposes";
- **national parks:** the management regime is set by in-house protection and conservation regulations and plans, approved by the entitled national scientific and administrative authorities. National parks correspond to IUCN Category II - "National park: protected area managed mainly for ecosystem protection and leisure";
- **natural monuments:** the management thereof is made pursuant to a strict protection regime ensuring the conservation of specific natural features. Depending on their degree of vulnerability, people's access may be limited or not. Monuments of nature correspond to IUCN Category III - "Natural monument: protected area managed mainly for the conservation of specific natural features";
- **natural reserves:** the management thereof is made in a differentiated manner, in respect to their characteristics, by active management measures to ensure the conservation of habitats and/or the protection of certain species, groups of species or biotic communities. Apart from scientific activities, as the case may be, organized tourism or education activities may be allowed. These reserves correspond to IUCN Category IV, namely management area of habitats/species (Fig. 3.130);

- **natural parks:** the management thereof aims at preserving the harmonious interaction between man and nature by protecting the habitat and landscape diversity, promoting the conservation of traditional land uses, encouraging and strengthening the traditional activities and practices of local populations. They correspond to IUCN Category V - "Protected landscape: protected areas managed mainly for landscape conservation and leisure";
- **biosphere reserves:** the management thereof is made in compliance with in-house regulations and protection and conservation plans, pursuant to the recommendations of the "Man-Biosphere Program", under the auspices of UNESCO (Fig. 3.131);
- **wetlands of international importance:** the management of these areas is aimed at their conservation and the sustainable use of the biological resources they generate, pursuant to the provisions of the Convention on the Conservation of Wetlands of International Importance, mainly as habitat of waterfowl (Fig. 3.133);
- **world heritage natural sites:** the management thereof is made pursuant to in-house regulations and protection and conservation plans, in compliance with the provisions of the Convention on the Protection of the World Cultural and Natural Heritage, under the auspices of UNESCO;
- **Special Areas for Conservation (SACs):** designated for the conservation of natural habitats and habitats of species listed in Annexes 2, 3 and 4 of GEO no. 57/2007 on the regime of natural protected areas, the conservation of natural habitats, wild flora and fauna, as subsequently amended and supplemented. These special areas for conservation are included in the NATURA 2000 European network, after their status was acknowledged by the European Commission (Fig. 3.132);
- **Special Protection Areas for birds (SPAs):** are designated pursuant to the provisions of Directive 79/409/EEC on the conservation of wild birds and are included in the NATURA 2000 European network after their status was acknowledged by the European Commission (Fig. 3.133).

Natural reserves and natural monuments
National and natural parks

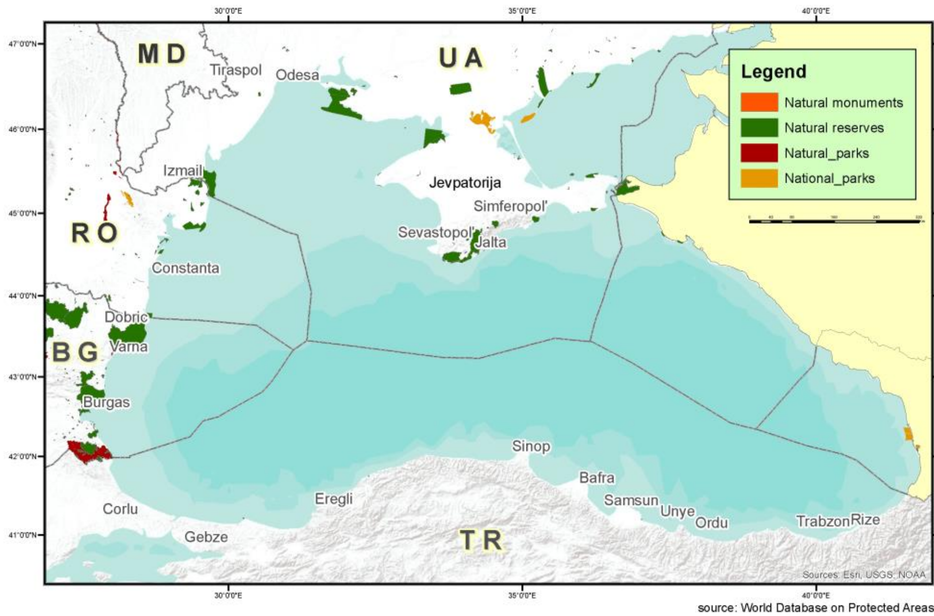


Fig. 3.130 Natural reserves and natural monuments around the Black Sea *(original map)*

Ramsar sites
Wetlands of International importance

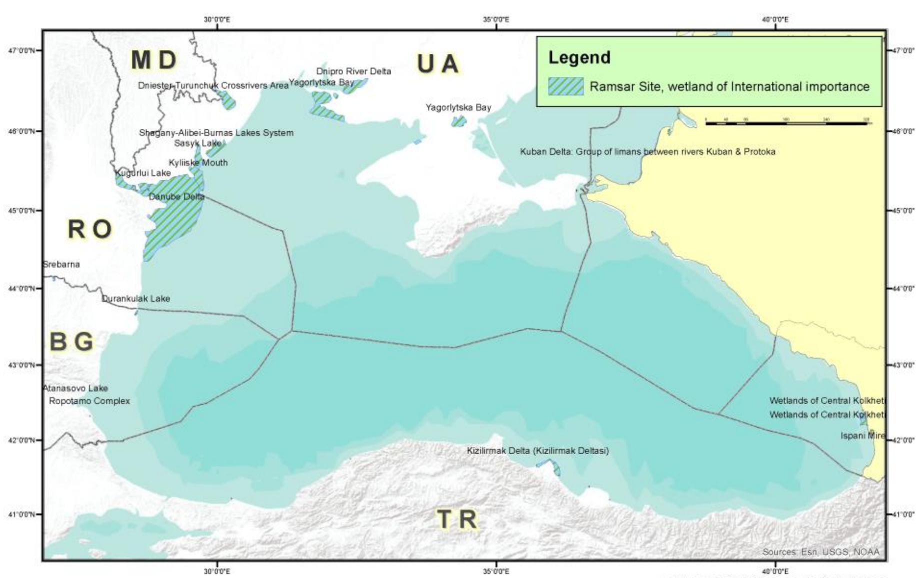


Fig. 3.131 Wetlands of international importance (Ramsar) around the Black Sea *(original map)*

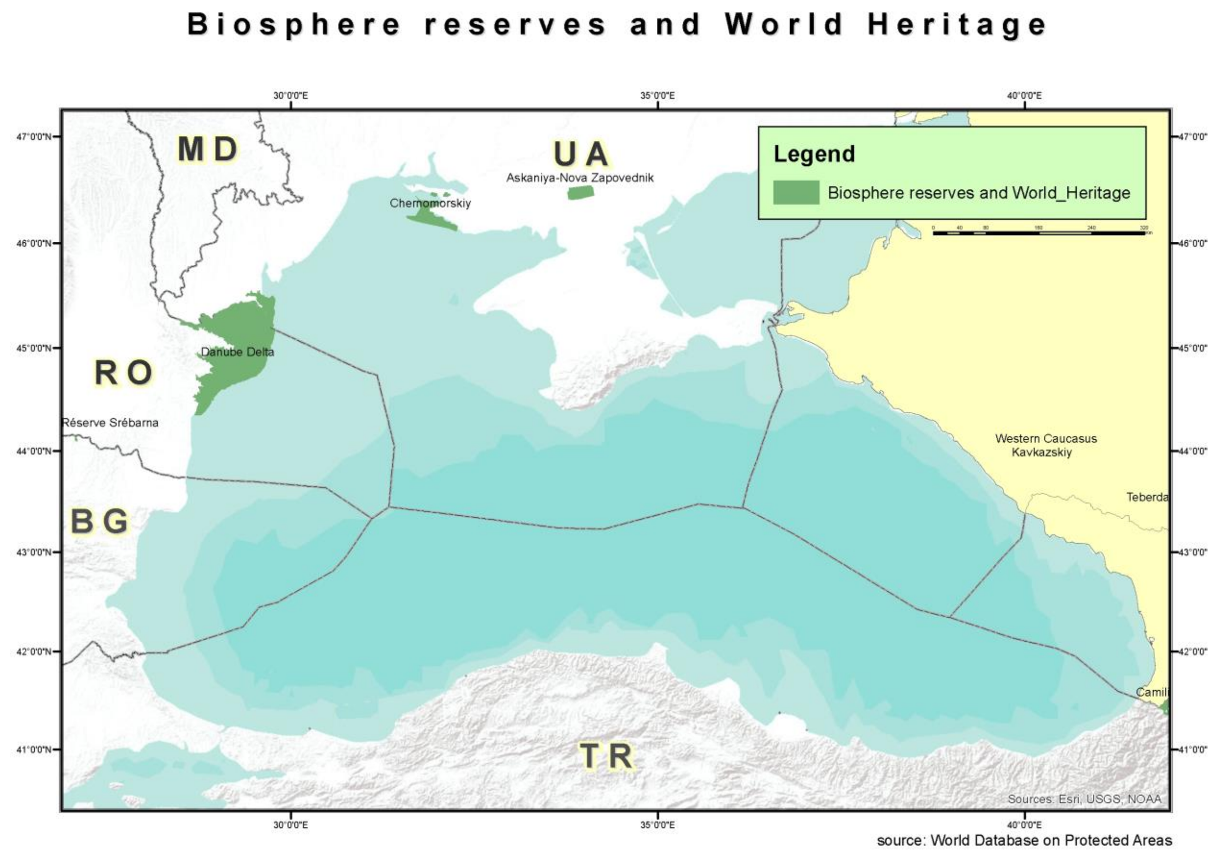


Fig. 3.132 Biosphere reserves and world heritage sites around the Black Sea
(original map)

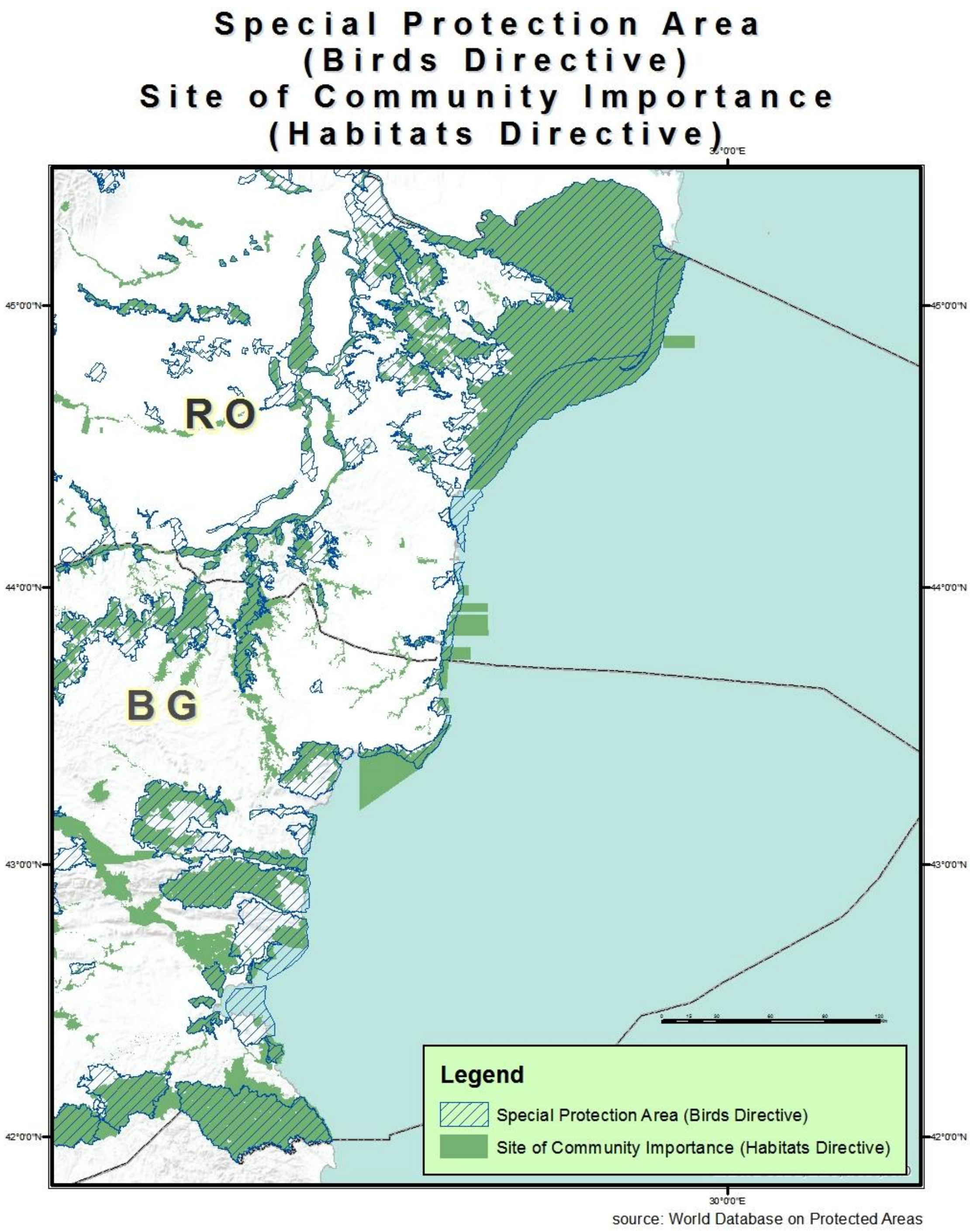


Fig. 3.133 Special Protection Areas (Birds Directive) and Sites of Community Importance (Habitats Directive) in Black Sea EU member states (Romania and Bulgaria)
(original map)

Bulgaria

The criteria for selection of sites for designation of MPAs are based on relevant national (Protected Areas Act and Biodiversity act) and international Acts (Council Directive 92/43/EEC on the conservation of natural habitat and of wild flora and fauna; Convention on the conservation of European wild life and natural habitats, Bern, 1979; IMO Resolution A.982 (24) for the identification and designation of particularly sensitive sea areas, 2005 and a number of IUCN guidelines for MPAs designation and management (Kelleher G. & Kenchington R., 1992; EC, 2000; Saim *et al.* 2000).

Lake of Durankulak

Lake of Durankulak has the following National and international protected status:

- Wetland of international importance under the Ramsar Convention, size - 350 ha;
- Important Bird Area designated by BirdLife International, size - 3355.90 ha;
- Protected area (under the Protected Areas Act), size - 446.50 ha;
- Protected zone “Lake of Durankulak” BG0000154, protected zone under the Habitats Directive, overlapping the protected zone under the Birds Directive, size - 5050.8 ha, including the marine area of 3737,6 ha;
- Protected zone “Lake of Durankulak” BG0002050, protected zone under the Directive on the conservation of wild birds, overlapping part of a protected zone under the Habitats Directive (size - 3355, 98 ha); Order № РД-258, dated March 16th, 2010.

The lake of Durankulak is located in the northeastern part of Bulgaria and is a firth coastal freshwater to brackish lake of natural origin with significant fouling of water vegetation. It is surrounded by farmland, heaths, sand dunes and beach (separating the lake from the sea). The lake has two islands, one of which is an archaeological site. The lake is fed by groundwater and rain water. There are 260 bird species in the lake of Durankulak and the nearby areas, as 72 species are included in the Bulgarian Red Book (1985). 110 species are of European conservation concern (SPEC) (BirdLife International, 2004): 14 species as globally threatened in category SPEC1 and 27 threatened in Europe species in category SPEC2.

The lake of Durankulak is a place of global importance for winter waterfowl, mainly due to large concentrations of geese. Almost the entire world population of red-breasted geese (*Branta ruficollis*) resides in the area of lakes of Shabla and Durankulak during the months of January and February. The globally threatened lesser white-fronted goose (*Anser erythropus*) is regularly found in the area. The lake is one of the places with large concentrations of mallard (*Anas platyrhynchos*) during the winter. Plovers (*Gavia stellate*), maiden crane (*Antropoides virgo*) and little bustard (*Tetrax tetrax*) have been seen during the last five years. The lake is of the most important stopover locations during the migration along the Bulgarian Black Sea coast. It is a stopover for the great white pelican (*Pelecanus onocrotalus*), pygmy cormorant (*Phalacrocorax pygmeus*), and some greater spotted eagle (*Aquila clanga*). The lake is one of the most important breeding sites in the country for the purple heron (*Ardea purpurea*), kentish plover (*Charadrius alexandrines*), marsh harrier (*Circus aeruginosus*), pratincole (*Glareola pratincola*), little crake (*Porzana parva*), little tern (*Sterna albifrons*) and red-footed falcon (*Falco vespertinus*). The lake is the main nesting area along the Bulgarian Black Sea coast of the globally threatened ferruginous duck (*Aythya nyroca*).

Smaller groups of threatened and rare birds nest in the area aswell: great bittern (*Botaurus stellaris*), stone curlew (*Burchinus oedicnemus*) and tawny pipit (*Anthus campestris*).
The following coastal habitats are preserved in the protected zone:
1210 Annual vegetation of drift lines;
2130 * Fixed coastal dunes with herbaceous vegetation (gray dunes);
2120 Shifting dunes with Ammophila arenaria along the coastline (white dunes);
2110 Embryonic shifting dunes;
1410 Mediterranean salt meadows.
The marine protected zone covers offshore area and bays with size 3737,6 ha, 74% of the area.

Lake Complex of Shabla

The Lake Complex of Shabla has the following National and international protected status:

- Wetland of international importance under the Ramsar Convention
- Important Bird Area designated by BirdLife International launched from an area 3195,44 ha
- Protected area (under the Protected Areas Act) with area 510.80 ha
- Protected zone “Lake Shabla - Ezerets” with code BG0000621 under Directive 92/43/EEC on the conservation of natural habitats and wild fauna and flora - size 2623, 53 ha including marine area of 1679,1 ha
- Protected zone “Lake complex of Shabla” with code BG0000156, determined in accordance with the requirements of Directive 79/409/EEC on the conservation of wild birds - size 3195.44 ha of which 664.56 ha marine area /Order № РД-258, dated March 16th, 2010.

The lake complex consists of the lakes of Shabla and Ezeretsko, and Shablenska Tuzla, situated over Sarmatian limestones in northeastern Bulgaria, 5 km northeast of the town of Shabla. The lake is separated from the sea by 30-50 m sandy beach on the east. The Shablenska Tuzla is a brackish lagoon, separated from the sea by high dunes. The lake shores are covered vastly with cane (*Phragmites australis*) with some lesser bulbrush (*Typha angustifolia*), broadleaf cattail (Typha latifolia), greater sedge (*Carex riparia*), etc.

There are 260 bird species on the territory of the lake complex, as 70 spieces are included in the Bulgarian Red Book (1985). 111 species are of European conservation concern (SPEC) (BirdLife International, 2004): 13 species as globally threatened in category SPEC1 and 26 threatened in Europe species in category SPEC2.

The lake complex, together with the lake of Durankulak, is of strategic importance for the globally threatened red-breasted goose (*Branta ruficollis*), as almost the entire world population spends the winter in the area. Large concentrations of white-fronted goose (*Anser albifrons*) and a few species of the globally threatened lesser white-fronted goose (*A. erythropus*) are observed in the area during the winter season. The lake is one of the places in the country with significant concentration of whooper swan (*Cygnus Cygnus*), mallard (*Anas platyrhynchos*) and pygmy cormorant during the winter.

The following globally threatened species are observed in the lake complex during the autumn and winter migration: Dalmatian pelican (*Pelecanus crispus*), pygmy cormorant

(*Phalacrocorax pygmeus*), lesser white-fronted goose, ferruginous duck (*A. nyroca*), white-headed duck (*Oxyura leucocephala*) and greater spotted eagle (*Aquila clanga*). The complex is a nesting place for two globally threatened species – the ferruginous duck (*Aythya nyroca*) and corncrake (*Crex crex*). The lake is one of the most important breeding places in the country for the Kentish plover, collared pratincole (*Glareola pratincola*), black-winged stilt (*Himantopus himantopus*), little tern (*Sterna albifrons*) and red-footed falcon (*Falco vespertinus*).

Fishing is allowed only in a limited section of the territory.

The following coastal habitats are preserved in the protected zone: 1210 Annual vegetation of drift lines; 1150 *Coastal lagoons; 2110 Embryonic shifting dunes; 1410 Mediterranean salt meadows.

The marine protected zone covers offshore area and bays with size1679,1 ha, 64% of the area.

Kaliakra

Kaliakra has the following National and international protected status:

- Two reserves - natural reserve "Kaliakra" (713.70 hectares) in the lands of Balgarevo village and the archaeological reserve "Yailata" in the lands of Sveti Nikola village;
- Protected area Taukliman (89.500 ha);
- Important Bird Area designated by BirdLife International (16,172.28 ha);
- CORINE site "Kaliakra";
- Protected zone under Directive 92/43/EEC on the conservation of natural habitats and wildlife and the Habitats Directive - Kaliakra complex BG0000573 (344,128.26 ha);
- Protected zone "Kaliakra", code 0002051 BG under Directive 79/409/EEC on the conservation of wild birds (16 172.28 ha);
- Salt lake Balchishka Tuzla (9 ha), used for mud treatment and medical clay production.

Kaliakra covers the eastern part of the Dobrudzha plateau around Cape Kaliakra, the coastal line, and the adjacent shallow marine area of Cape Shabla near the town of Kavarna. The coast is characterized by steep cliffs with caves and rock crevices. The most preserved and last remaining steppe habitats in Bulgaria are located in the area.

The territory of Kaliakra is habitation for forty species of rare, threatened and endemic plant species and subspecies, 8 rare or threatened species in Europe, and 20 species listed in the Bulgarian Red Book, as 10 are with status "threatened".

Annex II of Directive 92/43/EEC on the protected areas includes 18 mammal species, 6 amphibian and reptile species, 4 fish species, 9 invertebrate species.

310 bird species, as 95 of them are of European Union concern and listed in Annex 1 of Directive 79/409 are found in the territory of Kaliakra.106 species are of European conservation concern (SPEC) (BirdLife International, 2004): 17 species as globally threatened under category SPEC1 and 21 threatened in Europe species under category SPEC2. The area is inhabited with numerous typical steppe species - stone curlew (*Burhinus oedicnemus*), greater short-toed lark (*Calandrella brachidactyla*) and calandra lark (*Melanocorypha calandra*), 4 wheatear species, and pink starling (*Sturnus roseus*). Almost the whole Bulgarian breeding population of pied wheatear (*Oenanthe pleshanka*) is concentrated in the area. The rocky coasts are inhabited by the only Bulgarian colony of European shag (*Phalacrocorax aristotelis*). Various predatory birds are connected with the open biotopes, such as the long-legged buzzard (*Buteo rufinus*), common kestrel

(*Falco tinunculus*), Eurasian hobby (*Falco subbuteo*), levant sparrowhawk (*Accipiter brevipes*), Eurasian eagle-owl (*Bubo bubo*), etc. This area is an important migration location for considerable number of soaring birds: storks, pelicans and cranes, as well as over 3,000 raptors, including the globally threatened species pallid harrier (*Circus macrourus*), saker falcon (*Falco cherrug*) and imperial eagle (*Aquila heliaca*).

The marine section of the zone covers 43,747.8 ha. The coast and the adjacent underwater coastal slopes are steep and composed of cavernous limestone which is resistant to wave abrasion. The rocky bottom extends approximately 350 m from the shoreline followed by sandy bottom with predominantly lesser sand fraction (up to 1000-1500 m from the shoreline). The deeper areas contain sandy silt and silt materials. The rocky bottom is the typical habitat for the molluscs *Pholas dactylus* and *Barnea candida*.

Underwater meadows of the sea grass *Zostera noltii* are common for the wave-protected coastal areas west of cape Kaliakra (Kavarna, Byalata laguna), as the constructed jetties and piers create favorable conditions for sea grass. The rocky reefs (habitats 1170) are characterized with various biotopes, including the perennial *Cystoseira* algal communities on the infralittoral rocky bottom which is of high conservation significance. The *Phyllophora crispa* can be found in the lower infralittoral. Another widely spread habitat (subhabitat of 1170) are the *Mytilus galloprovincialis* beds on the sediment.

The marine area east of Cape Kaliakra (Tyulenovo village) is a habitat of *Clupeidae* fish, including a migratory corridor to the breeding and nurturing grounds in the Danube region. The marine area is with high significance for *Cetaceans* - *Phocoena phocoena* and *Tursiops truncatus*, which is a stopover during their trophic migrations.

Batova complex with the Baltata reserve and the Zlatni Pyasatsi nature park

The Batova complex has the following National and international protected status:

- Baltata nature reserve;
- Zlatni Pyasatsi nature park;
- Protected zone “Batova” for wild birds conservation (code BG0002061), under art. 6, para 1, item 3 and 4 of the Biodiversity Act;
- Protected zone ”Batova Valley” (code BG0000102), under art. 6, para 1, item 1 and 2 of the Biodiversity Act (protection of nature habitats and wild flora and fauna).

The Batova Complex and the Zlatni Pyasatsi nature park are located in northeastern Bulgaria, north of Varna, along the Batova river and most of Frangensko plateau including the coastline of Albena, Golden Sands and the adjacent shallow marine area. The site is characterized with several habitat types, as the largest ones are deciduous forests of oak (*Quercus cerris*), Hungarian oak (*Q.frainetto*), hornbeam (*Carpinus betulis*) and the cultivated lands. Balata reserve is located in the area of the Batova river mouth which contains natural dense forest, marsh and swamp hygrophyte formations. The dense forest consists of mainly narrow-leafed ash (*Fraxinus oxycarpa*), field elm (*Ulmus minor*), *Quercus pedunculiflora*, field maple (*Acer campestre*) and black alder (*Alnus glutinosa*) in combination with mesophilic and hygrophyte grass vegetation (Bondev 1991). Vines and climbing plants such as clematis (*Clematis vitalba*), *Smilax excelsa*, silk vine (*Periploca graeca*) are typical for the forest.

The Batova Complex comprises of different habitat types, characterized as typical for forest species and waterfowl. 184 bird species are found in the area with 50 species included in the Bulgarian Red Book and 80 species European conservation concern: 17 species under category SPEC1 and 24 threatened in Europe species under category SPEC2. There are three routes for migratory birds, gathering together over Batova Valley. The biggest concentration of migratory white pelicans (*Pelecanus onocrotalus*) and cranes (*Grus grus*) in Bulgaria are registered in this area.

The Zlatni Pyasatsi nature park (since 1943) is the largest protected area in the region with the purpose of preserving plant and animal species and their communities together with typical landscapes. The park is designated as a CORINE site in 1998 due to its European concern for the preservation of rare and threatened habitats. This area was designated as Important Bird Area by BirdLife International in 2005.

Marine protected zone Aladzha bed, BG 0001500, 669.64 ha

Aladzha bed is a protected nature habitat for:

1110 - sand and silty shallows constantly covered with sea water

Sandbanks are constantly, slightly covered with sea water.

1170 - Rocky seabed with brown, red and green algal communities Reefs

Species referred to in Article 4 of Directive 2009/147/EC and listed in Annex II of Directive 92/43/EEC and site evaluation for them :

4125 Alosa immaculata
4127 Alosa tanaica
Alosa caspia
Alosa pontica
1351 Phocoena phocoena
1349 Tursiops truncatus

Aladzha bed is one of the biggest in the Bulgarian Black Sea and contains more than 3% of the national rock reefs. It is located along the coast against the Golden Sands and Riviera beach, at a distance of 400 m to 2100 m from the shoreline, with length of 4 km and a width of up to 1.5 km. Aladzha bed is represented by the biotope "Infra- and circalittoral rocks and overgrowth of the mussels *Mytilus galloprovincialis* and *Mytilaster lineatus*", a subtype of habitat 1170. The mussel overgrowth has 100% coverage of the rocky bottom. The concomitant attached and mobile invertebrate fauna is highly diverse. Aladzha bed is important for the connection between the reefs from southern and northern Black Sea coast into a network of marine protected areas.

The environmental importance of the bed is due to its character as a natural biofilter of the Golden Sands resort coastal waters and as a larvae donor for restoration of mussel colonies on other rock reefs, affected by the invasion of *Rapana venosa*. A lot of methane sources are found in the bed area.

Galata

Galata has the following national and international protected status:

- Protected zone under Directive 92/43/EEC on the conservation of natural habitats and wildlife - Galata (BG0000103), 1623.72 ha, mainly marine area
- Protected zone Galata (BG0002060), under Directive 79/409/EEC on the conservation of wild birds, 8136.74 ha.

- Declared as an Important Bird Area by Bird Life International
- Protected area "Liman" and protected area "Rakitnik"

Galata is situated on a limestone plateau, cut by the deep gulleys of several rivers. The coast is characterized with soil and rock steep slopes and landslides with sandy beaches and coastal forests in the southern lower part. The main habitat in the protected area for conservation of birds are deciduous oak (*Quercus cerris*) and Hungarian oak (*Quercus frainetto*) forests, occupying half of the total area.

Galata supports 178 bird species, 34 of which are listed in the Bulgarian Red Book (1985), 75 species are of European conservation concern (SPEC) (BirdLife International, 2004), 1 globally threatened species under category SPEC 1 and 22 threatened in Europe species under category SPEC 2. Galata includes the longest and still untouched coastal line of the Bulgarian Black Sea, thus considered as one of the most important sites in the country for the Mediterranean shearwater (*Puffinus yelkouan*) and its supposed breeding site. Large concentration of seagulls and tarrocks, including the slender-billed gull (*larus genei*), sandwich tern (*Sterna sandvicensis)* and common tern (*Sterna hirundo*) can be found on the coast during the breeding and migration season. Some Eurasian spoonbills (*Platalea leucorodia*) and glossy ibis (*Plegadis falcinellus*) can be found in the area. The coastal rock and steppe-like habitats support significant breeding population of the pied wheatear (*Oenanthe pleshanka*).

In the protected zone under the Habitat Directive BG0000103 with marine area of 1455.95 ha are conserved: four types of marine habitats (shallows, silty-sand coastal areas, extensive shallow bays and reefs), two types of coastal habitats (annual vegetation of coastal drift lines and embryonic shifting dunes), one freshwater habitat (such as natural eutrophic lakes) and two types of terrestrial habitats (open calcareous or basophilic grasslands and riparian galleries of *Salix alba* and *Populus alba*). The protected zone supports populations of 17 mammal species, 4 amphibian and reptile species, 3 fish species, 13 invertebrate species and two plant species, listed in Annex II of the Habitats Directive.

The following conservation valuable sand biotopes are found in the area - subtypes of habitat 1110, "Shallow sands with large and medium sand particles with *Donax trunculus*", "Sands with small and medium sandparticles with *Lentidium mediterraneum*", "Clean sands with *Callianassa candida* and *Arenicola marina*", "Sands and silty sands with *Chamelea gallina*", "Silty sands with *Upogebia pusilla*" and subtype of habitat 1170 "Infralittoral rocky bottom with perennial brown algae *Cystoseira*".

The location is important for achieving the required habitats covering (codes 1110 and 1170) and for the species *Alosa immaculata*, *Alosa tanaica*, *Phocoena phocoena* and *Tursiops truncatus*.

Complex Kamchia

Complex Kamchia has the following National and international protected status:

- “Kamchia reserve”, 842 ha;
- “Kamchiiski Pyasatsi” protected area 372.6 ha.
- Complex Kamchia protected zone (Code BG0002044) under Directive 79/409/EEC on the conservation of wild birds
- Kamchia protected zone (Code BG0000116) under Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora.
- Important Bird Area.

The Kamchia nature complex includes riparian floodplain forests known as “Bulgarian longoz”, around the mouth and lower reaches of the Kamchia river, vast sand dunes and beaches, bush and grassland communities, freshwater marshes and marine area with adjacent breeding-ponds.

Sand dunes are covered with psammophytic (drought-resistent) grasslands with dominant mammoth wild rye (*Leymus racemosus*), European marram grass (*Ammophilla arenaria*), *Alyssum borseanum*, etc.

The forest ecosystem has unique vegetation, structure and specific environmental conditions. This type of forest ecosystem is spread only on the Balkan, as the Kamchia forest is the biggest and most preserved one in area. The region of the Kamchia Nature Complex currently supports 237 bird species, 53 of which are listed in the Bulgarian Red Book (1985), 101 species of European conservation concern (SPEC) (BirdLife International, 2004), 7 globally threatened species under category SPEC 1, 25 listed under category SPEC 2. The grey-headed woodpecker (*Picus canus*), pied wheatear (*Oenanthe pleshanka*) and semi-collared flycatcher (*Ficedula semitorquata*) breed in the complex in considerable numbers, thus characterizing it is one of the important sites for these species in Europe. In the area, the semi-collared flycatcher has the densest breeding population in the country. The complex is one of the three places along the Black Sea Coast where the white-tailed eagle (*Haliaeetus albicilla*) is confirmed to breed. Kamchia is located on the Via Pontica migration flyway with rich migratory birds diversity. Passing flocks of white storks (*Ciconia ciconia*), Dalmatian pelicans (*Pelecanus crispus*) and white pelicans (*P. Onocrotalus*) can be observed annualy during migration, along with the corn crake (*Crex crex*) and representatives of the herons, *Charadriidae* and songbirds species. The flooded areas to the south-west of the reserve are especially valuable as wintering grounds of the whooper swan (*Cygnus cygnus*), great white egret *(Egretta alba*) and red-breasted goose (*Branta ruficollis*). The pygmy cormorant (*Phalacrocorax pygmeus*) can also be found in the area during the winter season.

The following habitats are conserved in the protected zone under the Habitat Directive BG0000116, with marine area of 745.03 hectares:
1130 Estuaries;
1140 Mudflats and sandflats coastal areas non-covered or partially covered with sea water;
1160 Large shallow inlets and bays;
2110 Embryonic shifting dunes
2120 Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes); 2130 * Fixed coastal dunes with herbaceous vegetation (grey dunes);
2180 Wooded dunes of the Atlantic, Continental and Boreal region;
2190 Humid dune slacks

Emine Irakli (BG001004)

Emine Irakli has the following National and international protected status:

- 8 protected areas including the “Koketreys” sand bed marine protected area (since 2001);
- “Emine” protected zone (Code BG0002043) under Directive 79/409/EEC on the conservation of wild birds, 66750.520 ha
- “Emine Irakli” protected zone (Code BG001004) under Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, 11 282.80 ha
- “Emine”Important Bird Area, 68,811.23 ha

The site includes the Stara Planina suburbs and vast areas around Cape Emine, including marine areas. The site is of great importance for the conservation of habitats for species like *Elaphe quatrolineata sauromates*, *Testudo hermanni*, *Testudo graeca*. Most of the deciduous forests are thermophilic oak woods (habitat type code 91M0) and a smaller area covered by habitat code 91AA. Common for the site are mesophilic forests (habitat type 91S0 and 91G0). The coastal habitats are steep cliffs with endemic species of *Limonium spp.* (code 1240), with vast sections with annual vegetation of alluvial lines (code 1210), white dunes (code 2120) and embryonic dunes (code 2110) near the Irakli beach. The sandy bottom (1110) extends up to 2500 m in the sea. The communities of psamofilni organisms, inhabiting the area, are characterized by a very high diversity of invertebrates and fish - the invertebrate fauna, inhabiting sandbeds, has over a hundred species of molluscs, crustaceans, *Polychaeta* and representatives of other groups. Some sections of "Koketrais" bed are lithified calcareous sands, overgrown with *Mytilus galloprovincialis* - habitat subtype 1170. Among the species of conservation concern are those listed in the Black Sea Red Book and the Protocol for the protection of biodiversity and landscape of the Black Sea (Sofia, 2002) to the Convention on the protection of the Black Sea against pollution (Bucharest, 1992) as crustaceans *Upogebia pusilla*, *Pilumnus hirtellus*, *Xantho poressa*, *Diogenes pugilator*, *Apseudes acutifrons* and *Branchiostoma lanceolatum*, which increases the regional (Black Sea) conservation value of the site.

The territory of Emine supports 218 bird species, as 60 are listed in the Bulgarian Red Book (1985), 96 species are of European conservation concern (SPEC) (BirdLife International, 2004), the globally threatened Mediterranean shearwater (*Puffinus yelkouan*) under category SPEC 1, as the coast cliffs and the marine area of Emine are one of its few permanent habitats in Bulgaria. Emine is one of the most important breeding sites in the country under the European Union concern also for the olive-tree warbler (*Hippolais olivetorum*), woodlark (*Lullula arborea*), semi-collared flycatcher (*Ficedula semitorquata*), Middle spotted woodpecker (*Dendrocopos medius*), European roller (*Coracias garrulus*), lesser spotted eagle (*Aquila pomarina*), levant sparrowhawk (*Accipiter brevipes*), pied wheatear (*Oenanthe pleshanka*), common tern (*Sterna hirundo*) and little tern (*Sterna albifrons*). Large numbers of black-throated loon (*Gavia arctica*), pochard (*Aythya ferina*) and other waterfowl can be found in the coastal area during the winter.

Emona marine protected zone (BG0001501)

The protected area Emona (BG0001501) occupies an area of 55345.28 ha, entirely in the Black Sea. The site is one of the most important on the Bulgarian Black Sea Coast for the biotope "sublittoral mussel beds on sediments", which as a biogenic reef is a subtype of habitat 1170 "Reefs" under Annex I. The dominant species, forming the biogenic reefs is *Mytilus Husgalloprovincialis*. The protected zone provides sustaining habitat for the young of the included in Appendix II fish species: Mediterranean tricks (*Alosa fallax*), shad (*Alosa immaculata*) and harip (*Alosa tanaica*). Included in Annex II are also the *Cetaceans* harbour porpoise (*Phocoena phocoena*) and bottlenose dolphin (*Tursiops truncates*) as permanent residents of the sustaining habitat.

Lakes of Bourgas Complex

Bourgas lakes have the following National and international protected status:

- Maintained reserve Lake of Atanasovo, 1074.5 ha;
- “Poda” protected area, 100.7 ha;
- “Uzungeren” protected area, 211.13 ha;
- “Chengene Skele”P protected area, 160.0 ha;

- “Vaya” protected area, 379.35 ha;
- Lake of Bourgas - wetland of international importance under the Ramsar Convention;
- Lake of Atanasovo - wetland of international importance under the Ramsar Convention;
- Poda - wetland of international importance under the Ramsar Convention;
- “Lake of Atanasovo” protected zone (Code BG0000270) under Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora and Directive 79/409/EEC on the conservation of wild birds, 7210, 016 ha;
- “Lake of Bourgas” protected zone (Code BG0000273) under Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora and Directive 79/409/EEC on the conservation of wild birds, 3066,89 ha
- Important Bird Area and CORINE site - the Lake of Bourgas, 3092.02 and Lake of Atanasovo, 7208.89 ha;
- CORINE site - “Mandra”;
- “Mandra - poda” protected zone (Code BG0000271) under Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora and Directive 79/409/EEC on the conservation of wild birds, 6139.17 ha.

The Lakes of Bourgas Complex include the lakes of Bourgas, Mandra, Atanasovo and the protected areas Poda, Chengene Skele and Uzungeren around Bourgas. Three of the lakes, together with the protected area Poda are under the Ramsar Convention and with international importance, especially as a waterfowl habitat. The Lakes of Bourgas Complex is one of the three most significant wetland complexes for congregations of waterfowl on the Bulgarian Black Sea coast.

The lake of Bourgas is a shallow brackish coastal lake: open firth with small connection to the sea and wetlands vegetation along the banks. It is located west of Bourgas, and entirely borders on east with the industrial and residential areas of the city. The lake is connected with the sea by a canal-lock. The lake has prevailing open water area, up to 1.3 m depth. The water salinity is about 10.58 per thousand with significant seasonal and annual fluctuations. The shores are covered with wetland vegetation, mainly cane (*Phragmites australis*), fernleaf cattail (*Typha angustifolia*), broadleaf cattail (*Typha latifolia*), etc., forming vast overgrowth in the western and northwestern areas of the lake. There are several small marsh ponds to the northeast of the lake. Wet marshy meadows, halophytic grasslands (dominated by *Puccinellia convoluta*), meso-xerothermic grasslands (mostly bulbous (*Poa bulbosa*), perennial ryegrass (*Lolium perenne*), etc., cultivated lands and pastures (Bondev 1991; Yankov, 1993) can be found around the lake.

The lake of Atanasovo is a hyper-saline lake with a firth characteristic in its northern section and lagoon features in the south. A significant area of its surface is used as salt pans with preserved primitive salt production. The lake of Atanasovo is characterized by significant habitats variety: most common are the shallow saltwater ponds with no higher vegetation, separated by dikes covered mostly with glasswort (*Salicornia europaea*), and a few beds of freshwater wetlands vegetation, mostly fernleaf cattail (*Typha angustifolia*), broadleaf cattail (*Typha latifolia*), common reed (*Phragmites australis*), etc. There are small freshwater marshes and wet meadows, and also a system of channels and dry areas, overgrown by marsh vegetation around the lake.

The Mandra - Poda lake is a former brackish lake, converted into a freshwater dam lake with a preserved lagoon between its walls and the Black Sea. The cascade fishponds in the northwestern part of the lake as well as the valley south of the Cherni Vrah village also belong to the site. The main habitat in the complex is the lake with open water area of 1300 ha, still water and areas with wetlands vegetation along the banks. The lake is surrounded by forests, mainly quercus oak (*Quercus pedunculiflora*), English oak (*Quercus robur*) and maple (*Acer campestre*) and areas with cane (*Phragmites australis*) and cattail (*Typha sp.*), together with some *Artemisia santonicum*, sea rush (*Juncus maritimus*) and sea clubrush (*Bolboschoenus maritimus*). The shallow saltwater areas are overgrown with glasswort (*Salicornia europea*), and the sand to the sea is overgrown with *Leymus racemosus subsp. sabulosus*, threefork gypsophila (*Gypsophilla trichotoma*), etc. (Bondev 1991; Marinov, draft). The Uzungeren area is a deeply recessed inland bay with banks mostly overgrown with reed and cattail.

The lakes are protected coastal habitats: 1150 * Coastal lagoons; 1310 Salicornia and other annuals colonising mud and sand; 1410 Mediterranean salt meadows; 1530 * Pannonian salt steppes and salt marshes; 2110 Embryonic shifting dunes; 3150 Natural eutrophic lakes with vegetation type Magnopotamion or Hydrocharition; 1310 Salicornia and other annuals colonising mud and sand; 6110 * Open calcareous or basophilic grasslands of Alysso-Sedion albi; 8230 Siliceous rock with pioneer vegetation of alliances Sedo-Scleranthus Sedo albi-Veronicion dillenii.

The lakes are one of the most important stopovers for the bird migratory routes along the Bulgarian Black Sea coast since they are located on the migratory route Via Pontica. The lakes are a typical "bottleneck migration" site for migratory soaring birds of a significant part of North, Central and Eastern Europe. Up to 240,000 storks and 60,000 raptors fly over the site annually during the autumn migration, as well as pelicans (*Pelecaniformes*), geese (*Anseriformes*), plovers (*Charadriiforme*), herons (*Ardeidae*) in large numbers. The lakes are a particularly important stopover for the Dalmatian pelican (*Pelecanus crispus*), the great white pelican (*Pelecanus onocrotalus*), pygmy cormorant (*Phalacrocorax pygmeus*), marsh harrier (*Circus aeruginosus*), red-footed falcon (*Falco vespertinus*), lesser kestrel (*Falco naumanni*), spoonbill (*Platalea leucorodia*), and also the second site of concentration (after the Bosphorus) of lesser spotted eagle (*Aquila pomarina*). The globally threated corncrake (*Crex crex*) and ferruginous duck (*Aythya nyroca*) are found in the site, together with the extremely rare and globally threatened billed curlew (*Numenius tenuirostris*).

Since the lakes do not freeze in winter, they are a site of international importance for the concentration of wintering waterfowl (130 000 birds of 82 species, amongst which are the Dalmatian pelican (*P. crispus*), greater white-fronted goose (*Anser albifrons*), red-breasted goose (*Branta ruficollis*), shelduck (*Tadorna tadorna*), pied avocet (*Recurvirostra avosetta*), pygmy cormorant (*Ph. Pygmeus*), cormorant (*Ph. Carbo*), whooper swan (*Cygnus Cygnus*), pochard (*Aythya ferina*), ruddy duck (*Oxyura leucocephala*), tufted duck (*Aythya fuligula*), great egret (*Egretta alba*), etc.

Moldova

According to the requirements of the Convention on Biological Diversity, a system of natural areas protected by state was set up in the Republic of Moldova. Regulations on organizational structure and activity fields were elaborated, a classification of natural areas protected by state according to IUCN criteria was adopted and served as a basis for the "Law on State Protected Natural Areas Fund", adopted in 1998 (Tables 3.32 and 3.33).

Table 3.32 Fund of natural areas protected by state (Moldova)

Protected area type	**IUCN category**	**Number**	**Area, ha**
I. Scientific reserves	I	5	19378.0
II. Nature monuments	III	1035	2907.2
a. Paleontological and geological		87	2682.2
b. Hydrological		31	99.8
c. Botanical		446	125.2
III. Natural reserves	IV	63	8009.0
a. Forest		51	5001.0
b. Medicinal plants		9	2796.0
c. Mixed		3	212.0
IV. Landscape reserves	V	41	34200.0
V. Resources reserves	VI	13	523.0
VI. Areas with multifunctional management	VII	32	1030.4
a. Representative sectors with steppe vegetation		5	148.0
b. Representative sectors with meadow vegetation		25	674.7
c. Windbreaks		2	207.7
VII. Dendrological gardens		2	104.0
VIII. Landscape architecture monuments		20	191.1
IX. Zoological gardens		1	20.0
X. Wetlands		3	94705.5
Total		308	161182.1*

* Some areas are incorporated into bigger territories (e.g. - in the wetlands of international importance), that is why the real surface constitues 157.6 thousands ha or 4.65%.

Table 3.33 Scientific reserves (Moldova)

Reserve name	Foundation year	Area, ha
Codrii	1971	5177
Iagorlîc	1988	836
Prutul de Jos	1991	1691
Plaiul Fagului	1992	5642
Pădurea Domnească	1993	6032

A 12 fold increase of the surface of natural areas protected by state occurred in the last 20 years. Protected areas currently represent 4.65% of the Republic of Moldova. It is accepted, in general, that through the extension to the spatial level of the network of natural areas protected by state up to 10% of the national territory, the protection of 50% of the total of species that reflect the taxonomic diversity of biological systems structure (biota) can be achieved (Fig. 3.134).

Fig. 3.134 Map of Moldovan natural protected areas

The relatively reduced weight of the natural areas protected by state in comparison with the total territory and the isolated character of the protected objects placement do not provide an effective conservation of biological diversity according to international requirements stipulated in different international conventions, and bi- and multilateral agreements. This situation is worsening because of the non-observance of the protection regime of some territories from the natural areas protected by state, because of institutional gaps, unsatisfactory level of staff qualification and local authorities' responsibility. All these factors can provoke a negative impact of large proportions on biodiversity conservation in the Republic of Moldova.

The analysis of the functional structure of natural areas protected by state indicates the fact that the nucleus of these areas consists of landscape (51.5%) and scientific (29.4%) reserves. As a result of biodiversity conservation activities undertaken in the last years, the number of state protected plant and animal species considerably increased. Thus, 269 plant species (by 219 species more than in 1975) were taken under state protection. The number of state protected animal species increased from 65 to 215 species. It is specific to the national network of protected areas that 89.5% of its total area, respectively 59,495 ha, is placed in the forest sector and represents 18.8% of the total area of the National Forest Fund. Unfortunately, the regime of protected areas is partially observed only in scientific reserves, where forests occupy an area of 18,028 ha (5.0 % of the total area covered by forests). The analysis of representativeness of the main forest communities in scientific reserves indicates that Quercus petraea and Quercus robur groves are not efficiently protected, constituting less than 10% of the total area of forest communities. The main landscape units of state protected areas are: Codrii - 38.1%; forest steppe plateaus - 24.2%; steppe and meadows - 28.6%.

The National Ecological Network

The ecological lack of poise, social-economic situation, intensive and extensive exploitation of natural resources and of the whole vital space of the country impose an urgent identification, recognition and development of the National Ecological Network (NEN), which would include the network of protected areas, representative natural geosystems and ecosystems maintained in different landscape regions of the country. The establishment of NEN will obviously contribute to biodiversity restoration, maintenance and conservation.

The concept of NEN setting up was developed in 1991 (Complex Territorial Scheme of Nature Protection in the Republic of Moldova) in collaboration with a series of ministries and departments. NEN structure includes the following main elements:

- Representative natural areas for ecosphere/biosphere structure (nucleus);
- Migration and dispersion ecological corridors;
- Reorganized ecological texture (agrocenoses);
- Buffer zones.

The representative natural areas are destined to the self-regeneration of natural components, flora, and fauna genetic diversity conservation. The representative natural areas for NEN of the Republic of Moldova are the natural areas protected by state. At present these areas occur in both natural zones and the 5 landscape regions of the republic. In order to ensure the functioning and integrity of the ecosystems, a strict regime will be set up on the territory of these representative natural areas with ecological corridors. It will stipulate:

- Prohibition of large industrial units placement;

* Limitation of transport and thoroughfare construction;
* Increase of the territorial share of natural complexes up to 30% in the forest steppe zone and up to 20% in the steppe zone;
* Increase of protected areas network;
* Stable functioning of agrocenoses and getting ecologically pure agricultural products.

Taking into consideration the above-mentioned, the framework-scheme of NEN was elaborated in 1991, at a scale of 1:200 000, which includes 6 sub-zones connected by protection forest belts from the Nistru, Prut, Răut and Bâc meadows (Figure 3.135).

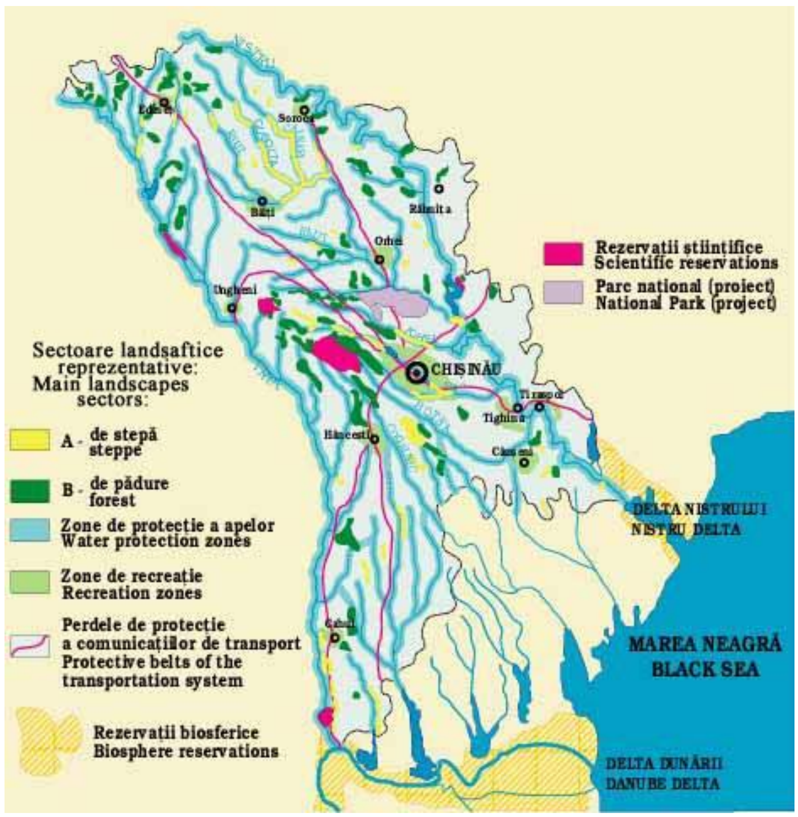


Fig. 3.135 Structure of the National Ecological Network (Moldova)

Taking into account the area and territory geomorphological features of the Republic of Moldova and according to calculations, NEN will occupy the territory of 11 113 km^2 or 33% of the country. The territory of forests proposed to be included in NEN constitutes 207 thousand ha, including: the forest steppe zone - 176 thousand ha; the steppe zone - 31 thousand ha. For the maintenance of a dynamic balance of biodiversity protection and conservation it will be necessary, firstly, to increase the forest areas included in NEN up to 290 thousand ha (Table 3.34), that is: in the forest steppe zone - up to 240 thousand ha; in the steppe zone - up to 50 thousand ha.

Table 3.34 Characteristics of the National Ecological Network model (Moldova)

Zones of ecological balance	Zone area (thousand ha)	Area of forests and shelterbelts (thousand ha)	Afforestation level (%)
a) forest steppe	879	240	27.3
b) steppe	232	50	20
Total	1111	290	25.7

The following wetlands are components of global significance of NEN: zone of the Prut overflowing into the Danube Delta (biosphere reserve "Danube Delta" and zone of the Nistru overflowing into the Black Sea (biosphere reserve "Delta Nistrului"). They serve as habitats for the majority of migratory species flying to south-north and east-west.

The NEN components of European importance are as follows: the meadows of the Nistru and Prut rivers, "Codrii", "Plaiul Fagului", "Pădurea Domnească", "Prutul de Jos", "Iagorlâc" scientific reserves. They can also serve as areas for the European Ecological Network "Emerald" setting up.

The main components of NEN of national importance are the meadows of Răut, Bâc, Botna rivers and other tributaries of the Nistru and Prut rivers, natural reserves and representative landscape sectors, lakes and large water reservoirs, recreation zones, protection forest screens and biocenotic oases from agroecosystems.

The preliminary analysis of measures, in which the already established elements for NEN structure satisfy the international requirements and reflect respectively the specific features of the republic's territory, highlighted a series of aspects that have to be taken into account at the next stage:

1. Tendency of urbanized territories increase compared to natural ones (increase of urban settlements as a result of excessive use of the territory). Urbanization centers and communication systems have a negative impact on natural ecosystems placed between them by emitting polluting substances into the troposphere and surface waters, different construction works, unorganized recreative activities of the population. Beginning with the '90s, a rapid increase of the areas with urban settlements has occured, due to individual dwelling construction activities. The areas, assisting to stabilize the environment, which are represented by territories of natural ecosystems anthropically unmodified or those with limited human activities, decrease every year.
2. The network of already created protected natural areas of national importance is not enough representative, because many valuable natural areas have not got a respective protection status, while some natural ecosystems (steppe, wetland areas) are insufficiently represented in NEN.
3. One of the representativeness indices of areas assisting to stabilize the environment is their distribution in the existing landscape diversity (Table 4). It turns out, that at present, the area of the territories assisting to stabilize the environment (natural areas protected by state and territories poorly modified by the anthropic impact) constitutes 17.45% of the republic's area and it is insufficient for biodiversity conservation. Moreover, they are differently distributed, constituting 29% in the region of plateaus with the forests of Codrii and only 10–15% in the region of plateaus and plains with hay fields of Bugeac steppe and the region of steppe plains of the Lower Nistru terraces.

4. The connection between NEN component parts with the elements of the European Ecological Network has not been provided. The system of territorial protection complexes of the Nistru and Prut meadows and their tributaries, springs, lakes and other wetland meadows, formed by the above-mentioned rivers lacks. There exists great danger for migratory species, which use the republic's wetlands as habitats.

Taking into account the period of transition to the market economy some elements of the NEN concept need to reviewed. The Central State Environmental Authority is in charge of the setting up and functioning of NEN in the Republic of Moldova.

Romania

MPAs designation was made based on the data stored in the National Informatics System (NIS), created specifically for the purpose to extend the European ecological network into Romania. The NIS was created and supplied with with available data/information by the national scientific community. NIMRD was part of the national team, having the responsibility of providing and completing the NIS with data/information about the marine environment. During the process, the scientists noticed that most of the provided data were old, while there was little information about the present diversity of marine species and habitats, and their spatial distribution. Meanwhile, the Black Sea ecosystem has changed a lot over the last decades, which strongly imposes the need for actualizing of the data/information in the NIS and their regular update. In the declaration process of the Romanian marine protected areas network, the scientists took into consideration the following general requirements (widely recognised in designing MPA networks) based on selected ecological criteria:

The criteria for selection of areas suitable for MPAs designation are defined according to the objectives to be achieved at the protected sites. When the main goal is biodiversity conservation and maintenance of vital ecological processes, priority is given to ecological criteria with emphasis on uniqueness or rarity of ecosystems, diversity and representativeness of habitats, occurrence of threatened species and habitats and preserved naturalness. In case the protected areas aim at ensuring sustainable fisheries, the criteria should focus on identification of critical marine habitats associated with the life functions (breeding, nurseries, feeding, migration roots, etc.) of the target species. If the objectives are mainly to safeguard areas for tourism and recreation in wilderness settings, the criteria could emphasize scenic value, remarkable seascapes and features of non-living nature, the presence of such other interests as cultural or archaeological sites, accessibility and carrying capacity; i.e., the number of visitors the area can sustain without degrading the environment or destroying the quality of the wilderness experience by crowding.

Clearly, social acceptance of the MPAs is critical to successful implementation of measures. During the selection process eligible areas should be assessed relative to traditional livelihoods and economic activities practiced by local residents. Conflicts of interest and conflicts between natural resource values and human activities should be taken into account and minimized. Areas where socio-economic developments have lead to problems that cannot be overcome by MPAs designation solely should be excluded and attended in the complex policies of marine spatial planning.

In Romania, the first step toward MPAs was to identify the marine habitat types, according to the Habitats Directive, and elaborate a specific typology for the Romanian Black Sea. When correlating the RO classification with the Palearctic Habitats Classification, as a ready example, the scientists referred to the types indicated in the Interpretation Manual of European Union Habitats. They insisted on the necessity of interpreting the habitat types according to the European classification for the purpose of harmonization. Besides, the EU Interpretation Manual allows flexibility in building habitat classification schemes, particularly for the cases when habitats are fragmentary and under anthropogenic impact, which is the case in Romania.

In creating the Romanian network of MPAs, the scientists started from the main target of MPAs: preserving the marine resources (biodiversity and underwater landscape) for the benefit of the present and future generations. It was assumed that the implementation of a proper management could ensure permanent benefits in these marine areas, while avoiding as much as possible the eventual conflicts with the users. The RO scientists also considered the necessity of preserving the species and habitats of 64 European importances, including in the network the marine sites already proposed to be part of the NATURE 2000 network. The Romanian Black Sea spans a coast length of 245 km (6% of the total Black Sea coast), with a shelf area of 30,000 km2 (16%), and an EEZ (1986) of 30,000 km2. The Romanian MPA network consists of 8 sites and has a total area of 1,162.86 km2, which amounts to 4.65% of the EEZ and 3.88% of the Romanian shelf zone, while the marine part of the Danube Delta Biosphere Reserve represents 88.57% of the whole network‘s area.

Besides the Danube Delta Biosphere Reserve (DDBR), for which there is a special protection and administration law concerning the economic and social development and water infrastructure, the Dobrogea region in Romania holds another 39 protected areas. In Romania, the national network of marine protected areas comprises two Marine Reserves at present: the 2 Mai - Vama Veche Marine Reserve (5.000 ha) and the marine part of the Danube Delta Biosphere Reserve (buffer zone - about 103.000 ha). Under the Habitats Directive there are 8 sites designated and 1 is under the Birds Directive. In accordance with the stipulations of the Government Ordinance No. 57 from June 20, 2007, regarding the regime of protected areas, the preservation of natural habitats, of the wild flora and fauna (Official Monitor No. 442 from June 29, 2007), as well as with the 79/409/CEE and 92/43/CEE European Directives, the following natural protected areas were established in the Romanian BS area:

ROSPA0076 Black Sea: Site of Community importance, according to the 79/409/CEE Birds Directive, directly nominated Special Protected Area - SPA - through GD no. 1284/2007 regarding the declaration of avifaunistic protected areas as an integrating part of the Natura 2000 European ecological network in Romania - 147,242.9 ha (Custodian SC EURO LEVEL);

ROSCI0269 - Vama Veche - 2 Mai: Site of Community Importance, according to the 92/43/EEC Habitats Directive, adopted through 2009/92/EC Decision, which overlaps the Vama Veche - 2 Mai Marine Reserve, natural protected area of national importance - 5,272 ha (Custodian NIMRD);

ROSCI0094 - The Sulphide Seeps in Mangalia (362 ha): Site of Community importance, according to Habitats Directive 92/43/EEC, established by Decision 2009/92/EC - 362 ha (Custodian NIRD GEOECOMAR);

ROSCI0197 - Submerged beach from Eforie North - Eforie South: site of Community importance, according to the Habitats Directive 92/43/EEC, established by Decision 2009/92/EC - 141 ha (Custodian SC EURO LEVEL);

ROSCI0273 - Marine area from Cape Tuzla: site of Community importance, according to the Habitats Directive 92/43/CEE, established by Decision 2009/92/EC - 1,738 ha (Custodian NIRD GEOECOMAR);

ROSCI0237 - Submerged methanogenic carbonate structures Sf. Gheorghe: site of Community importance, according to the Habitats Directive 92/43/EEC, established by Decision 2009/92/EC - 6.122 ha (Custodian NIRD GEOECOMAR);

ROSCI0066 - Danube Delta - marine zone: site of Community importance, according to the Habitats Directive 92/43/EEC, established by Decision 2009/92/CE, overlapping the marine area of Danube Delta Biosphere Reserve - natural protected area of national and international importance - 121.697 ha (Custodian DDBRA).

Concerning the European ecological network NATURA 2000, in 2007, through *Order no. 1964 of the Environment and Sustainable Development17 Minister, December 2007, on instituting the natural protected area regime on the European interest sites as part of the European ecologic network NATURA 2000 in Romania* six marine sites were moved to a special preservation regime; in all these sites the special conserving area regime was instituted (Special Conservation Interest - SCI). In 2011, based on NIMRD's proposal, two new marine sites (SCIs) were declared by the Order of the Environment and Forests Minister no. 2387/2011 (23 August 2011), amending the Order of the Environment and Sustainable Development Minister no. 1964/2007 regarding the natural protected area regime of the sites of Community importance, as part of the European ecological network NATURA 2000 in Romania. The aim of this proposal of NIMRD was to protect some sub-types of 1170-Reef habitat, including 1170-2-Biogenic reefs with *Mytilus galloprovincialis*, insufficiently covered in previously declared sites. These new sites were:

ROSCI0281 - Cape Aurora (No custodian yet);

ROSCI0293 - Costinesti (No custodian yet).

Thus, Romania has approved the designation of these newly proposed sites (Cape Aurora and Costinesti) under the Habitats Directive; however, no custody of them is yet arranged. Detail information on the sites designated as MPAs in Romania is provided below.

ROSCI0269 2 Mai - Vama Veche Marine Reserve: important through the presence of some habitats of European interest. It is also an MPA in the national network of protected areas, part of the - Natural reserve category (corresponding to category IV IUCN - Protected area managed mainly for conservation through management intervention - Habitat/Species Management Area), having the aim of protecting and conserving marine natural habitats and species. The surface of this Reserve is of about 5.000 ha. The Reserve comprises a mosaic of NATURA 2000 habitat subtypes. It is rich in benthic and pelagic life and a refuge and breeding area for many marine species (Fig. 3.136).

Fig. 3.136 Special underwater landscapes from the Marine Reserve 2 Mai – Vama Veche.
Photos: D. Micu (NIMRD)

It is an important area both due to its biodiversity and location (the southern limit being at the Romania-Bulgaria border). Within the reserve there is a minor anthropogenic impact due to: overdevelopment of human settlements, unregulated touristic activities, Mangalia shipyard, sand and rock exploitation, illegal wastewater discharges, and illegal fishing.

Considering the interest of the scientific communities from the two neighboring countries (Bulgaria and Romania) and the need for solving environment problems of transboundary nature, there might be prospects for establishing a transboundary reserve jointly managed by Bulgaria and Romania. The idea has appeared a few years ago, including the interest of ACCOBAMS to enhance the protection of Cetaceans through such a transboundary MPA18, however, no advancement is so far in place. The MISIS Project considered the option to work toward the enlargement of the Vama Veche MPA into Bulgarian waters. However, priority was given to the areas between Bulgaria and Turkey, because there are no MPAs in Turkish Black Sea waters, and the MISIS Project saw it as a more substantial gap to address in enhancing the Black Sea environment protection.

ROSCI0094 Underwater sulphide seeps from Mangalia: the seeps occur on both rocky, sandy and peat bottoms and are connected to the Dobrogea plateau‘s karst complex. A detailed interdisciplinary study is needed in order to identify the causes of the emissions and their effects on the marine ecosystem. Although small (approx. 360 ha), this site is a biodiversity hot - spot, harboring the highest diversity of habitats and species along the Romanian coast. Among them are ecosystem - engineering species like the seagrass *Zostera noltii*, the perennial brown alga *Cystoseira barbata* and the lugworm *Arenicola marina*. Extension of this highly valuable site is envisioned.

ROSCI0273 Cape Tuzla marine area: Along the Romanian coast, around Cape Tuzla rocky reefs (Figure 6) reach their maximum depth (at 28m). The underwater landscape of the reefs is very diverse, with plateaus, canyons, drop-offs, overhangs and small caves. These several microhabitats are populated by a rich marine fauna. The area is severely affected by road building along the coast, especially nearby beaches. Massive amounts of clay are being dumped into the sea, infilling small gulfs. In 2011, in the area there were realized coastal defense works in the aim to protect the coast against further erosion.

ROSCI0197 The submerged beach from Eforie North - Eforie South: Along the southern Romanian coast, only here the hydrodynamic processes and natural habitats, specific for an exposed beach, are yet present. This is the only place at the Romanian shore where the bivalves *Donacilla cornea* and *Donax trunculus* up to date still survive (Figure 7). In the past (years 1950s-60s), *Donacilla cornea* and *Donax trunculus* were widespread in the midlittoral and upper infralittoral of sandy beaches from the southern Romanian Black Sea. Due to their environmental requirements (water purity, oxygen concentration, salinity), the mere presence of these two species was an indicator of good water quality. Both species were presumed extinct as reported in the Romanian scientific literature between 1980 and 2000 (the period of progressive eutrophication and ecological decline of the Black Sea), yet in 2005 a small extant population was found here (Micu, 2006). Today, the submerged beach is affected by: tourism-associated pollution and trampling, and freshwater discharges (non-compliant with standards). The size of the marine protected area is of about 140 ha.

ROSCI0237 Methanogenic submerged structures from Sfantu Gheorghe: present in the NW part of the Black Sea, between depths of 15 and 784 m, the submerged carbonate structures built by bacteria and archaea (around methane emissions grow larger beyond the oxic/anoxic interface characteristic for the Black Sea. The shallow occurences are the eastern limit of the Danube Delta Biosphere Reserve, which gives opportunity for a joint management with the other Natura 2000 site ROSCI0066 Danube Delta marine zone (overlapping on the buffer zone of DDBR). Beside the 1180 habitat, other sedimentary habitat types are present here, types that make part of the EUNIS categories - Biogenic structures over sublittoral sediments‖ and - Deep shelf sediments habitats.

The importance of the site is due to the existence of the unique carbonate-cemented sand structures. The anthropogenic pressure on this site is insignificant, due to it being relatively far offshore positioned. Some impacts may occur due to navigation and non-living resources exploration/exploitation in this part of the Black Sea (namely gas and oil). The area is public domain, part of the territorial sea and Economic Exclusive Zone of Romania. The surface of the marine protected area is of about 6.000 ha.

ROSCI0066 Danube Delta Biosphere Reserve - marine part: It is a natural protected area in the RO national network, Ramsar site and UNESCO site. It corresponds to the geographical unit of the reserve - the coastal area of the Black Sea, from the Danube discharge - Chilia branch, down to Midia Cape to the South, and up to the 20 m isobath to the East. Apart from the historical conditions that favored the forming of the Danube Delta, at the Danube discharging points in the Black Sea (they are three – Chilia, Sulina and Sf. Gheorghe) at least four current conditions are reunited, and these are:

- the existence of the limanic gulf having an almost triangular shape on the continental platform (shelf) that have depths of a few meters at shore and gets deeper up to 180 - 200 m on a distance of 180 km;
- small tide amplitude (30 cm);
- littoral currents that bring alluvia from the North - Western shore and block the Danube mouths;
- large quantity of alluvia transported by the Danube River itself.

The Danube Delta Biosphere Reserve has its own administration which, according to the Law No. 82/1993, has as main objectives the ecological management of the reserve territory, conservation and protection of the natural patrimony with great scientific value and promotion of sustainable exploitation of the natural ecosystems resources, and rehabilitation of some deteriorated habitats (because of the hydro technical projects19 realized before 1989). The surface of the DDBR marine area is of about 103.000 ha.

ROSCI0281 Cape Aurora and ROSCI0293 Costinesti - 23 August, the newly designated sites: As mentioned above, the aim of their designation is to protect some sub-types of 1170-Reef habitat, including 1170-2-Biogenic reefs with *Mytilus galloprovincialis*, insufficiently covered in the other sites at the Romanian coastline.

Danube Delta Biosphere Reserve (also SCI, SPA, Ramsar site)

At the end of a course of over 2,860 km, collecting the water from a vast hydrological basin that exceeds 8% of the area of Europe, the Danube (the second largest river of the Continent) has during the last 16,000 years built at its mouth with the Black Sea one of the most beautiful deltas in Europe, perhaps in the whole world. The Danube Delta is famous as one of the greatest wetlands of the earth. The wonderful natural habitats formed here offer good living conditions for an impressive number of plants and animals. Among these, reeds form one of the largest single expanses in the world, and Letea and Caraorman forests represent the northern limit for two rare species of oak that are more frequently met in the south of the Italian and Balkan peninsulas. Together with the great number of aquatic and terrestrial plants, there are also many important colonies of pelicans and cormorants, which are characteristic of the Danube Delta, as well as a variety of other waterbirds which reside in or visit the delta for breeding or wintering. The large number of fish is also notable, with species of both high economic and ecological value.

Without doubt, the impressive range of habitats and species which occupy a relatively small area makes the Danube Delta a vital center for biodiversity in Europe, and a natural genetic bank with incalculable value for global natural heritage. Many of the plant and animal species found in the delta are also important natural resources for economic use as food, building materials and medicines, they have attracted people to the area since ancient times. The human dwellings were chiefly based on the use of these natural resources, so developing traditional economic activities and characteristic cultural and social habits. Later, there was a tendency to overexploit some of these natural resources.

This tendency, which is still seen at present time, puts increasing pressure on the resources, especially fish and grasslands, and was caused by the development of economic activities which were not in harmony with the environment; for example, sand mining at Caraorman disturbed the ecological balance, causing the loss of some areas of natural fish spawning grounds through the sedimentation and eutrophication (or nutrient enrichment) of water channels and lakes. Because of the cumulative negative effects of human activity in the delta, together with those occurring around the delta itself, there was an increasing danger that the natural ecological balance would become irreparably harmed if appropriate measures were not taken to reduce these impacts, to restore already damaged areas, to protect the existing unaffected areas, and to harness local and regional support for these measures.

The factors briefly described above provided arguments for the designation of the Danube Delta Biosphere Reserve (DDBR) by the Romanian Government in 1990, a decision then confirmed by the Romanian Parliament through law 82 of 1993. The universal value of the reserve was recognised by the Man and Biosphere Programme of Unesco in 1990 through its inclusion in the international network of biosphere reserves. In fact, DDBR possesses all the main features of a biosphere reserve, namely:

a) it conserves examples of characteristic ecosystems of one of the world's natural areas and contains strictly protected core areas, traditional use areas, e.g. for fishing and reed harvesting, and buffer zones to reduce external impacts;

b) it is a land and coastal/marine area in which people are an integral component, and which is managed for objectives ranging from complete protection to intensive yet sustainable production;

c) it is a regional center for monitoring, research, education and training on natural and managed ecosystems;

d) it is a place where government decision-makers, scientists, managers and local people cooperate in developing a model programme for managing land and water to meet human needs while conserving natural processes and biological resources;

e) it serves as a symbol of voluntary cooperation to conserve and use resources for the well-being of people everywhere.

From September 1990, the DDBR was listed as a wetland of international importance especially as waterfowl habitat under the Ramsar Convention, and is among the largest of the 600 or so wetlands so recognised. The universal natural heritage value of the reserve was recognised in December 1990 by the inclusion of the strictly protected areas in the World Heritage List under the World Heritage Convention.

Natural Maritime Dunes Reserve at Agigea

Near the Marine Biological Station of Agigea is located the Natural Maritime Dunes Reserve, a unique protected area in Romania. Very rare plants are raising in here, like the sandy madwort *Alyssum borzaeanum* (an endemic plant), *Ephedra distachya* and the sandy bindweed (*Convolvulus persicus*). Fauna is represented by sandy specific species *Testudo graeca ibera*, *Lacerta agilis euxinica*, *Dolicophis caspius*, *Coronilla austriaca*, *Zebrina varniensis*, *Scolia flavifrons*, *Myrmeleon formicarius*.

These maritime dunes had been formed by depositing the sand from an old marine gulf situated to the north. The idea of a scientific reserve was presented by Prof. Ioan Borcea at the First Congress of Naturalists from Romania held in 1928. For protecting rare and very rare plants, Prof. Borcea limited the access to 600 m².

The total area of reserve is 105504 m². Despite of a limited area, in this reserve were identified more than 241 taxa of vascular plants and 8 species of moss.

Since 21.03.2004, the “Alexandru Ioan Cuza” University (UAIC) of Iasi assumed the custody of Natural Maritime Dunes Reserve from Agigea, agreed by the Ministry of Environment and Forests.

Turkey

Turkey is one of the greatest peninsula countries of the world, bordered by four seas with different ecology and oceanography: the Black Sea, the Sea of Marmara, the Aegean Sea and the Mediterranean Sea. The Turkish coastline is 8,592 km without islands coastline (The Min. of Environment & Urbanization, 2012). **1132 km** of it is protected such as: **National Parks, Ramsar sites, Nature parks** etc. In addition, **Marine Protected Areas** is **6.57% of Turkey** (The Min. Forestry % Water Affairs, 2012), however, they are not in the Black Sea.

The Black Sea coastline is 1,700 km (Demirkesen *et al*., 2008; Stanchev *et al.*, 2011). Along Turkish Black Sea Coast; there are many protected areas (National Parks, Ramsar sites, Nature parks etc). The total length of coast line is ~ 8560 km and ca. 60% of the total population lives within the 100 km of the coast. There are very few MPAs along the Turkish coast: in the Mediterranean and Aegean Sea. They have been designated to protect certain species as the monk seal or for biodiversity objectives. There are no MPAs designated to sustain fisheries. Besides, the existing practices for MPAs in the Mediterranean and Aegean Seas are not uniform in terms of designation objectives and protection measures. Despite their designation as protected areas the marine parks still face a number of threats, including fishing and pollution. Most of the Coastal Protected Areas (CPAs), about 90% of the CPAs in Turkey are along the Mediterranean too. At the Black Sea, Turkey has no designated MPAs, and has the least coverage of coastal protected areas, compared with other Black Sea countries (Black Sea TDA 2007). While Turkey has much longer shoreline than other Black Sea countries: 1.700 km (only Ukraine has longer shoreline if Azov Sea is included as part of the Black Sea). Over fishing and pollution are the main causes for habitats destruction in the Turkish Black Sea. Comparing to last 20 years, some of the fish species have diminished such as sturgeon, brown meager, bogue, and gurnard fish.

Turkey‘s marine biodiversity has been seriously impacted by anthropogenic pressures. The following are amongst the key types of threats and associated causes of marine biodiversity loss: degradation of marine habitats and ecosystems, overharvesting of marine resources and destruction of coastal habitats. Protected areas have a potentially significant, yet largely unrealized, role to play in eliminating these threats to marine area biodiversity in Turkey. Currently, about 6.57% of Turkey‘s territorial water is protected.

Several sites at the Turkish Black Sea coast are already recognized for their high ecological values. There are two internationally important wetlands: Kizilirmak delta, designated in 1998 as Ramsar site and Yesilirmak delta, both deltas are located in the province Samsun. Designation of these two internationally important wetlands as MPAs is important in order to ensure better protection. For the designation of the sites as MPAs more efficient scientific data is necessary. Further, 5 marine sites are also known for their rich biodiversity, but there is no sufficient scientific data for their designation.

İğneada Flood-Plain Wetland and Forest in Kırklareli

Igneada Flood-plain Forest is the largest of the few remaining flood-plain forests in the entire Europe. The forest is under water during winter and spring months. It is located in a small town called Igneada. The town is in Demirköy in thevKırklareli Province. Igneada is only 5 km in the south of the Mutludere River between Bulgaria and Turkey.

The main economic activities in this area are forestry, fishery, and recently historical and ecological tourism. The forest is also marked by another wetland called the Lake Saka, which is a

Nature Reserve Area. However, the area harbors other lakes such as Erikli, Mert, Hamam, Pedina, Sülüklü ve Ramana.

Igneada Flood-plain Forest consists mainly of oak forests which are also seen in the Strandja Mountains. The forest is also knowb for its alliaceous plants. The Igneada wetland is home to many different bird species. It hosts almost half of the total bird species in Turkey. Some of these species *are Haüaeetus albicilla, Ciconia nigra, Picus canus, Parus major, MotaciHa alba, Falco naumanni, Anser albifrons, Egretta garzetta, Anas querquedula, Fulica atra*, and *Phalacrocorax pygmeus*.

The forest area has been a national park since 2007. However, the wetland also needs to be under the protection of the state. Without the wetland the forest cannot sustain itself. There have been fruitless efforts to make the wetland a Ramsar area.

Ukraine

Marine protected areas percentage (% of territorial waters) in Ukraine was 4.86 as of 2010. Its highest value over the past 20 years was 4.86 in 2010, while its lowest value was 4.06 in 1990. There are 12 MPAs in Ukraine, classified in four different categories. These are:

Biosphere reserves

- Danube Biosphere Reserve,
- Black Sea Biosphere Reserve.

National nature parks

- “Tuzlovski Lymany”,
- “Biloberezhzhia Sviatoslava”

Special Nature reserves

- “Zmiinyi Island” (zoological),
- “Zernov’s Phyllophora field” (botanical),
- “Small Phyllophora field” (botanical),
- “Karkinytskyi” (ornithological),
- “Swan Islands”(ornithological).

Nature reserves

- “Cape Martian”,
- “Karadazkyi”,
- “Opukskyi”.

Zernov’s Phyllophora field

“Zernov’s *Phyllophora* field” is a unique habitat located in the north-west Black Sea. The site is home to a dense stand of red algae (*Phyllophora*) and a range of associated species. On November 21st 2008 the area was declared a botanical reserve of national importance. This made it the first offshore, fully marine MPA in the Black Sea. The reserve covers 402,500 ha which accounts for 12.5% of the north-west Black Sea shelf.

The reserve is managed by the Ukrainian Scientific Centre for the Ecology of the Sea (UkrSCES) who have developed a management programme for the reserve. The aims of the programme are: Preservation, Restorationa nd Sustainable resource use.

The *Phyllophora* field was significantly damaged during the 1970's due to human pressures (Fig. 3.137). However, in recent years the area has begun to recover and extend its boundaries. It is hoped that this recovery will be aided by the added protection of the MPA designation.

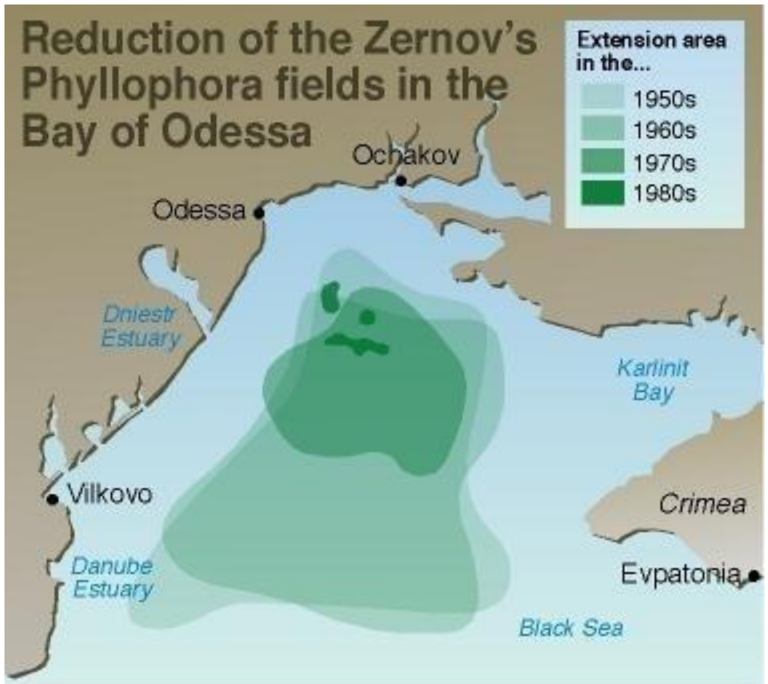


Fig. 3.137 Reduction of the Zernov's *Phyllopora* field
(Source: http://www.grida.no)

The Botanical Nature reserve known as the "Small Phyllophora Field" was created by a 31 August 2012. The aim of the reserve is the conservation and restoration of natural areas of the Black Sea that have special environmental, scientific, aesthetic and cognitive value. The reserve is located in the Karkinitsky Bay of the Black Sea and is covers approximately 385 square kilometers (Fig. 3.138). The field survey of the inner part of Karkinitsky Bay in September 2008 showed that communities of benthic macrophytes flourished over approximately 80% of the seabed. In the coastal part, stands of the sea-grasses of *Zostera nana* and *Z. marina* dominated, whereas the central part of the bay was covered with aggregations of unattached (spherical form) *Phyllophora crispa*. At the present time the overall area of the Small *Phyllophora* Field is represented by two areas of *Phyllophora* growth.

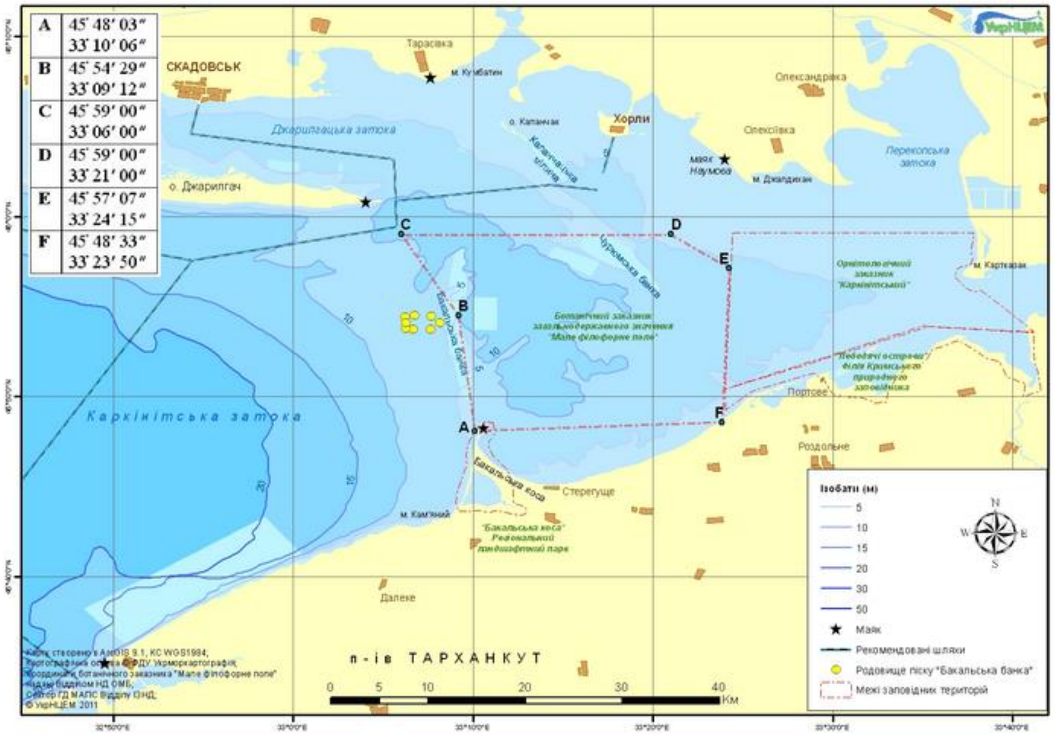


Fig. 3.138 The Botanical Nature reserve “Small *Phyllophora* Field”

Danube Biosphere Reserve

The Danube Delta is one of Europe’s largest wetlands, consisting of reedbeds, water channels, lakes, flooded forests, meadows, marshes, sand, and remnants of steppe. At approximately 2860 km, the Danube River is the second longest river in Europe. The Danube Delta has a total area of 4180 km2, of which 82% is located in Romania and 18% in Ukraine. The delta is a haven for wildlife and is considered to be one of the world’s 200 most endangered wetlands (WWF Global 200).

The Kiliya delta, located south of Vylkove, Ukraine, is the newest part of the Danube Delta and has formed in the last 400 years. The Romanian - Ukrainian ‘Danube Delta Biosphere Reserve’ was declared on December 9th 1998. In total the reserve covers approximately 50,252.9 ha and is home to a number of rare and Red Data List specBlack Sea Biosphere Reserve Black Sea Biosphere Reserve biosphere reserve was established in 1927 and is located on the northern Black Sea coast in the regions of Kherson and Mykolaiv oblasts. This large reserve is home to a range of habitats including gulfs, islands, groves, sand dunes and steppes. Many endangered species of plant can be found on the reserve which is also home to a wide variety of bird species. Due to the areas rich birdlife the reserves wetlands have achieved international recognition. In December 1984 the reserve was included in the World Network of Biosphere Reserves. It is also on the international list of the Ramsar Convention.

As a general conclusion, the main economic activities exerting pressure on the Black Sea coastal and marine environment can be summarized in the Table 3.35:

Table 3.35 Anthropogenic activities impacting directly on the marine environment

Pressure	**Economic activity**	**Sub-activity/Marine water use**
Biological disturbances	Fisheries	Living resources catches Fish/Mollusks
Damages to the physical environment (from geological and geomorphological point of view, as well as constructed shoreline/infrastructure)	Anthropogenic origin structures (including the construction stage)	Coastal protection & protection against flooding
		Harbor operation
		Emplacing and operating offshore structures (other than those producing energy)
		Oil/gas extraction
Other disturbances of the physical-chemical environment	Transportation	Maritime transportation
		Marine litter
	Tourism	Tourism and leisure, including sailing, swimming
	Vessel construction	Pollution with solid wastes/noise/fumes
Nutrient and organic substance enrichment	Human settlements/Industry/ Agriculture	Waste water discharges from industry/emissions; Waste water discharges from municipalities; Nutrients discharged by the Danube
Hazardous substances contamination	Industry	Hazardous substances discharge by the Danube

Addressing the complexity of the interdependence of different anthropogenic pressures requires, however, an assessment of the estimated costs of measures to help restore and prevent marine environment degradation in relation to the pressures and the activities that generate such pressures, and this approach must be made to define a reference state, a normal range of variability for different parameters/status indicators associated to coastal processes. All of these measures for which it has been possible to assess the amount/degree of impaction can be analyzed in relation to the related pressures.

To reduce and control the problems at the Black Sea 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.

Chapter 4: Legal, political and institutional frameworks for ICZM in the target countries

4.1. National legislations

Legal framework in Bulgaria

The most important legislative and planning documents for the regulation and application of the IMCA principles are:

- Black Sea Coast Development Act
- Spatial Development Act and sub delegated legislation thereunder
- Regional Development Act
- Water Act and sub delegated legislation thereunder; most importantly, Ordinance for environmental protection in sea waters, which implements in national legislation the requirements of Directive 2008/56/EC (Marine Strategy Framework Directive)
- Environmental Protection Act
- Protected Areas Act
- Biodiversity Act
- Maritime Spaces, Inland Waterways and Ports of the Republic of Bulgaria Act
- Cultural Heritage Act
- Forest Act

The two main Bulgarian legal acts which regulate the management of the coastal zone are the Bulgarian Law for Spatial Planning of the Black Sea Coast and the Bulgarian Spatial Planning Act. In 2012 some important amendments related to the coastal zone have been adopted, namely, requirements to the municipal spatial and land-use plans to include regulations and conservation measures for the coastal water-area as well.

Another key legal document related with the regulation of the activities in the coastal zone trough measures for integrated water management is the Water Act (Prom. SG. 67/27 Jul 1999). According to the requirements of the Act, the territory (and the aquatic areas) of Bulgaria are divided into river, basins as a basic unit for integrated water management, each of them having their own management structure and their own management plan. In 2012 the Water Act was amended with a requirement for the Minister of Environment and Waters to participate in the National Council for Spatial Planning when spatial plans concerning coastal zones, coastal biodiversity and coastal infrastructure will be discussed and approved.

The *Water Management Plan for the Black Sea River-Basin Management Region* was adopted in 2010 by the Order of the Minister of Environment and Waters (No.РД-294, of 22.03.2010). The Plan is the main inter-sectoral strategic tool for water management in Bulgaria. It includes a set of measures (Program of Measures) for water protection and restoration, most of which are related to the activities still to be implemented in the coastal zone, thus setting the frame for integrated coastal zone management in Bulgaria.

In Bulgaria the provisions on seawater area planning are established by the:

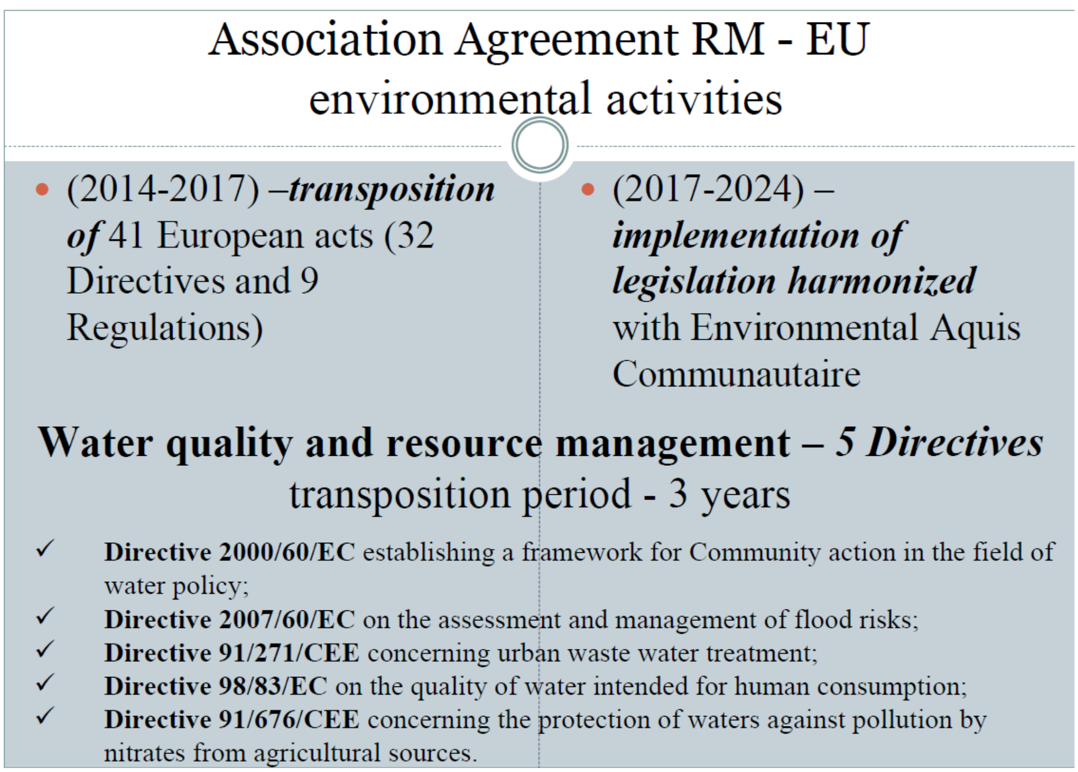
- Law on Sea Spaces, Inland Waterways and Ports in the Republic of Bulgaria, which settles the legal regime of sea spaces and the ports of the Republic of Bulgaria. The Law regulates the use of the Black Sea, the provisions for safety of shipping, the protection of the sea environment and the maintenance of environmental equilibrium. In compliance with its provisions spill, disposal and submersion of any kind of solid and liquid wastes and other harmful substances for the health of people or the animal resources of the sea is forbidden.

- Law on water, introducing the basic principles of the Water Frame Directive; it envisages zoning of the water area, the way they are defined even today: the boundaries of the regions of the actual and perspective water-use; the boundaries of polluted or endangered by pollution water, and vulnerable zones, which are under nitrate pollution from agricultural sources; the boundaries of water sites in the Black Sea, providing for conditions for habitation of fish species and reproduction of shellfish organisms; the belt of sanitary protection. The policy for integrated management of water at a basin level is realized by drawing a Plan for Water Management of the Black Sea Basin Region. The Plan is under elaboration, and includes water categorization by type, ecoregions and morphological properties; water bodies are defined and reference conditions are under determination; a survey of the impact of human activity on the state of surface water was made and water bodies under risk were defined, the zones for water protection, for bathing and recreation were declared. Plans for control and operative monitoring in the sense of Water Frame Directive (WFD), including the sea were developed. Traditionally in Bulgaria monitoring of coastal seawater has been performed since 1988, including also monitoring of oil products and biological monitoring since 2002 as well.
- Law on fishing and aquaculture, which envisages that the activities, related to the use of water of the Black Sea for Fisheries and Aquaculture, will be organized and conducted so that they do not hinder the natural reproduction of fish resources and their migration tracks and not endanger the sustainable development of their stock.
- This legal framework settles the acquisition, management and disposition of land, the sustainable development of exurban territories, the protection and use of environmental components and the control on prevention and limitation of their pollution (incl. land resources).

Legal framework in Moldova

- Law on Environmental Protection no. 1515-XII / 16.06.1993
- Water Law. no. 272-XVI / 23.12.2014
- Water Code No. 1532 /22.06.1993.
- ***Water Law 272-XVI /23.12.2011, in force from October 2013***
- Law on Ecological Expertise and Environmental Impact Assessment no. 851-XIII / 29.05.1996
- Law on the fishery, fishing and fish no. 149-XVI / 08.06.2006
- Law no. 440-XIII of 27.04.1995 on the areas and water protection strips for rivers and water basins
- Decision of the Parliament of Republic of Moldova no. 325-XV /18.07.2003 on approval of the national policy in the field of water resources
- Government Decision no. 32 /16.01.2001 on measures establishing riparian areas and riparian strips for the protection of river and pond water
- Government Decision no. 763 / 23.9.2013 on the State Water Cadastre Regulation.
- Government Decision no. 747/ 03.11.1995 on the methodology of elaboration and approval of schemes of complex use and protection of water.

- Government Decision no. 853 /14.09.1999 on the opening of international traffic on the dam Hydrotechnical Node Costesti - Stinca on the river Prut.
- Government Decision no. 1030 /13.10.2000 on approval of the Scheme of protection of the localities from Republic of Moldova against floods.
- Government Decision no. 1934 / 15.08.2007 on the establishment of automated information system "State Register of waters".
- Government Decision No. 672 /30.07.2010 on the establishment of the Commission for the development of water resources management system and flood protection.
- Agreement between the Government of the Republic of Moldova and the Cabinet of Ministers of Ukraine on the use and protection of the border water bodies, signed on 23 November 1994 in Chisinau.
- Agreement between the Government of the Republic of Moldova and Romanian Government for the protection and sustainable use of water in rivers Prut and Danube signed in Chisinau on 28 June 2010.
- Government Decision no. 433 /18.06.2012 approving the Regulation on flood protection dikes
- Law on Access to Information no. 982 /11.05.2000.
- Directive 2000/60 / EC / 23.10.2000.
- Directive 2007/60 / EC / 23.10.2007.



(Source: Water Governance in Transboundary Basins of Republic of Moldova, EUROPE INBO 2014, 12 November 2014, Bucharest, Romania)

Legal Framework in Romania

- Emergency Government Ordinance nr. 202/2002 regarding the integrated management of the coastal zone approved with modifications and completions by Law no.280/2003;
- Government Decision no. 1015/2004 regarding the organization and functioning of the National Committee of the Coastal Zone;
- Government Decision no. 749/2004 for establishing of the responsibilities, criteria and the delineation manner of the land stripe close to the coastal zone to preserve the environment, patrimonial and landscape values close to the shore;
- Government Decision no. 546/2004 approving the methodology to delimit the public state domain in the coastal area;
- Government Decision no. 898/2004 on the approval of guidelines for groundwater exploitation and areas of interface between freshwater and marine waters;
- Government Decision no. 317/2004 on the use of coastal wetlands as areas of anchorage.
- Law no. 205/2006 approving Government Emergency Ordinance no. 195/2005 on environmental protection;
- GD 764/2007 for the approval of the setting up of the Regional Committees for Strategic Assessment and Correlation and of the regulation framework for their organization and functioning, with further modifications and ammendments;
- GD 1213/2006 on the procedure for environmental impact assessment for certain public and private projects.
- Law No. 98 of September 16, 1992 for the Ratification of the Convention on the Protection of the Black Sea Against Pollution, signed in Bucharest on April 21, 1992.
- Law no. 5/1991 for ratifying the Convention on Wetlands of International Importance, especially as Waterfowl Habitat, signed in RAMSAR, 2 February 1971 -Official Gazette no. 18 / 26.01.1991;
- Law no. 58/1994 ratifying the Convention on Biological Diversity, adopted in Rio de Janeiro, June 5, 1994. Official Gazette no. 199 / 08.02.1999;
- Decree 187/1990 of acceptance of the Convention on protection of World Heritage cultural and natural, adopted by the General Conference of the United Nations Educational, Scientific and Cultural Organization on 16 November 1972 - Official Gazette no. 46 /31.03.1990.
- Law no. 350/2001 concerning territorial development and urban planning with further modifications and amendments
- Order no. 562/2003 (of the minister of Transport, Constructions and Tourism) for the approval of the technical regulation “Methodology framework and content development of urban planning documentation for construction protected areas (PUZ)”;
- Government Decision no. 525/1996 for the approval of the General Regulation of urbanism;
- Law no. 215/2001 on local public administration, republished, with further modifications and amendments;
- Decentralization Law no. 195/2006
- Law no. 51/2006 regarding the services of public utilities, with further modifications and

amendments;

- Law no. 213/1998 on public property and its legal status, with further modifications and amendments;
- Law no. 315/28.06.2004 on regional development in Romania, with further modifications and amendments.

Legal framework in Turkey

The comprehensive program for the management of the integrated coastal areas in Turkey takes place within the National Environment Strategy Action Plan. One of the goals of this program is to decrease, as much as possible, the negative effects that urban sprawl causes to the coastal ecosystem. To achieve this decrease, a new management model was developed so that the people benefiting from the coast on a variety of different levels could contribute as well. However, this model could only be successful if new legal regulations and coastal management plans were prepared and put into effect.

Turkey has a Coastal Law, but no integrated legislation covering multiple aspects of coastal zone management.

Coastal legislation: A comprehensive framework law for integrated coastal management is not available in Turkey (Sesli et al., 2009). Several pieces of legislation in existence, however do address various issues of coastal zone management (PAP/RAC, 2005):

- Turkish Constitution (9.11.1982): The idea of conserving the environment in Turkey started with the Constitution in 1961 and has been conscientiously carried on up to the Constitution of 1982 (Nurlu, 2002). Article 43 of the Turkish Constitution Law is devoted to coasts and shore buffer zones. This article states: "Coasts are under the jurisdiction and responsibility of the State. In benefiting from the sea, lake and river coasts and from shore buffer zones bordering sea and lake coasts, benefit to the public is primarily sought. The widths of coasts and shore buffer zones, in relation to purposes of use, possibilities and conditions for people to benefit from these places, are established by law" (Nurlu, 2002).
- Coastal Law (number: 3621/3830, date: 1990/1992)
- The purpose of Coastal Law is stated (Art 1) as *"to set out the principles for protection of the sea, natural and artificial lakes and river coasts and the shore buffer zones, which are extensions of these places and are under their influence, by paying attention to their natural and cultural characteristics and for their utilization towards the public interest and access for the benefit of society"*. As it is understood from this statement, the Coastal Law is not a comprehensive coastal management law. The Law gives definition as the "coastline" and the *"coast"*. The *"coastline"* is defined as "*the line along which water touches the land at the coasts of seas, natural or artificial lakes and rivers, excluding the inundation periods". The* *"coast"* is the area between the coastline and the "shore border line", which is defined as "the natural limit of the sand beach, gravel beach, rock, boulder, marsh, wetland and similar areas, which are created by water motions in the direction of land starting from the coastline". It is observed that, although the location of the shore border line is very important for managing development at the coast, its definition is far from clear and precise. The "shore buffer zone" is set to have a minimum of 100 m width horizontally, starting from the "shore border line", according to the amendment-dated 1992. Shore is *"open to benefit of all,*

equally and freely" (Art. 6). It is illegal "to excavate the coast and to mine sand, gravel etc. At scales which may cause changes at the coast". It is forbidden to dump excavated soil, furnace ballast, debris, or wastes along the coast and the shore buffer zone. The Coastal Law outlines the rules and regulations for gaining land through reclamation and drainage. It rules that these activities, subject to a land use planning permit, can be carried out along sea, lake and river coasts only in cases where the public interest is served and under the proviso that sufficient attention and care are given to ecological characteristics. On land areas gained through reclamation and drainage, in addition to the facilities which may be located on the coast as described earlier, technical and social infrastructural facilities such as open car parks, recreational parks and children's playgrounds can be built (PAP/RAC, 2005) (Nurlu, 2002).

- Harbors Law (14.4.1923): Management, cleaning, deepening, enlargement, dragging, placement of buoys, and protection, and all related harbor works are the responsibility of the Government. The Government agency, which carries out this responsibility, is the Ministry of Transport (Nurlu, 2002).
- The Environmental Law (9.8.1983, amendments 4.6.1986 and 3.3. 1988): This Law administered by the Ministry of Environment (renamed the Ministry of Environment and Urbanization) covers environmental issues generally. Some of the articles however, have strong implications for the coastal zone. Several by-laws that have been passed under the Environmental Law deal with issues such as air pollution, noise, water quality, solid waste management and environmental impact assessment (EIA), and provide the rules and regulations for environmental management (Nurlu, 2002).
- The Fisheries Law (22.3.1971, Amendments 15.5.1986): The scope of this law is the protection, exploitation, production and control of living resources. The responsible government unit is the Ministry of Agriculture& Rural Affairs" (Nurlu, 2002).
- National Parks Law (9.8.1983)
- Law on the Protection of Cultural and Natural Wealth (21.7.1983)
- Council of Ministers' Decree for the establishment of an Agency for specially Protected Areas (19.10.1989)
- The Coastal Security Force Law (9.7.1982)
- The Settlements Law (3.5.1985)
- The Tourism Incentives Law (12.3.1982)
- The Forestry Law (31.8.1956; Amendments, 23.9.1983)
- Legal and Regulatory Framework
- Coastal Law No. 3621 of 1990, amended in 1992
- Land use and Development Law of 1985
- The law for the Protection of Cultural and Natural Values Code No: 2863 of 1983
- Environmental Law Code No: 2872 of 1983
- National Parks Laws Code No: 2873 of 1993 (Nurlu, 2002)
- Basic principles of the current coastal law are:
- Protecting the coasts of the seas, shores of the lakes and banks of the rivers,
- Utilizing the coastal developments only for public benefit,
- Enabling free access of the public to the coastlines in order to enhance social equity,
- Respecting the natural and cultural differences of the coastal areas,

- Differentiating the coastal areas which are subject to a development plan and which are not.

A draft of a new coastal law is issued by the Ministry of Public Works on March 27, 2006. This includes a new definition for the *coastal band* as the horizontal area from the coastal edge line towards the mainland at the seas, natural and artificial lakes; which is minimum 100 meters in width outside the settlement areas and the area of minimum 50 meters in width in urban and rural settlement areas. The proposed law includes watchtowers, roads, railroads, airports, terminals, railway depots, outdoor car parking areas, restaurants, cafeterias that may be built by provisional elements, entertainment areas, parks, green fields, outdoor recreation areas, outdoor swimming pools, and playground structures among the premises that are allowed on the coastal band and filled areas. In addition to the foregoing, the construction of administrative, supportive, repair and maintenance, technical and social infrastructure, accommodation units for cruise ports and marinas, as well as tourism facilities will also be permissible at the coastal bands, coasts, and filled areas. Under the Integrated Coastal Area Management concept, the draft shall take over the approval authority of the plans that fall within the scope of the Coastal Law from local administrations and assign to the Ministry of Public Works. In addition, a further amendment on the draft is granting the investors the opportunity of preparing a development plan proposal together with a feasibility report that complies with the legislation.

The law proposes changes to the *acquired rights* concept as well. Whether the development plan exists or not, buildings constructed before this law complying with appropriate legislation will be accepted as an acquired right. Besides, the vertical line which joins the front side of the buildings will be recognized as the boundary of the coastal band and the development plans will be prepared according to these borders.

The protection principle of coastal areas has been destroyed by the new approaches such as *“vested interest“*. In addition, misuse of words in definitions can be interpreted in various ways. For example, constructions, unplanned but appropriate to the coastal law can be located in coastal areas.

The Integrated Coastal Management Concept which first appeared in the draft of the coastal law has lately been understood not to include an integrated planning approach for the whole city. In this manner, integrated coastal planning issues will be implemented in special areas selected by the ministry and authorization of the local governments will be replaced by the central authorities. In summary, the new law prepares the legal basis for dense construction in the coastal band and filled areas near the coasts (Ceylan, 2006).

Legal Framework in Ukraine

In 2001, the Parliament of Ukraine approved by law The State Program of the Protection and Rehabilitation of the Black and Azov Seas. This comprehensive document includes description of the goal, objectives, priorities, plan of actions and timeline, responsible governmental authorities and stakeholders, budget estimation and financial sources.

In 2002, Ukraine develops a draft law on the coastal zone. It has not been adopted by the parliament so far, therefore the management of the coastal zone is ruled by cross sectorial acts in land and water management or maritime activities, such as The National Regional Development Strategy of Ukraine till 2015 or the Law on Planning and Development of Territories

Development of coastal areas is planned in compliance with the same legal enactments as for the development of other territories of the state (e.g., The National Regional Development Strategy of Ukraine until 2015, The National Program for the Formation of the Environmental Network of

Ukraine for 2000-2015, The National Program of Conservation and Restoration of the Sea of Azov and the Black Sea Environment, The Law of Ukraine «On planning and Development of Territories») with application of certain additional land use planning, environmental and sanitary and hygienic requirements connected with the natural features of the sea coastal area. Development of the territories is accomplished in accordance with the long-term comprehensive and target-oriented national and local programs.

In accordance with the Law on "Exclusive (sea) Economic zone of Ukraine", Ukraine pursues, within its exclusive economic zone, exploration, development and extraction of living and non-living resources of the sea in water, at sea bottom and in the subsoil beneath the seabed as well as implements other steps aimed at conservation and restoration of the living resources, scientific research and support of shipping. As far as that seas and the sea subsoil are referred to the significant all-national objects in compliance with the Water Code of Ukraine, their planning and use are reflected in the sectorial programs and the programs of social and economic development of the country. However, the environmental activity remains, most probably, the main kind of the activity in the sea water areas.

De lege ferenda: In order to *improve the regulatory and legal base* and restrictions of various kinds of activities in the costal zones adjoining the high biological value water areas, to recommend the Parliament of Ukraine to adopt the Law on *"coastal zone"* which have been already made effective in the overwhelming majority of the Black Sea countries.

Statutory and regulatory arrangement of business activity in the coastal zone aimed at harmonization of economic and environmental relations necessitates that a number of enactments, above all the Law on *"Coastal Zones of Seas"* are to be adopted. This document should establish the coastal zone limits, principles of the national coastal policy, priorities of uses of natural resources and of individual, particularly valuable sites, kinds of ownership of natural resources, functions and authority of the management bodies at the governmental, regional and local levels in the sphere of the use of coastal resources, requirements to ecological safety that comply with the Convention for Protection of the Black Sea Against Pollution and the Ministerial Declaration on the Protection of the Black Sea, ecological standardization, introduction of norms and certification of the natural uses, and environmental audit. The law should include such important sections as the economic mechanism regulating the coastal and sea uses, institutional structure, control system, liability for violations of the legislation and principles of international cooperation. It is expedient as well to develop and introduce additions and amendments to the tax legislation with due account of preferences to environment-friendly activities.

4.2. Management structures (national - regional - local)

Institutional framework in Bulgaria

On national level, there are several Councils for cross-sector coordination. Their functions are related to the application of the IMCA principles:

- National Expert Council on Spatial Development - competent for the review and assessment of the Specialized Black Sea coast spatial development scheme.
- Supreme Water Advisory Council - makes reviews, provides statements, makes propositions

and draft decisions on the plans for management of river basins before and after public discussions.

- Environmental Advisory Council - discusses issues related to environmental protection for present and future generations and the protection of human health; also, preservation, use and sustainable management of environmental components (including Black Sea coast territories)
- Supreme Ecological Expert Council and Interdepartmental Commission - support to the Minister of Environment and Water in decision making on Environmental Impact Assessments (EIAs) and Strategic Environmental Assessments.
- National Biodiversity Council - reviews and proposes statements for the inclusion / exclusion of territories from the Natura 2000 network and the establishment of new protected areas.
- Advisory and Coordination Council on Environmental Protection in Black Sea waters and Management of the Implementation of Sea Strategy and Measures Program – specially established body within the Council of Ministers for management, coordination and control of the implementation of the Sea Strategy and Measures Program for achievement of good ecological condition of the maritime environment. The Advisory and Coordination Council is newly established, pursuant to the Marine Strategy Framework Directive 2008/56/EC. The focus of its future work is going to be review of problems with IMCA implementation as an important element of the assessment on the condition of the marine environment.
- Currently, in the process of their establishment are the following entities:
- Interdepartmental Coordination Council on Safety of Navigation and Environmental Protection from Ship Pollution – a body within the Council of Ministers, competent in the cross-sector coordination of safety of navigation and environmental protection from ship pollution activities.
- Interdepartmental Council on Spatial Data – stipulated as a supporting consultation body to the Minister of Transport, Information Technologies and Communication, whose competences are in the long term development of national infrastructure and provision of access to spatial information through compatible INSPIRE services on national and European level.

At regional and municipal level:

- Coordination Councils engaged with the implementation of regional and municipal strategies and development plans;
- Spatial Development Expert Councils, Engineering Infrastructure Expert Councils, which include representatives of authorities responsible for environment and water and maritime activities - with the purpose of coordination of policies when approving investment projects.
- The most developed practices are in the fields of environmental, water and biodiversity protection policies through public discussion in EIA procedures, The Plan for Management of River Basins, compatibility with Nature 2000 assessments, discussion on the protected areas management plans, etc.
- A firm practice has been developed whereby, prior to presentation of strategic documents (programs/plans/reports) for review by the Regional Development Councils, these documents are reviewed with the participation of NGOs, scientists, private individuals, etc.
- The Union of Bulgarian Black Sea Local Authorities (UBBSLA) is an independent non-

governmental, voluntary, self-governing and non-profit organization established as a juridical person in 1992, uniting the interests of all member municipalities and encouraging strong and effective local self-government and active citizen participation in the Black Sea Region.

Today the Black Sea coastal zone is subject to heavy human pressure, especially in relation of intensive development. Large areas have been seriously damaged or destroyed by inappropriate development in the past, lack of planning and bad management. The Black Sea and its coastal zone are also affected by the economic activities developed within the whole catchment basin.

It is compulsory to point out that there are some differences between countries that have already become members of the European Union (EU) (Bulgaria and Romania) and the other Black Sea countries. The EU has stricter demands with regard to environmental law enforcement and the integrated approach to using natural resources.

The Black Sea countries are strong and active supporters of the global efforts to acknowledge the importance of wetlands and modify human practices so that these areas are retained for future generations. The governments of Black Sea countries are signatory parties to several international treaties relating to environmental and wetland conservation; in particular they are responsible for the management of RAMSAR sites and also administer a range of social, economic and environmental programs that affect wetland conservation and use throughout the country. For this reason, the governments have to ensure that their obligations under these treaties are met through the approval and implementation of national policies on wetlands, including the development and implementation of national wetland conservation strategies. The significant role of the national governments in wetland conservation should be realized through cooperation and partnership with other governments, the business sector and local communities.

The European Union legal framework:

The guiding documents and regulations that guide, from the European Union level, the national legislation on environmental protection, water management, natural heritage management, integrated coastal zone management and management of programs financed from EU funds are:

- The Accession Treaty (The 21^{st} and 22^{nd} Chapters);
- The Water Framework Directive 2000/60 / EC;
- The Framework Directive on Marine Strategy, 2008/56 / EC ;
- The Parliament and the Council of Europe Recommendation on the implementation of Integrated Coastal Zone Management in Europe;

Institutional framework in Moldova:

- Currently the environmental institutional system in Moldova consists of the Ministry of Environment and its subordinated The State ecological Inspectorate, within Chisinau, Cahul, Balti and UTA Gagauzia Ecological Agencies and Ecological Inspections over districts nationwide – they perform state ecological control;
  structures:
- The State Hydrometeorological Service – develops and broadcasts hydrometeorological forecasts on the weather conditions and quality of environmental components;

- The Geology and Mineral Resources Agency - responsible for regulation and coordination of the study, protection and sustainable use of subsoil, and development of the mineral raw material base of Moldova;
- The National Agency for Nuclear and Radiological Activities Regulation established for the development of the state policy on nuclear and radiological issues, promoting and monitoring the implementation of the exclusively peaceful nuclear and radiological activities in Moldova;
- “Apele Moldovei” Agency - water supply and sanitation;
- Geography and Ecology Institute (double subordination) – scientific research in the environmental protection field;
- The state enterprise EHGeoM (Hydro-Geological Expedition Agency of Moldova).

Institutional framework in Romania

Several organizations and bodies play a significant role in the Romanian coastal zone management, as follow:

• The National Committee on Coastal Zone (NCCZ) is a consultative body including approximately 40 authorities, institutions and stakeholders, and has the responsibility to ensure the integrated management of the coastal zone of the Black Sea. To this purpose, its structure consists of key organisms relevant to managing complex problems in the area. It includes in its structure a permanent secretariat, which is provided by the Ministry of Environment and Water Management, through the National Institute for Marine Research and Development “Grigore Antipa“ - Constanta.

• The Romanian Waters National Administration (ANAR) is responsible for administering water basins nationwide, contributing to the formulation and implementation of national strategies in the field and is a member of NCCZ. In addition, ANAR is responsible for the implementation of proposed investments to be financed under the priority 5 of SOP.

• The National Administration Romanian Waters, Dobrogea – Littoral Water Basin Administration has got under its management the coastal zone as part of the stretch of basin water.

• The Ministry of Environment and Climate Change, formulates and implements through subordinated institutions strategies and environmental policies on all variety of aspects in the field; It also monitors the implementation of projects financed from various sources, as part of the implementation of sustainable development. Given the national and transnational importance of the coastal zone, it is subject to specific legislation and an integrated approach by CNZC.

•The Ministry of Transport manages the strategy, policies and investment programs on transport and infrastructure, in connection with the operation of transnational corridors connecting transport systems nationwide. Investments in transport infrastructure and facilities in the coastal zone are crucial for the national economy and availability.

• The Ministry of Regional Development and Public Administration, is mainly involved in planning national and regional territorial development, cross-border, transnational and interregional cooperation, urban and regional planning, housing construction, all relevant to the coastal zone. MRDPA manages a broad suite of programs financed from EU and national funds with impact on the coastal zone in the mentioned areas.

• The Ministry of Economy is directly involved in integrated coastal zone management, given the large scale economic activities that are taking place in marine transport, air, road and rail, trade, energy production, tourism.

• The Ministry of Culture manages, within the coastal zone, sites and important objectives for national and regional cultural heritage and provides the conditions for maintaining their quality and attractiveness in a context marked by various large-scale economic activities, tourism of several categories, aggressive real estate development and environmental issues.

• The Ministry of Health is involved in managing specific services and features in general. Population health issues related to technological risks and industrial emissions in the area are considered.

• Ministry of Agriculture and Rural Development (MARD), responsible for agriculture and rural development both in terms of strategies, policies at European and national level, as well as that of their implementation through programs and projects designed to address issues of local, regional and national nature. Complex activities taking place in coastal areas in agriculture, viticulture, livestock and fisheries require the involvement of MARD in correlation with other aspects of coastal zone development.

• The Ministry of Defense holds responsibilities, facilities and specific logistics related to the national security within the coastal zone and it is an integral part of the functions and activities of the area and its integrated management.

• The Ministry of Administration and Interior cover, in terms of coastal zone issues, responsibilities for organizing local authorities, public services and public safety issues, emergencies, customs activities etc.

• The Romanian Academy supports, through strategy, programs and research institutes, the research of critical aspects of the coastal zone. The Romanian Academy ensures the quality of the research products and conditions to support decision making in the areas and issues of interest based on scientific substantiation.

• NIRDEP - The National Institute for Marine Research and Development "Grigore Antipa" (NIMRD) has the responsibility to ensure the Technical Secretariat of the NCCZ. The Institute is mainly involved in basic, applied and technological research, with a crucial role for the knowledge, protection and management of coastal zone and marine environment within the Exclusive Economic Zone (EEZ) of Romania at the Black Sea. INCDM may propose the Ministry of Environment and climate change regulations in the field and to represent Romania in the marine sciences field, at various organizations and groups of experts of international conventions Romania has adhered too. NIMRD is the technical operator of the national network for physical, chemical and biological monitoring and of the surveillance of coastal erosion.

• GeoEcoMar (National Institute of Research - Development of Geology and Geoecology) is the research and development institute of national interest in geology, geophysics and geoecology with emphasis on aquatic, marine, deltaic and fluvial environments , constituting a pole of excellence in marine research, functioning as European and national center for studies of the large-type macrosystems river delta sea. The integrated coastal zone management is a major area of interest and competence, the Institute is attested by the Ministry of Environment and climate change (impact studies, environmental assessments) and the Romanian Naval Authority (safety management for marine activities). The Institute is not part of the NCCZ.

• The National Institute for Research and Development Danube Delta (DDNI) Tulcea is structured in three main areas: research, design and administration. The Institute conducts basic and applied research to support scientific management in the Danube Delta Biosphere Reserve area and other wet areas of national and international importance, for the conservation of biodiversity and sustainable development. The Institute is not part of the NCCZ.

• The National Institute for Research and Development in Tourism (INCDT) is focused on the research and planning in tourism, in ecological and sustainable bases. One area of concern is the Black Sea coastal area, interest reflected in a wide suite of studies, strategies and tourism projects. It is currently involved with other institutions in developing Zoning Plan for Coastal Zone, southern sector. The Institute is not part of the NCCZ.

• The National Institute for Research and Development Urbanproiect INCERC is the developer of patial development plans of special importance for Romania, regionally, nationally, cross-borderly and transnationally. The Institute developed the methodological approach to planning this area, and a suite of spatial development plans. The Institute is not part of the NCCZ.

• The Environment Protection Agencies in the counties of Constanta and Tulcea and the corresponding structures in the Southeast Region Development respond to environmental quality in the coastal area, checking Development plans, concrete interventions and their impact, focusing on issues specific to the region, the risks and hazards, climate change, natural heritage, biodiversity.

• Danube Delta Biosphere Reserve Administration (DDBRA) Tulcea is the entity responsible for the preservation and management of nature reserves and all aspects that make it unique, in terms of its exposure to the impact of navigation, aggressive tourism and the poverty of the area demographic challenges, climate change.

• The Prefectures of Constanta and Tulcea pursue enforcement of the law in the coastal zone and are part of the institutions responsible for the integrated management of it.

• The County Councils of Constanta and Tulcea counties are responsible for the overall management of the development of the two counties along the coast and contribute by all departments and investing activities specific to problem solving and the development of the coastal zone.

• The South-East Development Region is becoming increasingly important both in promoting integrated coastal zone and the financing of relevant projects in the area. This structure will overtake a concrete package of tasks in the planning and development of the area. RDA is not part of the NCCZ.

• Mayors in the coastal zone (Constanta, Mangalia, Eforie, Sulina and Costinesti, Limanu, 23 August, Tuzla, Agigea, Mihai Kogalniceanu, Corbu, Brasov, Istria, Mihai Viteazul, Jurilovca, Murighiol, Sf. Gheorghe, C.A. Rosetti) plan and manage local development, ensure land management towards development and direct the development through policies and public investments. Local authorities are responsible for the preparation and observance of urban plans and construction authorization in cooperation with other relevant public institutions in various areas of public interest.

• Chambers of Commerce Industry and Agriculture of the two counties are important actors in facilitating and improving economic activities in the coastal zone. These organizations were part of the strategy formulation of the integrated management of the area process, but are not part of the NCCZ.

• Employers and professional organizations in the field of tourism, ANTREC, own tools of concrete action towards the development of tourism in the area and are direct users of coastal zone in general and beaches in particular. Activities and generated by tourism businesses have a direct impact on the quality and physical condition of the area. These organizations are not part of NCCZ.

• The Romanian Naval Authority (RNA) - port authorities in the coastal zone are subordinated to the Ministry of Transport and carry out specific economic activities respecting a complex legislation that integrates environmental, economic, security issues.

• Nongovernmental organizations (Oceanic Club, Mare Nostrum, Naval League, Delta Friends, Ornithological Society) are responsible for inclusion in integrated coastal zone management of issues concerning the protection of natural areas, biodiversity, local communities, water sports and marine activities.

• Local communities are the most active factors of development in the area. Their interests are represented by local authorities, local elected officials and NGOs.

Institutional framework in Turkey

Turkey has a number of laws and policies that address coastal planning, environmental protections and sustainable use of resources. Despite a coastal law, there is neither legislation nor an institution that covers all aspects of coastal zone management.

The institutional set-up for coastal management in Turkey goes down from the Government (through Ministries: the Ministry of Reconstruction and Settlements, of Tourism, of Environment, of Forestry, Governorates and Directorates, to Municipalities. Each town in Turkey with a population of over 2,000 people may have a municipal structure, including a mayor, a municipal council, and various offices. The municipal authority is empowered to carry out a number of functions that are highly significant for coastal zone management. These include detailed town planning, infrastructural works and waste management, and water quality control (PAP/RAC, 2005).

The National Committee on Turkish Coastal Zone Management (KAY) established in 1993 plays an important role in promoting integrated coastal zone management (ICZM). The Turkish National Committee on Coastal Zone Management (KAY) is a national committee which is a national network with international connections. It is legally set up under the framework of the Higher Education Law. The Turkish National Committee on Coastal Zone Management (KAY) has contributed to the development of coastal policies in Turkey, by providing expert opinions on various coast-related developments, by publishing a newsletter, and by organizing a national conference series entitled The National Conference on Coastal and Marine Areas of Turkey - The Turkish Coast". Furthermore, the national committee has been a lead organization in the international MEDCOAST initiative.

The Committee is administered from the Middle East Technical University (METU, Ankara). The President of the Committee and the Chairman of the Executive Board is the representative of the Middle East Technical University. In 2003, the by-laws of the national committee were amended and the composition of the Executive Board was changed to 7 members without any allocation apart from the representation of the METU where the secretariat of the national committee is located.

The goals of the National Committee are stated in its by-laws as follows:

a. To support the efforts towards the conservation of and benefits from the nation's coastal areas by balancing the needs of the various uses.

b. To provide a medium for information exchange and cooperation between public agencies, universities, municipalities, NGOs, and the private sector, operating in or conducting research on the coastal zone.

c. To contribute to the development of scientific scientific research projects aiming towards the rational use of the coastal areas and their conservation; to sponsor and participate in these projects, to organize scientific meetings and to publish related topics.

d. To establish a Center to store data and information useful for coastal zone management, with an emphasis on national needs, and to provide these to users under certain arrangements.

e. To define, investigate and monitor the problems of coastal uses that are present in the country now, or that will appear in the future; to contribute to the efforts onwards solution of these problems, and to support and sponsor these efforts.

The Coastal Inventory Agency in the Ministry of Public Works and Housing is charged with the determining the coastal shoreline and developing inventories in implementing coastal law. In 1997 the Environmental and Coastal Management Agency was established by the Ministry of Environment to prepare, implement and evaluate environmental management plans (PAP/RAC, 2005).

On the other hand, the National Coastal Engineering Conference is organizing by Turkish Chamber of Civil Engineers biennially since 1995.

Institutional framework in Ukraine

According to the law, the Ministry for Environmental Protection of Ukraine is responsible for supervision and coordination of the activities aimed to achieve Programs goal. The Program has inter sectorial nature and includes issues related to pollution reduction and control, integrated coastal zone management, human health, biodiversity and landscape protection, sustainable use of marine resources, environmental monitoring and emergency response, and others.

The National scale of the Program requires relevant institutional support. For these reasons, in February 2004 the Inter ministerial Advisory Commission on Environmental Issues of the Black Sea Region (the Commission) has been reestablished to coordinate related activities, implemented by different governmental bodies. Taking into account the importance of the ecological safety in marine region and implementing the provisions of the Program, the special Intersectorial Task Force for Technogenic and Ecological Safety of Internal Waters, territorial waters and exclusive marine area in the Black and Azov Sea was established at the Cabinet of Ministers.

Finally, a special unit – Division of the Black and Azov Seas – was created at the Ministry for Environmental Protection within its Directorate of Biotic, Water, Land Resources and EcoNet. The purpose of these establishments is to promote and streamline the implementation of national policy as well as the coordination of national and international program in the field of environmental protection, sustainable use of natural resources and ensuring the ecological safety in the Black Sea region. All these institutional arrangements should be considered as evidences of serious governmental attitude to the marine environmental issues (Moychan, 2005).

4.3 Public participation process

Public participation involvement in discussions on spatial development plans is regulated by the Spatial Development Act only for plans of higher classification. When plans of smaller class are considered, the public is less involved. Public involvement is traditional and has a well-established practice in the EIA and compatibility assessments of plans, programs and investment projects.

Consultative bodies and their role in streamlining land-sea, vertical and horizontal integration of the governance were described above. The concept of ICZM partnerships is not practiced yet in the countries from the region. Mediation and conciliation procedures are still not part of the culture and regulations as well. Public participation and formal consultation mechanisms were used in GE when developing the national ICZM strategy with the support of the EuropeAid ECBSea project, but it seems that neither approaches motivated the Government to adopt the strategy. EU member Black Sea countries are obliged to implement public participation through EU Directives on Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA). Public rights to seriously challenge inadequacies in coastal plans and development projects are limited only to the combination of ecological expertise and EIA mechanisms in the former Soviet countries. EIA and SEA mechanisms for genuine participation are underutilised in Turkey as well. International consultations at the regional level are facilitated by the ICZM AG, and its role should probably be enhanced by including ICZM NFPs in the mechanisms of meaningful communication with regard to the strategies, plans, programmes and projects of transboundary nature.

Participation of Stakeholders and the General Public

Public participation is one of the key factors believed to drive ICZM. Participation means the involvement and collaboration of the private sector, NGOs, citizens' groups and other non-institutional organizations or individuals interested in or affected by the management of the coast. Coastal resource planning and management requires the highest level of stakeholder and public participation possible. All relevant agencies of central and local governments, resource users and other interests that would be affected by the planning process should be consulted during this process. Giving the public an opportunity to influence government decisions from the outset defuses opposition to particular government actions and builds broad-based consensus for environmental programs as a whole. If the public is involved in the full decision making process, their concerns may be met early on in the planning process when changes may be easier to make, rather than late in the process when even small changes may cost both time and money. In addition, by being involved in the full decision making process, the public is exposed to the multiple factors involved in each decision. Even if the public does not agree with the final decision, they are more likely to understand why the decision was made and thus may not oppose it. Thus, even though allowing for public input into an environmental decision may delay the decision making process in the short term, it can save valuable time and money in the long run by avoiding lengthy and divisive disputes after the decision is made.

Effective community consultation, early on in the ICZM cycle, also plays an important role in conflict prevention; conflicts during project preparation are costly both in terms of delays as well as in projects not approved as a result of conflict among stakeholders. The high priority accorded to "ownership of projects" and "stakeholder participation in all program phases" is a typical success factor for all integrated resources and environmental management fields.

The key principles of public participation for ICZM initiatives are as follows:

1) programmes should provide adequate opportunity for the active involvement of all stakeholders, direct and indirect, and the wider community;
2) the process should be open and transparent, conducted in a fair and impartial manner on the basis of shared information, data, and knowledge, using all suitable media; some conflict should be expected and managed;
3) wherever possible, stakeholders should participate responsibly in proceedings on behalf of their organizations, working towards collective agreements and actions; good leaders are essential;
4) every effort should be made to win political support and work closely with existing local institutions;
5) suitable mechanisms should be tailored to local circumstances, issues, and the needs of all participants, focused on consensus building;
6) participants should commit themselves to a long term vision for the sustainable coast, recognising their diversity of interests and working together in a process of shared learning;
7) participation should not be focused on problem solving alone, but also at securing opportunities for economic prosperity and conservation compatible with wider sustainable development goals.

The level of participation will be dependent on the extent to which stakeholders, public and authorities are prepared for participation. In some countries, special structures have been designed for this kind of involvement.

One of the important steps is to discuss and agree the type and style participation at the earliest stage. Modes of participation may vary between minimal consultation through shared working to shared decision-making and degrees of empowerment. Different approaches may require different mechanisms (*Methodology for Spatial planning within Integrated Coastal Zone Management, 2004*).

Chapter 5: Analysis of problems and opportunities in terms of the introduction of ICZM in the Black Sea Region

Everywhere in the world, the excessive exploitation of the natural resources and the intensive population growth have put enormous pressure on the ecosystems and this has lead to biodiversity loss and ecosystem degradation, erosion, pollution, conflicts between users and space congestions problems. Climate change impacts and related sea levels and water temperatures are expected to further intensify the treat to the world's coastal zones. The effects of climate change could be devastating to vulnerable coastal and marine areas as well as to the function and structure of their ecosystems. Increasing sea level (1.7 mm/year) changes the shape of coastlines, contributes to coastal erosion and leads to flooding and more underground salt-water intrusion. It is now widely accepted that development of the coastal zone should be based upon a proper understanding of the processes in the coastal zone, supported by a sound engineering technology and socio-economic skills to obtain an acceptable balance between short term benefits and long term assets.

Therefore, there is an urgent need for a controlled development of this area. Conflicts between the various user categories are becoming more and more manifest. These conflicts will grow in scope and size with increasing population density and related increase in the use of the earth's resources. There is a need for a common methodology which can be used to describe the complex interactions between the resource system and its potential users. There is a need, therefore, to plan and control this process in a systematic and sustainable way using the Integrated Coastal Zone Management (ICZM) approaches.

In the present Study, several items for further development of ICZM activities have been identified in the targeted countries:

Bulgaria

There is need to:

1. develop and use of a set of indicators, specific for the Bulgarian issues, useful for the evaluation of the progress on ICZM policies ;
2. create of GIS base Information System for the coastal and marine areas;
3. improve the monitoring activities of the natural processes in the context of the climate change and of the sea level rising with the aim of preventing the loss of coastal areas;
4. enhance the participation including the civil society
5. design the coastal defense structures; beach nourishment activities and increase of the natural park's areas;
6. protect and regenerate the coastal areas through specific research projects;
7. prepare the specific development plans for the marine areas;
8. develop the cross-border cooperation in the Black sea context
9. improve the cross-sector coordination mechanisms to better manage the ICZM issues.

Identified instruments:

• The legislative framework: need for a clear legal definition of the coast jurisdiction; need for a in depth analysis of the existing legislative framework in order to better manage and rule the public-private collaboration and to better harmonize the competencies of The Central government and local authorities).

• The institutional coordination: needs for a better inter institutional coordination in order to develop common actions to reinforce the coastal areas identified in the "General scheme for the protection of the Bulgarian coast of the Black sea"; need for support to small municipalities in their coastal development activities; Statistical data need to be disintegrated and to be define from point of view to support ICZM indicators according to Regional convention.

• The policy integration: lack of a in depth analysis of the existing international agreements in order to develop a specific strategic documents for ICZM implementation; lack of a common strategy among municipalities plans, programs and projects with strategic and planning instruments at national and regional level.

• The information sharing: need for a unified information system in order to manage planning and use in the coastal areas.

Moldova

The Republic of Moldova pays particular attention to the development of new opportunities for the Giurgiulesti International Free Port (GIFP) at the Danube River, which connects Moldova with the Black Sea.

Landlocked Moldova obtained the area where the port is located - a small strip of territory on its borders with Romania and Ukraine - through a 1999 land swap with Ukraine. Moldova gained thereby access to international waters. The small port is owned by Netherlands-based EASEUR Holding (80%) and the European Bank for Reconstruction and Development (EBRD) with 20% (http://www.bne.eu/content/landlocked-moldova-gets-international-port]. Today, Giurgiulesti has terminals for oil products, grain and vegetable oil, and a small container terminal that opened in 2012.

Previously, imports and exports by sea were channeled via Odessa, which is less than 60 km from the Moldovan border, and other Ukrainian ports. “Having its own port gives Moldova more reliable access to international markets, as it is no longer dependent on the authorities of a neighbouring country. Secondly, with the opening of an alternative port competition increased and transportation costs have fallen,” says Thomas Moser, chairman of Danube Logistics. “This has helped to diversify Moldova’s export trade.”

Giurgiulesti International Free Ports’ entire territory has a status of a free economic zone until 2030. Due to its location on the Lower Danube with available water depths of up to 7m, GIFP is capable of receiving both inland and sea going vessels. Against this background GIFP serves its client as:

- the only direct sea/river-borne transshipment and distribution point to and from the Republic of Moldova
- a regional logistics hub on the border of the EU with access to road, rail, river, sea, and
- an excellent location for business development, because of its strategic location, tri-modal transport infrastructure, low cost environment and a unique customs and tax regime.

Romania

Romania has recognized that ICZM is a valuable instrument and created structures and legal framework to promote its implementation. Since 2002 Romanian Government decided to initiate and strengthen efforts on integrated coastal zone management by issuing the Emergency Ordinance for ICZM. An integrated approach (Principle 1) is required to ensure that the Romanian coastal zone is environmentally and economically sustainable, as stated in the National Plan for Integrated Coastal Zone Management (draft emission 2006-2007), which is the main document concerning the Romanian ICZM strategy. This allows the co-ordination of multiple, often contradictory, interests. It provides directions for the desired developments in the most important economic sectors of the coastal zone (agriculture, tourism, industry, infrastructure, [international] trade and fisheries), taking into account the need to protect the environment.

The strategy is also considering as a long-term policy document, considering the highest social, economic and ecological benefit for the present and future generations (Principle 2). Relevant elements of the Romanian long-term strategy should be translated into medium-term policies and short-term action plans by the relevant sector agencies in a coordinated and integrated manner. Furthermore, a long-term perspective, in order preserve the environmental, cultural and heritage appeals, is taken into account in the sustainable tourism development, with the National Tourism Development Master Plan (2007-2026).

Little progress can be identified towards the implementation of Principle 3. It mainly refers to the efforts to protect the coastal zones from climate change risks (mainly erosion), started very recently. In particular the Coastal Protection Plan for southern coastal unit (completed in 2007) and northern coastal unit (started in 2008) have studied the better protection systems in order to make the coastal zones more prepared for climate change risks, and erosion related problems. The planned activities for the implementation of adequate infrastructure of natural risk prevention in most vulnerable areas (within the Sectorial Operational Programme 2007-2013) will also contribute to the protection and rehabilitation of the Romanian coastal zone and improving of environmental factors, through engineering works for combating coastal erosion.

Local specificities (Principle 4) and working with natural processes (Principle 5) are both considered in the Romanian ICZM Strategy, though specific progress of implementation have not been reported apart from the above mentioned activities related to erosion and climate change.

Some progress features public participation (Principle 6), considered essential for sustainable coastal zone management. Several meetings of the National Committee of the Coastal Zone have been held since 2006 in order to discuss about over 170 investment projects in the Romanian coastal area. Furthermore 3 working group meetings for debating 4 major projects (MATRA, PLANCOAST, ASCABOS and National ICZM strategy Action Plan) developed in the same area have been held in the same years. The National Committee of Coastal Zone (NCCZ), established since 2004 in order to ensure an integrated coastal zone management, has the major role in the vertical institutional coordination among different levels of governance (Principle 7). Its role could be strengthened, according to the proposed draft amended Government Emergency Ordinance on Integrated Coastal Zone Management.

The activities of the above mentioned NCCZ also contribute to the achievement of the Principle 8, in particular supporting coherence among different activities for the protection of the coastal zone. It focuses on achieving consensus between ministries and agencies regarding relevant coastal zone issues. It endorses the plans regarding integrated coastal zone management and local and regional spatial planning.

New responsibilities for the NCCZ are expected by the proposed draft amended Government Emergency Ordinance on Integrated Coastal Zone Management. They include the analysis and agreement of the documents related to coastal area delineation, urban planning, and territorial arrangement; analysis and agreement of the measures for erosion control, analysis and agreement on documents related to ICZM policy and strategy as well as legislative proposals; agreement on activities for integrated control and monitoring of coastal zone.

The Romanian report on ICZM implementation has provided a short outlook of the main needs, opportunities and obstacles for further development of ICZM. The main themes are referred to:

• the legislative framework: need of a new government decision for creating a more effective NCCZ, including the delineation of the coastal zone and of the interdiction zone;

• information sharing: need for a National Database for coastal zone environment; methodology for organization and updating of the National Database for coastal zone environment; methodology for public access to the National Database for Coastal Zone Environment;

• science based approach: need for an integrated control and monitoring system of the coastal zone environment and for the implementation of Integrated Marine Spatial Planning.

Turkey

The identified needs are:

- There is a strong need for new (ICZM) laws or amendments of existing laws related to sustainable development in the coastal zone. This also includes a need of strengthening of local governments.
- There is a poor inter-departmental coordination in the coastal zone both governmental and non-governmental.
- In the different sectors in the coastal zone there are increasing current and potential conflicts concerning the exploitation of resources.
- There is an absence of or weak public participation in the decision-making process focused on coastal zone management.
- There is a lack or severe shortage of financial resources for environmental/ICZM investments, partly due to transition to a market economy.
- The shore edge line should be determined before the planning process starts, theoretically prior to any development along the coastal area.
- The definition of the shore edge line does not cover the ecological differences.
- Lack of scientific criteria and using proper techniques.
- Institutional organisation and the capacity of professionals are quite limited. Efforts to improve activities within the scope of the BSEP ICZM program have proven insufficient in many respects. Particularly, the establishment of a database research studies, institutional and professional education, public awareness and enhanced participation of the public could not be satisfactory achieved.

- In Turkey, local organizations are weaker than central organisations. There are deficiencies in local administrations and in local organisations of the central government, especially with regard to decision-making, budgeting and getting financial aid. Although Turkey has assumed the principle of being administered locally as a policy, the necessary arrangements to fully implement this policy have not been realised yet.
- Legal mechanisms with regard to public participation and Access to information are not sufficient. Legal arrangements in this respect (EIA etc.) provide limited possibility to the public to participate in few areas. On the other hand, NGO initiatives and public consciousness are more and more developing and becoming widespread.
- In the process of EIA, which has been applied since 1993, there are still problems with regards to its application, supervision and monitoring. There is no legal basis and criteria in strategic EIA and environmental.

Major ICZM problems of Turkey are:

- Widespread urban sprawl, tourism development and near-shore illegal construction.
- Coastal waters polluted by municipal, industrial, agricultural and ship waste.
- Biodiversity protection required for extremely rich biodiversity and last natural habitat for monk seal, green turtles and other rare species.
- Hot spots with serious municipal and industrial pollution of coastal areas.
- Need for protection of marine and coastal biodiversity such as dunes, wetlands, marine systems with sea grass beds, whales, turtles and the last monk seal population.

The following concrete suggestions will serve many purposes for ICZM in Turkey, both directly and indirectly:

- Conflicts between the public and individuals will come to an end.
- Using the new model, the coastal areas will become part of the public domain without charge and without requiring compensation.
- As stated within the details of the model, the public will receive an additional public share of 20 % for each application area.
- The problems in the implementation of the provisions in the coastal Law no. 3621 will be eliminated. The coasts will be open, free of charge, to the public and the infrastructures will be ready to be developed for recreation, resting areas and green areas, etc.
- The number of lawsuits field for the annulment of title deeds by the revenues and for compensation by the property owners will significantly decrease. As a result, the workload of the judicial system will be reduced and there will be fewer losses, in terms of both time and economics, for the administrators and individuals.
- The supervision of the restructuring and the zoning operations involved in the subheadings in the coastal programmes will be enabled.
- The balance between protection and usage with respect to urban settlement and maintaining the natural environment will be enhanced.

Ukraine

Statutory and regulatory arrangement of business activity in the coastal zone aimed at harmonization of economic and environmental relations necessitates that a number of enactments, above all the Law *«On Coastal Zones of Seas»* are adopted. This document should establish the coastal zone limits, principles of the national coastal policy, priorities of uses of natural resources and of individual, particularly valuable sites, kinds of ownership of natural resources, functions and authority of the management bodies at the governmental, regional and local levels in the sphere of the use of coastal resources, requirements to ecological safety that comply with the Convention for Protection of the Black Sea Against Pollution and the Ministerial Declaration on the Protection of the Black Sea, ecological standardization, introduction of norms and certification of the natural uses, and environmental audit. The law should include such important sections as the economic mechanism regulating the coastal and sea uses, institutional structure, control system, liability for violations of the legislation and principles of international cooperation. It is expedient as well to develop and introduce additions and amendments to the tax legislation with due account of preferences to environment-friendly activities.

Significant role in the development of the statutory and regulatory basis of business activity in the coastal zone belongs to a formation of a complex of national standards and regulatory and methodological documents in the sphere of marine resource management.

The priority elements are:

- development of the standards and terms in the sphere of marine uses (general terms and definitions);
- realization of the classification and classification codes, quality standards and regulations), environmental and economic substantiation of the decisions in the field of marine resource management with due account of potential damage of various kinds of businesses;
- ranking of the coastal zone sites according to the anthropogenic loads;
- development of the methodological guidelines for selecting the priority directions for developing the marine economy and the development of natural resources potential of the coastal zone.

Conclusions

The analysis of issues in marine and coastal areas and those originating from catchment basins reveals (Black Sea Transboundary Diagnostic Analysis, 2008) that the underlying causes of individual problems in many cases interact with each other, sometimes have common basis, and may frequently lead to effects of combined and cumulative nature. One of the root causes leading to wide range of such issues is poorly regulated development and resource use in coastal zones, and a brief tour around the region immediately reveals the large scale of this. Obviously, the multiplicity of interdependent problems there can only be dealt with and responded in a holistic and integrated manner.

The Black Sea coastal countries, including Romania, Bulgaria, Ukraine, Turkey and Moldova, cooperating within the framework of the Bucharest Convention, agreed therefore to employ common governance methodologies based on “ecology principle”, that coastal economic development (associated with the coast and the sea itself) to be sustainable should take full account of marine and coastal environment safety and consider also developments upstream in the wider catchment areas that may negatively impact the state of the Black Sea.

In particular, through signing the *Strategic Action Plan for the Environemntal Protection and Rehabilitation of the Black Sea, 2009* (BS - SAP (2009) countries confirmed to adhere to the following governance and management approaches:

- Integrated Coastal Zone Management (ICZM);
- The Environmental Impact Assessment (EIA);
- Integrated River Basin Management (IRBM).

Combined application of ICZM and IRBM was repeatedly confirmed as a legally binding general obligation in the updated Protocol on the Protection of the Marine Environment of the Black Sea from Land -Based Sources and Activities (LBSA, 2009), which is urging countries to endeavor applying the integrated management of coastal zones and watersheds.

BS - SAP (2009) shares the common definition of ICZM with the Communication 2000 (547) from the Commission of the European Communities to the Council and the European Parliament on Integrated Coastal Zone Management: A Strategy for Europe (EU, 2000).

In the context of Ecosystem Approach the harmonization of ICZM and Maritime Spatial Planning (MSP)/Marine Protected Areas (MPA) processes would be the manifestation of the principle of integration of terrestrial and marine domains.

The planning at landward and seaward should therefore be conducted in truly coordinated manner if the fulfillment of the 'ecology tenet' is looked for. In that way, MSP - MPA, ICZM - MSP and ICZM - IRBM links has to be established with legacy, planning practices, etc. for sustainability of the governance and environmental protection.

Furthermore, sound scientific knowledge and information on coastal margins (lands and waters) and proper management of human development and activities in these areas are indispensible for achieving all four Ecosystem Quality Objectives (EcoQOs) set by the BS SAP (2009).

Based on analysis provided by the experts in the project, we can make the following conclusions with regard to the medium - and long - term priorities for ICZM in the Black Sea region:

- Legal framework and strong management instruments are needed in all Black Sea countries to facilitate ICZM implementation on the ground.
- The Black Sea region should agree on and apply a coherent system of indicators for an integral assessment of the state of the coastal zones in the Black Sea, and the progress with implementation of ICZM.
- ICZM Guidelines should be developed to serve as a solution in a medium term.
- ICZM legal instrument, such as protocol to the Black Sea Convention, could be developed and adopted in the medium to long term perspective.

Based on these conclusions, the BSSAP (2009) contains two broadly defined targets (and related outputs) in the field of ICZM:

(i) to further recognise and implement integrated coastal zone management principles (through development of ICZM Guidelines);

(ii) to disseminate the knowledge of ICZM at various levels of governance (through development of education packages and delivery of practical training).

These targets (and related research and development needs) are in line with the statements of the ICZM Communication of European Commission, concerning the generating information and knowledge about the Coastal Zone, in which the European Community pledges to:

(iii) promote the research that meets coastal zone management needs;

(iv) put special emphasis on definition of indicators for the coastal zone;

(v) support education and training in ICZM.

It should also be recognized, that the coastal management tasks and governance objectives can not be achieved without the application of sound science and its integration with coastal decision - making. Therefore, in the spirit of the Shared ICZM Governance Platform with Mediterranean, the strategic research agenda for coastal sciences is proposed to follow the two decades of best practice applied in this partner region as well as in the Black Sea area.

Based on the experience of almost 20 years of ICZM work within the framework of the Bucharest Convention and BS-SAP, as well as on the extensive collaboration with EU initiatives towards the Black Sea and other regional seas, the following key governance, policy and management oriented research areas are proposed for inclusion in the field of science and research:

- Research to support the development of ICZM legal instrument, such as protocol for the Black Sea.
- Develop monitoring and research capacity in the Black Sea region to comprehensively study the state of the coast, with special focus on sensitive coastal resources and ecosystems (beaches, dunes, wetlands, estuaries, lagoons, bays, river mouths, etc.).
- Compile data in agreed formats for regular calculations of statistical, spatial and progress indicators for ICZM, including indicators defined for MSP and IRBM needs, and harmonized with coastal sustainability indicator schemes applied in other European regional seas.
- Adapt, develop and implement comprehensive set of training and education packages (based on experience from other regional seas) oriented towards the scientists, decision makers and practitioners involved at various levels in coastal research and management.
- Further promote and implement the strategic research agenda for coastal sciences & engineering in support of ICZM in the Black Sea region, building on networking experiences of international scientific fora, such as biannual Medcoast and Black Sea Outlook conference series.
- Extend the research and application of the Shared ICZM Governance Platform developed under the FP7 PEGASO Project
- Establish on an operational basis the observation system of the Black Sea catchment, following the key recommendations of FP7 EnviroGRIDS.

Orientations for the future of the Black sea ICZM recommendation include the following items:

- ICZM should be based on a clearly focused and visible instrument to be effective and maintained in the long term;
- the substance of the instrument should be more specific and concrete, with more precise tools and deliverables, providing a clearer sense of objectives and/or preferred development orientation;
- ICZM should address the continued need for integration in planning and management across the land-sea boundary. Coherence as from the design of policies should be a priority, including the development of initiatives at the EU and international level. Cooperation in the regional seas context is particularly relevant to ensure a coherent development and use across the land-sea boundary and shared sea space;
- the long-time span for implementation of integrated approaches should be better recognised;
- flexibility is necessary to adapt existing initiatives and structures to need.

Chapter 6. What has to be done to improve opportunities for introducing ICZM in the Black Sea Region

6.1 Suggestions to the national governments on how to improve national policies towards ICZM

Integrated coastal zone management is a process that brings together all those involved in the development, management and use of the coast. The objective is to establish sustainable levels of economic and social activity in our coastal areas while protecting the coastal environment. This process involves multiple problems and causes of problems, multiple objectives to achieve required outputs from the use of coastal incomes. Integrated coastal zone management involves different creative capacities over space and time, multiple actors like stakeholders and institutions with variable duties for different elements of administration.

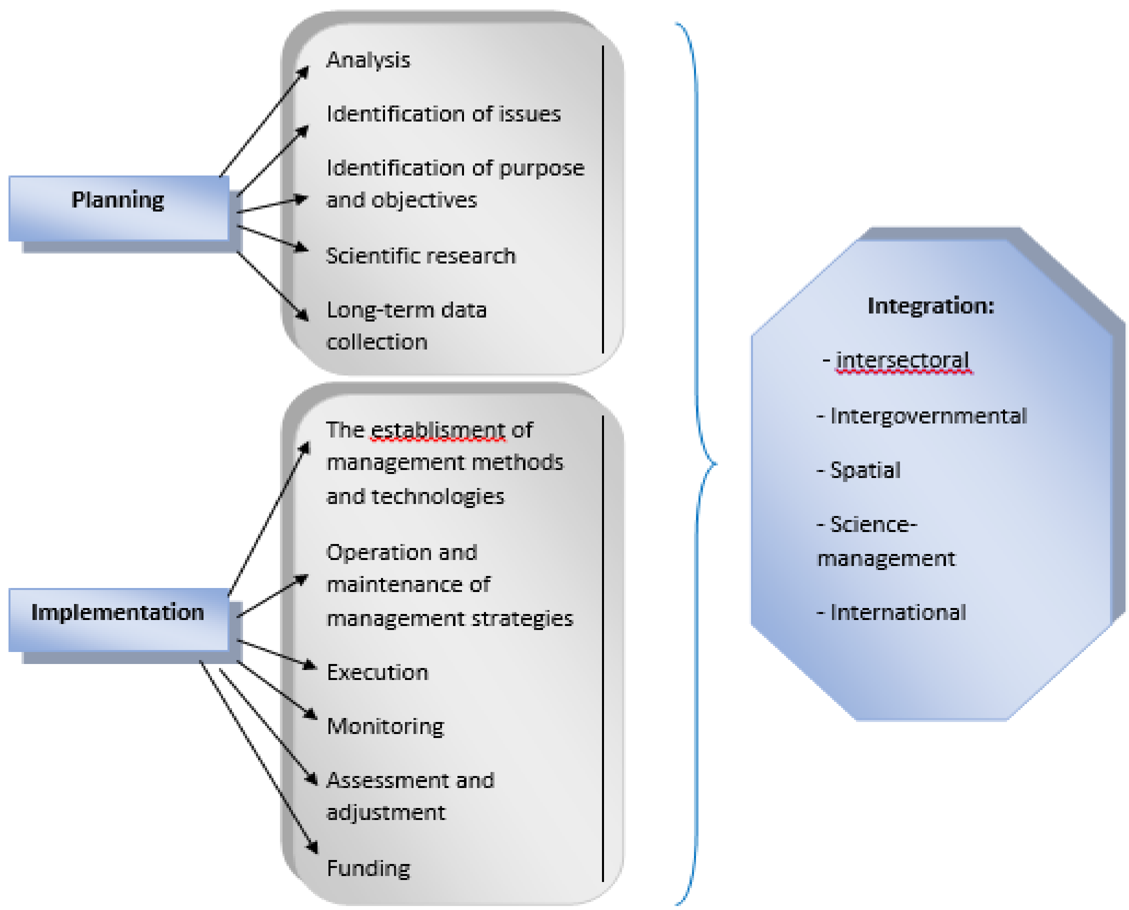


Fig. 6.1 ICZM process components

The coastal structure necessities to be managed is a complex, forceful web of interrelationships among human activities, demands in society, existing natural incomes and external natural and human influences. There is very important to establish a framework (the responsible and their mandates), because it isn't a single agency/institution for integrated planning/implementation of policies or action plans across the several sectors of coastal zones. The main actors are government institutions of each country linked to the coastal area. Unfortunately, many government institutions – at numerous levels of administration - perform facilities and operate programs on the basis of different mandates and laws often containing different goals, objectives and policies.

Institutional co-operation depends on 3 key factors:

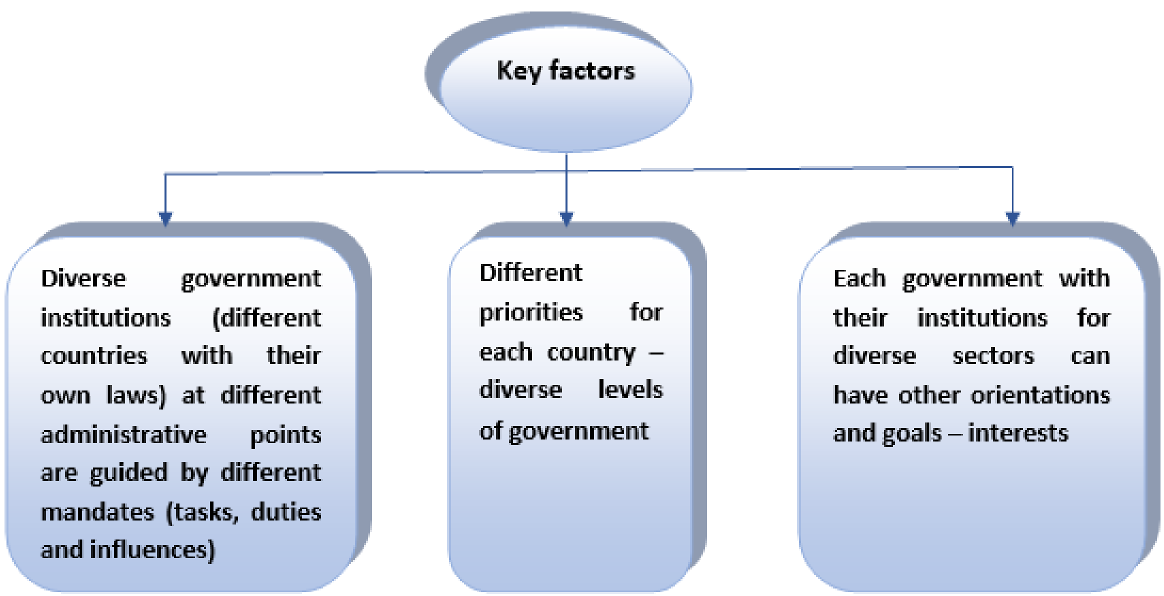


Fig. 6.2 Key factors of institutional co-operation

The main challenge is to be able to guarantee that all actions taken by different government institutions (involving stakeholders like private sector, NGO`s, inhabitants) are coordinated with one another and are reliable with agreed aims and objectives (consequent from the coastal strategy). That means we need to create an institutional mechanism that can co-ordinate the countless actors and organizations involved in coastal issues in order to guide processes and steer developments into the stated guidelines to accomplish desired goals and objectives.

Management and co-ordination

Within the legislation of the European Union (EU) frameworks for the implementation of ICZM have been established. The EU is one of the parties of the Barcelona Convention, so that through common policies, legislation, strategies, programs and projects of the EU and international organizations a framework for the development and implementation of ICZM initiatives at the national level is created (Protocol on ICZM in September 2010).

Even not all the Black Sea states are EU members, most of them are trying to accomplish requirements of the European Union (EU) frameworks for the implementation of ICZM. The zones of the marine environment and coastal areas are topic to a wide range of EU policies and regulations, including:

Table 6.1 EU policies and regulations covering zones of the marine environment and coastal areas

The Water Framework Directive (2000/60/EC)
Marine Strategy Framework Directive (2008/56/EC)
Environmental Impact Assessment Directive (85/337/EEC)
Strategic Environmental Assessment Directive (2001/42/EC)
INSPIRE Directive (2007/2/EC)
The Habitats Directive (92/43/EEC)
The Birds Directive (79/409/EEC)
Management of Bathing Water Quality Directive (2006/7/EC)
The Nitrates Directive (91/676/EEC)
Urban Waste Water Treatment Directive (91/271/EEC)
Integrated Pollution Prevention and Control Directive (IPPC, 96/61/EC)
Other regulations in relation to hazardous substances

Additional significant regulations and policies in the EU, which are relevant to coastal zone management: Recommendation on ICZM from 2002, the network of ecologically valuable areas, Natura 2000 for marine ecosystems and coastal areas, and the revision of the Common Fishing Policy (CFP), with the integration of environmental issues. New EU policies were formulated on the basis of the ecosystem approach through documents such as the EU Marine Strategy from 2005, the Blue Book: Integrated Marine Policy of the European Union from 2007.

The National Committee of the Black Sea states, as the primary coastal management entity, should rather function(s) at an upper level than that of the sector agencies so it has the necessary powers to match sector policies, plan and actions. The NC should be sufficiently financed and staffed.

The proper functioning of sector agencies of each Black Sea country (in charge with integrated coastal zone management) and NC, with supervisory, steering and co-ordination tasks, is based on having the following characteristics:

1. Sector agencies must be authoritative - suitable legal/legislative authority.
2. Sector agencies must be able to guide the actions of all agencies and stages of government that have decision making authority relative to the coastal zone.
3. Sector agencies and NC carry out their tasks and responsibilities based on the mandate derived from each government.
4. Sector agencies must be seen as a legitimate/appropriate fragment of the process.
5. Sector agencies must be capable of creating knowledgeable decisions - have access to appropriate scientific and technical expertise and information.

The sector agencies should delegate certain authorities to the NC but will remain final responsibility. The NC is accountable to sector agencies.

In order to improve the current conditions in marine area, some suggestions must be taken into account:

- The legal framework should become the fundamental legislation to illustrate the nature and current practices used by the authorities responsible with the organizational functions in ICZM process.
- The regulation should be in total compliance with other legislative initiatives, generating an integrated system;
- The legal framework should eliminate the current incompatibilities. The coastal area should be clearly delineated through the document.
- The legal framework should also delineate the mandate of every authority implied, in order to avoid legislative duplication in implementation process.

6.2 Suggestions on improving intergovernmental and international cooperation

It is important to approach intergovernmental collaboration and coordination and to facilitate synchronization in development policies and plans for the coastal zone to achieve established goals and objectives which should be derived from the coastal zone management strategy. Planned institutional set-up is consequently based on the identification of the coordinating bodies (or entities) needed, the tasks/activities that need to be carried out by these forms as already identified in the existing coastal zone management legislation.

The appropriate functioning of this institutional set-up is based on the following:

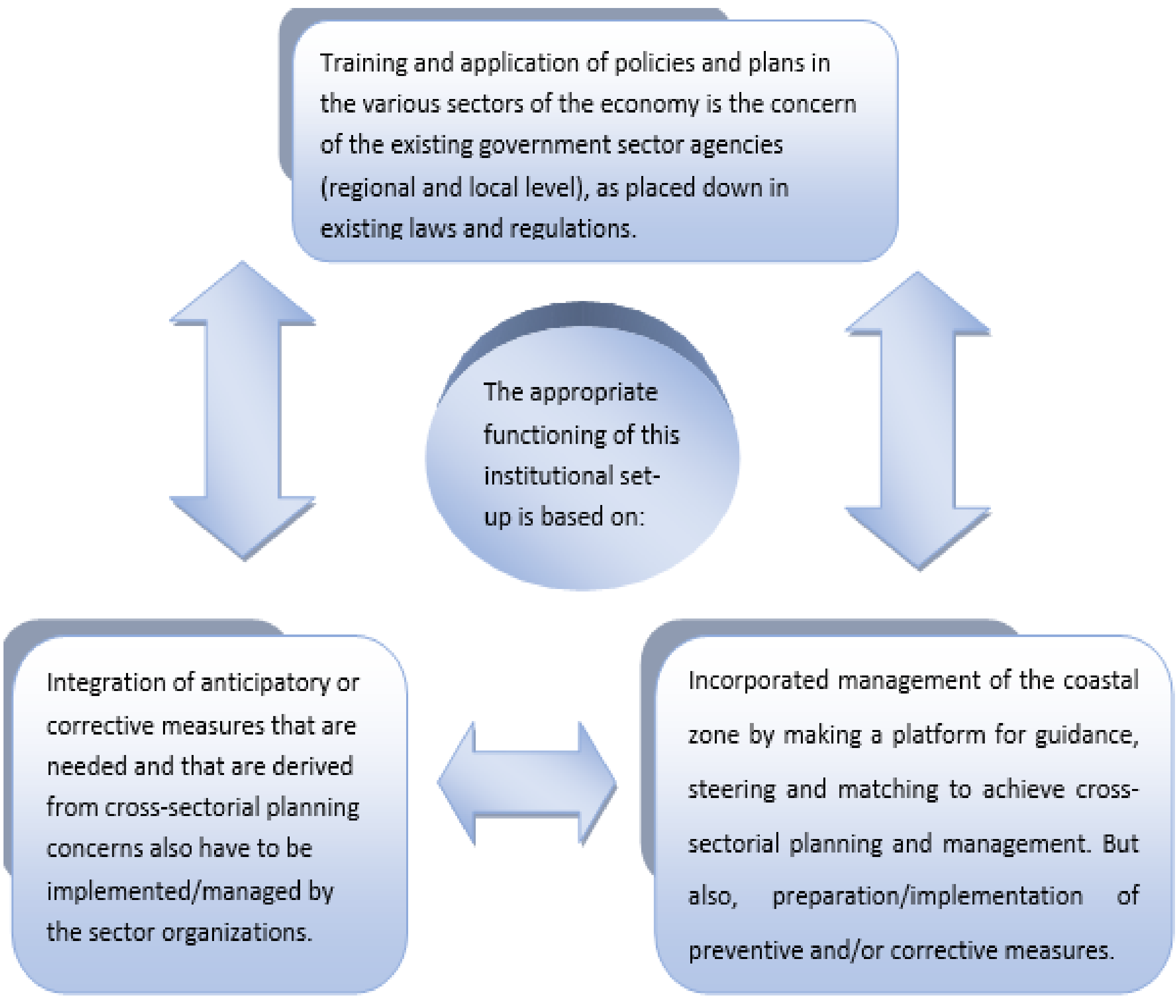


Fig. 6.3 The appropriate functioning of this institutional set-up

It is crucial that these facts are carried out by the coordinating bodies in partnership with the executing bodies.The bodies functioning are sector agencies established on the basis of each country`s current law and regulations having their own jurisdiction over the various policy areas. These sector agencies will be the bodies or entities responsible for real implementation of policies and plans. Their duties are: to translate/ transpose the (long-term, multi-sector) strategy objectives into medium-term policies and short-term action plans. Sometimes agencies have to realize the essential degree of incorporation and correction by defining preventive and/or corrective measures in close relationship and discussion with their relevant associated sector agencies.

Table 6.2 Proposed responsibilities of the NCCZ

National Committees for the Coastal Zone	
The responsibility for executive tasks (preparation and implementation) for sector policies and plans and applying the proper implementation tools, remain with the existing sector agencies, as already defined by existing laws and regulations.	Proposed responsibilities/tasks for the NC: 1. Must have the strategy for the coastal zone integrated into the broader national planning process of each country; 2.Allows responsibility for the proper management, steering, harmonization and strategic monitoring and control for the execution of the strategy; 3. Initiates activities as supposed necessary to facilitate ICZM on the basis of a cross-sectorial approach to (sector) planning and (sector) action planning - including starting actions to improve guidance (realize cross-sector matching and correction, and monitor and control its results). 4. Initiates and recommends actions for amending relevant legislation;

Operational Secretariat

Operational Secretariat involves:

- A permanent secretariat that accomplishes secretarial and logistical functions for the proper functioning/convening of the NC and performs public information dissemination functions;
- Experts/professionals originating from key stakeholders in the coastal zone, paid by their own representing agencies.

Expert-staff responsible for:

- Observing the "state of the coastal zone";
- Preparation of advice to the NC;
- Introducing, recommending and organizing the work contracted out to Working/Expert Groups (e.g. Consultants/Experts) - approved by NC.

Expert Groups

Expert Groups can be installed, proposed by the NC with the objective to prepare and provide expert advice on topics relevant for the proper implementation of the strategy for the coastal zone, like: observing and reporting on the state of the coastal zone, updating or reviewing the strategy for the coastal zone, advising on the technical and economic/financial feasibility/desirability of proposals from regional/local sector agencies for co-financing arrangements, counselling on for need for legislative reform and counselling on execution of training and education programs.

Further agencies have to be involved

Is important that sector agencies report on a regular basis to the NC what they have accomplished in their efforts to jointly manage the coastal zone in an integrated manner. The obligation for honest implementation of the strategy lays with the already existing sector agencies across Europe. These agencies will mainly be the regional/local sector agencies with jurisdiction in the coastal zone. They are eventually responsible for the proper translation/exchange of the strategy improvement goals and objectives and the needed incorporation across sectors.

Numerous dimensions of integration should to be addressed as part of the ICZM process:

1. Intersectional integration - horizontal integration, meaning that land-based and marine sectors need to take their policies into account and take helpful measures where needed.

2. Intergovernmental integration - vertical integration, which means integration between the numerous levels of government;

3. Spatial integration and science - management integration;

4. International integration, implying that states have to address transboundary issues.

Community contribution

Community contribution is an important tool to promote ICZM. Stakeholders have to be up-to-date about the state of the coastal zone, the required goals and objectives of future progresses and the helpful action that need to be taken to prevent environmental degradation.

By including stakeholders in decision taking procedures - with concern to strategy preparation-formulation of policies and plans a feeling of understanding will be created for the complexity of ICZM as well as a feeling of joint ownership of the strengths and opportunities as well as the weaknesses and uncertainties in the coastal zone. Public contribution also increases stakeholders' readiness to – individually or group-wise- make their (individual) contributions, and should be it in terms of caring for the environment, adhering to environmental regulations and standards and paying of taxes and fees.

In addition, information needs to be spread to the public to make sure that informed resolutions can be taken by members in decision making bodies by representatives of the general public.

In order to improve the current conditions in marine area, some suggestions must be taken into account:

- National/Regional Committees/Centers for the Coastal Zone in the Black Sea Region should be either considered as a decision making authority, or an executive one. The NC is a specific structure (with identified powers and obligations) and acts under the coordination of a lead agency.

- A multilateral interest between government agencies to cooperate in a voluntary way, not using an imposed form of collaboration (enforced by legislation) should be achieved.

- Existence of two entities in the marine field: a central authority represented by the National/Regional Committees/Centers for the Coastal Zone and regional and local stakeholders, which are empowered with the effective decision making process should be useful.

- The financing system is very important for ICZM, so a major task for coastal zone management legal framework is to maintain all alternatives opened.

- To create an efficient framework for several bodies - National Committees for the Coastal Zone, Operational Secratariat, Working Groups and Expert Groups – it is useful to define a clear set of procedures and regulations.

- Elimination of the existing inconsistences that still persist in the coastal zone management legal framework should be carried out with the support of an expert team. The new draft law on ICZM development must avoid overlaps with other regulations, suggesting mutually beneficial solutions.

6.3 Achieving synergy of the current projects and initiatives related to ICZM in the Black Sea Basin

Relevant documents that influence directly ICZM

Marine Strategy Framework Directive has the basic goal a more efficient protection to marine environment across Europe until 2020. Adopted on 17 June 2008, the Directive wants to preserve the resources base upon which marine/maritime economic and social activities depend. This is the first instrument of the EU relating to marine biodiversity maintenance, stressing in the same time the sustainable use. Applying geographical and environmental principles the Directive divide the marine area into regions (the Black Sea, the North-east Atlantic Ocean, the Mediterranean Sea and the Baltic Sea) and subregions. In order to achieve Good Environmental Status (GES) until 2020, each Member State must create a Marine Strategy and to adjust them every 6 years.

The Integrated Maritime Policy (IMP), adopted in 2008, establishes its fundament on realizing a more coherent approach to maritime problems. The focus is placed on the coordination between various policy areas. The Integrated Maritime Policy focuses on cross-cutting policies (e.g. knowledge of marine processes, blue growth, maritime spatial planning, sea basin strategies and integrated maritime control). The IMP importance refers to:

- Improve efficiency by determining authorities to cooperate in order to solve the same difficulties (sharing informations);
- Accentuate the relationship between industries and marine human activities;
- Develop long term collaboration (international, regional, local authorities, different fields, all level of administration).

Green Paper on a marine policy (2012) has the main goal to improve growth and enforcing the maritime areas by creating new jobs. In the same time, Green Paper on a marine policy offers realistic information about raising the productivity and the advantages of activities on sea (economic aspect and social perspective). The key accent in the analyzed document is on creating ICZM strategies in accordance with the demographic fluctuation in coastal areas and the maritime and coastal tourism sector and its importance for the general development of the marine zone. The document also stress the significance to finance form EU funds only the sustainable transport projects, after an attentive stage of choosing them.

The Black Sea is bordered by 6 countries and has found a regional cooperation in order to apply an adaptive management to the current conditions. The main document to organize the regional collaboration is the Black Sea Synergy, which was launched by the European Union. The document set an adaptive framework to an integrated policy, providing the basic data and regulations to reach the common goals.

There are also two regional bodies that ensure the viability of the programs initiated in the Black Sea Region:

- The Black Sea Economic Cooperation (BSEC)
- The Commission for the Protection of the Black Sea Against Pollution

Investments in the Black Sea Area, to accomplish the strategic measures and the operational plan are:

- Various EU funds related to marine and maritime area, while the most important are:
  - the Instrument for Pre-accession Assistance (IPA)
  - the European Neighborhood and Partnership Instrument (ENPI).

  These programs offer the financial support to implement the projects from the analyzed area.
- The Black Sea Basin Joint Operational Program has the main goal to realize a more sustainable development in the Black Sea Region (economic and social).

  The key-objectives of the program mentioned are:
  - creating a local collaboration;
  - cooperating in order to achieve common goals;
  - encouraging a sustainable development in the border zones – economic and social point of view.

The EU Horizon 2020 contains also a specific call for the Black Sea area and distributes considerable funding amounts to encourage the applicants.

Suggestions

The European Commission (EC) has started an assessment stage in order to review the **ICZM Recommendations.** The new documents that will be generated through several round of proposal analyze the environmental, economic and social effects of EC measures in the marine area. The EU Marine Strategy (2005) is one of the initiatives that emphasize the sustainable management by decreasing the pollution level and valorizing the marine biodiversity. It also contains a spatial management plan that implies:

- The evaluation of the present context;
- Analyzing what are the effects of human actions;
- Defining the main environmental objectives;
- Identifying the best measures to be taken;
- Finding the means to assess and monitor the results of the programs.

The Marine Strategy Framework Directive and directions for integrated maritime policy (also from 2008) was adopted, paying more attention to climate changes and other potential risks that can interfere with the coastal zone.

6.4 Reducing conflicts in the uses of the coastal zone (socioeconomic development and environmental protection objectives - key sectors have to be taken into consideration)

Conflict management represents a multidisciplinary research sector and emphasizes the importance of collaboration in the decision-making process. This approach is based on the necessity to generate a common vision, to share unique goals in the multiple advantages of different stakeholders. Because the sectorial use of resource use in the coastal management process can lead to various conflicts among stakeholders, a properly and time-efficient resolution is vital. One of the most common solutions in conflict resolution remains the use of facilitators with more experience in multisided negotiations. A professional mediator will increase positives effects in planning process and the willingness of stakeholders to act). But the facilitator must be fully skilled, understanding the communication process in the best way.

A major issue during operation of ICZM processes is the handling conflict of interests. In order to be able to handle these conflicts one must be aware of their causes and consequences, establish a transparent methodology to come to a solution (decision) and to have the capability to counteract the negative effects of proposed uses of coastal resources that have on other users, with appropriate measures. Establishing a good communication process among stakeholders is possible only in a positive atmosphere, developed in a long-term relationship. Existence of a mutual respect among group members, in order to pass the issues with responsibility, is essential. The first step in the participative management is time consuming and requires strong communication skills, but tend to be perceived by the stakeholders like a necessary investment in reaching the estimated results.

Conflicts that arise may be of a *"vertical"* nature, i.e., occurring between users at different levels, or of *"horizontal"* nature, i.e., users at the same level in different sectors. An example of the first is a conflict between a national authority, who wants to establish a nature conservation area in the context of a national nature policy, and a local community, who wants to invest in industrial development to raise the income of the local people. An example of the second is a conflict between people mining sand from the beach to build new houses somewhere up-country, and the people living near the coastline, who object the sand mining because their houses are threatened by the coastal erosion as a result.

Conflicts resolution works better because stakeholders have a major common objective and results. Either they have different position in the negotiation process, they can accept concessions in order to reach the desired outcome (for example, the improvement of a certain Black Sea area). It is essential to be clear in defining the objectives/outcomes desired before starting a management process, because it can affect the entire future initiative.

To address larger conflicts, the ICZM programs should establish an arbitration system. Such a system must provide a clear methodology to handle conflicts and come to a solution. One can distinguish between administrative and legal procedures. Administrative procedures are based on the willingness to co-operate by all parties. For every conflict, a procedure can be tailored to suit its specific needs. For example, an *ad hoc* task force can be established (a commission, a scientific body) to search for a solution for a particular problem. A policy dialogue could be established to bring the conflicting parties together and have them discuss under the leadership of an "*independent*" person (a mediator). An arbitration procedure can be started where it is impossible to find a solution through negotiations. If all fails, legal procedures must be used to enforce a solution. Such procedures are a time and money consuming and should therefore be avoided.

LIST OF FIGURES

Fig. 3.15 Long-term variations of annual-mean phytoplankton biomass (g m^{-3}) averaged over all stations in the Romanian (RO), Bulgarian (BG), Georgian (GE) shelves, as well as the coastal northwestern sector of the Ukrainian shelf *(NWS-UA, after Nesterova, 1987)*

Fig. 3.16 Long-term variations of summer-autumn mean phytoplankton biomass (g m^{-2}) (vertical bars; *after Mikaelyan, 2005*), the mean CIL temperature (^{o}C) (blue dots; *after Belikopitov, 2005*) averaged over all stations within interior basin and mean winter (December-March) sea surface temperature (SST) as an average of Hadley, NCEP-Reynolds and Pathfinder data sets. The phytoplankton biomass is expressed in terms of euphotic zone integrated values

Fig. 3.17 Long-term changes in species number contributing to annual phytoplankton biomass along the Bulgarian coastal waters *(after Moncheva, 2005)*

Fig. 3.18 Long-term changes annual-mean phytoplankton to edible zooplankton biomass ratio along the Bulgarian coastal waters *(after Moncheva, 2005)*

Fig. 3.19 Long-term change in percentage of biomass of main algal groups in Constanta monitoring station during 1986-2005 *(after Boicenco)*

Fig. 3.20 Long term annual-mean changes of bacterioplankton abundance in the surface layer of northwestern and Bulgarian coastal waters *(redrawn from Kovalova et al., 2008)*

Fig. 3.21 Long term monthly-mean changes of bacterioplankton abundance in the surface layer of northwestern coastal waters in the Black Sea *(redrawn from Kovalova et al., 2008)*

Fig. 3.22 Long-term variations of the annual-mean fodder zooplankton biomass in the northeastern basin (g m^{-2}) and the western coast (mg m^{-3}) obtained by averaging the Romanian, Bulgarian, and the northwestern Ukrainian data sets. Also included for comparison is the edible zooplankton biomass (g m^{-2}) measured near the Cape Sinop in central part of the Turkish coast *(after Shiganova et al.)*

Fig. 3.23 Distribution of summer edible zooplankton biomass (mg m-3) during 1954-1995 *(after Temnykh, 2006)*

Fig. 3.24 Mean *Mnemiopsis leidyi* abundance (ind.m^{-3}) in the Northeastern (NE), North-Western (NW), and Western (W) Black Sea inshore and offshore waters during the summer 1998-2004 *(redrawn from Kamburska et al. 2006)*

Fig. 3.25 Long-term change of total macrophyte biomass (kg m^{-2}) in the northwestern shelf dominated by small, opportunistic species *(after Minicheva)*

Fig. 3.26 *Cystoseira* spp. biomass at different depths along the northeastern coastal zone during 1970, 1988 and 2005 *(after Kucheruk, 2006)*

Fig. 3.27 Changes in floristic diversity of macrophyte communities in Zernov's *Phyllophora* field *(after Friedrich et al., 2008)*

Fig. 3.28 Temporal changes in species diversity of total macrozoobenthos community in the Romanian pre-Danubian and Constanta sectors (left) and the Bulgarian shelf (right) *(after Abaza, Todorova et al.)*

Fig. 3.29 Recent ecological state of the northwestern and western shelves according to the AMBI classification. Yellow and green colors signify moderate and good ecological state, whereas the brown spots are degraded regions of macrozoobenthos *(after GEF-UNDP Project Report, 2006)*

sediments; (2) carbonate-rich shelly sediments; ($CaCO_3$ 50%); (3) sediments covered by overgrowth of Phyllophora; (4) carbonate-poor and carbonate-bearing, organogenic-terrigenous mytilid muds ($CaCO_3$ = 10-50%); (5) carbonate-poor and carbonate-bearing phaseolina muds concretions. Deep-water sediments: (7) carbonate-free terrigenous sediments ($CaCO_3$ content 10%); (8) carbonate-poor organogenic-terrigenous muds ($CaCO_3$ content = 10-30%); (9) carbonate-poor, organogenic-terrigenous, finely dispersed muds ($CaCO_3$ content = 10-30%); (10) carbonate-bearing, organogenic-terrigenous, finely dispersed Coccolith muds ($CaCO_3$ content = 30-50%); (11) carbonate-rich (locally carbonate-bearing), finely dispersed Coccolith muds rich in organic matter; (12) modern sediments of considerable diversity with predominance of carbon-poor organogenic-terrigenic muds *(after Ross et al., 1978)*

LIST OF TABLES

LIST OF ABBREVIATIONS

AG - Advisory Group

BG - Bulgaria

BSC - Black Sea Commission

BSBD - Black Sea Basin Directorate

BSS - Black Sea Synergy

BS SAP - Strategic Action Plan for the Rehabilitation and Protection of the Black Sea

BSEC - Organization of Black Sea Economic Cooperation

BSEP - Black Sea Environmental Programme

CBC - Cross-Border Cooperation

CFP - Common Fisheries Policy

DPSIR - Driving forces - Pressure - State - Impact – Response

EAF - Ecosystem Approach to Fisheries

EC - European Commission

EcoQOs - Ecosystem Quality Objectives

EEA - European Environment Association

EEZ - Exclusive Economic Zone

ENI CBC BSB - European Neighborhood Instrument Cross Border Cooperation Black Sea Basin

ENPI - European Neighbourhood and Partnership Instrument

EU - European Union

EUCC - Coastal and Marine Union

FP7 - Framework Programme 7

GEF - Global Environment Facility

GES - Good Environmental Status

GFCM - General Fisheries Commission for the Mediterranean

CFRI - Central Fisheries Research Institute (Trabzon)

GHGs - greenhouse gases

GIS - Geographic Information Systems

GMSL - global mean sea level

IAEA - International Atomic Energy Agency

ICPDR - International Commission for the Protection of the Danube River

ICZM - Integrated Coastal Zone Management

IEG ASM - Institute of Ecology and Geography - Academy of Sciences of Moldova

IMO - International Maritime Organization

IPCC - Intergovernmental Panel on Climate Change

IOC - Intergovernmental Oceanographic Commission

IUCN - International Union for The Conservation of Nature

IUU - Illegal and unregulated fisheries

KAY - Turkish National Committee on Coastal Zone Management

LME - Large Marine Ecosystem

MD – Moldova

MLR - Marine Living Resources

MPA - Marine Protected Area

MSFD - Marine Strategy Framework Directive

MSP - Maritime Spatial Planning

NAFA - National Agency for Fisheries and Aquaculture

NC - National Committee

NCCZ - National Committee of the Coastal Zone

NIMRD - National Institute for Marine Research and Development “Grigore Antipa”

OWF - offshore wind farm

PMA - Pollution Monitoring and Assessment

PTS - Permanent Technical Secretariat

RES - Renewable Energy Sources

RNODC - Romanian National Oceanographic Data Center

RO - Romania

SCZ - Sea Coastal Zone

SWAT - Soil and Water Assessment Tool

TDA - Transboundary Diagnostic Analysis

TR - Turkey

UA - Ukraine

UBBSLA - Union of Bulgarian Black Sea Local Authorities

UNCLOS - United Nations Convention on the Law of the Sea

UNDP - United Nations Development Programme

UNEP - united nations environment programme

WHO - World Health Organization

WFD - Water Framework Directive

WMO - World Meteorological Organization

ADDITIONAL USEFUL REFERENCES FOR THE BLACK SEA ECOSYSTEM

1. Ataç, Ü., Aktaş, M., Yildirim, C., Alemdağ, N., Zengin, B., Alkan, A. 1997. Karadeniz bölgesinde su kirliliğine sebep olan faktörlerin belirlenmesi ve su ürünlerine etkilerinin araştirilmasi.; T.C. Tarim ve Köyişleri Bakanliği Tarimsal Araştirmalar Genel Müdürlüğü, TAGEM /iv/96/12/02/001, Su Ürünleri Merkez Araştirma Enstitüsü Müdürlüğü Trabzon - 1997;
2. Aydoğan, B., Çevik, E., Yüksel, Y. 2013. Güneybatı Karadeniz dalga verileri ile parametrik dalga modellemesi. Cihan ŞAHİN, 6. Ulusal Kıyı Mühendisliği Sempozyumu;
3. Bat, L., Sezgin, M. (Eds.) 2007. Turkish Black Sea Bibliography. 2nd Edition. Published by Turkish Marine Research Foundation, İstanbul, Turkey, Publication number 28;
4. Bat, L., Sezgin, M., Satilmis, H.H., Sahin, F., Üstün, F., Birinci-Özdemir, Z., Gökkurt Baki, O. 2011. Biological Diversity of the Turkish Black Sea Coast, Turkish Journal of Fisheries and Aquatic Sciences 11: 683;
5. Bat Levent, Sezgin Murat, Şahin Fatih, Özdemir Zekiye Birinci, Ürkmez Derya. 2013. Sinop City Fishery of the Black Sea; Marine Science 2013, 3(3): 55-64 DOI: 10.5923/j.ms.20130303.01;
6. Bat Levent, Sezgin Murat, Şahin Fatih; Impacts of OWF installations on fisheries: A Literature Review. 2013. Journal of Coastal Life Medicine 2013; 1(3): 241-252. doi:10.12980/JCLM.1.2013J17;
7. Boero F. 2013. Review of jellyfish blooms in the Mediterranean and Black Sea. GFCM Studies and Reviews 92: 53 pp.;
8. Briceag A., Stoica M., Oaie G., Melinte M.C. – Dobrinescu.2012. Late Holocene microfaunal and nannofloral assemblages of the NW Black Sea, GeoEcoMarina; Vol. 18, page 65, 2012;
9. Buesseler, K.O., Livingston, H.D., Honjo, S., Hay, B.J., Konuk, T., Kempe, S. 1990. Scavenging and particle deposition in the southwestern black sea—evidence from Chernobyl radiotracers. Deep Sea Research Part A. Oceanographic Research Papers, Volume 37, Issue 3, Pages 413-430;
10. Dulov V, Shokurov M, Chechina K, Soukissian T, Malinovsky V. 2013. On validation of regional atmosphere and wave models for the Black Sea region. Geophysical Research Abstracts, Vol. 16, EGU2014-2322, EGU General Assembly 2014;
11. Hay, B.J., Honjo, S., Kempe, S., Ittekkot, V.A., Degens, E.T., Konuk, T., İzdar,E. 1990. Interannual variability in particle flux in the southwestern Black Sea. Deep Sea Research Part A. Oceanographic Research Papers, Volume 37, Issue 6, Pages 911-928;
12. Kameyama S, Akamatsu T, Dede A, Öztürk A A, Arai N. 2014. Acoustic discrimination between harbor porpoises and delphinids by using a simple two-band comparison. The Journal of the Acoustical Society of America, 136, 922-929. doi: http://dx.doi.org/10.1121/1.4884763;
13. Karadeniz'deki Türk Balikçi Gemilerinin Yapisal Özellikleri ve Motor Güçlerinin Karşilaştirmali Olarak İncelenmesi. Ösdamar, E. 1995. Turkish J.Mar.Sci. 1.(213):109-120;

14. Kravtsova, A., Milchakova N., Frontasyeva M. 2014. Elemental accumulation in the Black Sea brown algae *Cystoseira* studied by neutron activation analysis. ECOL CHEM ENG S., 21(1): 9-23. DOI: 10.2478/eces-2014-0001.Link: http://www.degruyter.com/view/j/eces.2014.21.issue-1/eces-2014-0001/eces-2014-0001.xml;
15. Kravtsova, A.V., Milchakova N.A., Frontasyeva M.V. 2014. The features of trace elements accumulation by macroalgae *Cystoseira* in the coastal zone of marine protected areas of the Crimea (the Black Sea).Ecosystems, their optimization and protection, №. 10, 146-158. Link: http://www.irbis-nbuv.gov.ua/cgi-bin/irbis_nbuv/;
16. Maximov V., Zaharia T., Nicolaev S. 2013. State of the Fisheries, Stock Assessment and Management of the Black Sea turbot (Psetta maxima maeotica P.) in Romania. Journal of Environmental Protection and Ecology 14, No 3, 913-921;
17. Milchakova, N.A., Böer B., Boyko L.I., Mikulich D.V. 2014. The chemical composition and technological properties of seagrasses a basis for their use (a review). In: M.A. Khan et al. (eds.), Sabkha Ecosystems: Volume IV: Cash Crop Halophyte and Biodiversity. Conservation, Tasks for Vegetation Science 47, P. 313-323, DOI 10.1007/978-94-007-7411-7_22 Link: http://link.springer.com/chapter/10.1007/978-94-007-7411-7_22;
18. Micheli F, Halpern B S, Walbridge S, Ciriaco S, Ferretti F, Fraschetti S, Lewison R, Nykjaer L, Rosenberg A A. 2013. Cumulative human impacts on Mediterranean and Black Sea marine ecosystems: Assessing current pressures and opportunities. PLoS ONE, 8(12): e79889. doi: 10.1371/journal.pone.007988922;
19. Oray, I.K., G. Özberk, F.S. Karakulak. 1997. Investigations on the purse-seine fishing of Bonitos, Sarda sarda (Bloch, 1793), in Turkish Waters in 1995. Col.Vol.Sci.Pap. ICCAT,46(4):283-287;
20. Oros A., Gomoiu M.-T. 2012. A Review of Metal Bioaccumulation Levels in the Romanian Black Sea Biora during the Last Decade - A Requirement for Implementing Marine Strategy Framework Directive (Descriptors 8 and 9). Journal of Environmental Protection and Ecology 13, No 3A, 1730-1743;
21. Özsoy, E., Ünluata, Ü. 1997. Oceanography of the Black Sea: a review of some recent results. Earth-Science Reviews 42. pp:231-272;
22. Öztürk, B., Mokievsky, V.O. and Topaloğlu, B. (Eds) International Workshop on Black Sea Benthos. Published by Turkish Marine Research Foundation Turkey 2004 245 pp;
23. Öztürk, B., Tonay, A.M, Akkaya, A., Öztürk, A.A., Dede, A. 2011. Stranding of a Green Turtle, Chelonia mydas (Linnaeus, 1758), in the Turkish Black Sea. Zoology in the Middle East, 52:1, 115-117, DOI: 10.1080/09397140.2011.10638487;
24. Öztürk B.,Topaloğlu B., Kıdeys A., Bat L., Keskin Ç., Sezgin M., Öztürk A.A., Yalciner A.C. 2013. A proposal for new marine protected areas along the Turkish Black Sea coast. J. Black Sea/Mediterranean Environment Vol. 19, No. 3: 365-379 (2013);
25. Pankeeva, T.V. et al. 2014. Researches of bottom landscapes of the coastal zone Tarkhankut peninsula (Crimea, Black sea). Geopolitics and Ecogeodynamics regions, Vol. 10, Issue 1, 800-805 (in Rus.).
Link: http://geopolitika.crimea.edu/arhiv/2014/tom10-v-1/0135pank.pdf;

26. Pankeeva, T.V., Bondareva L.V. 2014.Methodical approaches to landscape- sociological assessment of coastal systems. Ecosystems, their optimization and protection. N 10, 50-60. Link: http://www.irbis-nbuv.gov.ua/cgi-bin/irbis_nbuv;
27. Pesic, V., Sezgin, M., Karaçuha, M.E., Ürkmez.2013. New records of marine water mites (Acari: Hydrachnidia, Pontarachnidae) from the southern Black Sea (Sinop Bay, Turkey) Medit. Mar. Sci. 14/1, 2013, 45-47;
28. Radu G, Anton E, Golumbanu M, Raykov V, Yankova M, Panayotova M, Shlyahov V, Zengin M. 2011. State of the Main Black Sea Commercial Fish Species Correlated with the Ecological Conditions and Fishing Effort. Journal of Environmental Protection and Ecology 12, No 2, 549-557;
29. Raykov V. St, Panayotova M. 2012. Cetacean Sightings of the Bulgarian Black Sea Coast over the period 2006-2010. Journal of Environmental Protection and Ecology 13, No 3A, 1824-1835;
30. Raykov V. St., Panayotova M., Radu G., Maximov V., Anton E., Nicolaev S. 2013. International Pelagic Trawl Survey in the EU Waters of the Black Sea, June 2010. Journal of Environmental Protection and Ecology 14, No 1, 172-179;
31. Sanchez, A. L., Gastaud, J., Noshkin, V., Ken O. 1991. Buesseler Plutonium oxidation states in the southwestern Black Sea: Evidence regarding the origin of the cold intermediate layer.; Deep Sea Research Part A. Oceanographic Research Papers Volume 38, Supplement 2, , Pages S845-S853;
32. Sezgin, M., Bat, L., Katağan, T., Ateş, A.S. Likely effects of global climate change on the Black Sea benthic ecosystem. Journal of Environmental Protection and Ecology, 11 (1): 238-246.-692;
33. Shakhmatova, O. A. and Milchakova, N.A. 2014. Effect of Environmental Conditions on Black Sea Macroalgae Catalase Activity". International Journal on Algae, p. 377-391. Link: http://www.dl.begellhouse.com/journals/7dd4467e7de5b7ef,059a8153393b6226,771f534b5be3cde4.html;
34. Shakhmatova O, Chernyshova E. 2015. Catalase activity and lipid peroxidation process of the Black Sea macroalgae dominants (epiphytes and lithophytes) under different environmental conditions J. Black Sea/Mediterranean Environment Vol. 21, No. 1: 23-34.;
35. Shiganova TA, Legendre L, Kazmin AS, Nival P. 2014. Interactions between invasive ctenophores in the Black Sea: assessment of control mechanisms based on long-term observations Mar Ecol Prog Ser, Vol. 507: 111-123;
36. Sur, H.I., Ozsoy, E., Ilyin, Y.P., Ünlüata. Ü. 1996. Coastal/deep ocean interactions in the Black Sea and their ecological/environmental impacts. Journal of Marine Systems 7. pp:293-320;
37. Tereshchenko, N.N., Mirzoyeva N.Yu., Gulin S.B., Milchakova N.A. 2014. Contemporary radioecological state of the North-western Black Sea and the problems of environment conservation. Marine Pollution Bulletin, Vol. 81, No. 1, 7-23.
Link: http://www.sciencedirect.com/science/article/pii/S0025326X14000046;

38. Timofte F., Tabarcea C. 2012. *Oithona brevicornis* Giesbrecht, 1892 (COPEPODA: CYCLOPOIDA) - First Record in the Romanian Black Sea Waters. Journal of Environmental Protection and Ecology 13, No 3A, 1683-1687;
39. Tonay, A.M, Dede, A., Öztürk, A.A, and Öztürk, B. 2007. Stomach Content of Harbour Porpoises (Phocoena phocoena) from the Turkish Western Black Sea in Spring and Early Summer.; Rapp. Comm. int. Mer Médit., 38;
40. Tonay, A.M, Öztürk, B. 2003. Cetacean by catches in turbot fishery on the western coast of the Turkish Black Sea. International Symposium of Fisheries and Zoology, Istanbul;
41. Topçu E.N., Öztürk B. 2015. Composition and abundance of octocorals in the Sea of Marmara, where the Mediterranean meets the Black Sea. 2015. Sci. Mar. 79(1): 000-000. doi: http://dx.doi.org/10.3989/scimar.04120.09A;
42. Topçuoglu, S., Kırbasoglu, C., Gungor, N. 2002. Heavy metals in organisms and sediments from Turkish Coast of the Black Sea, 1997–1998. Environment International 27. pp:521-526;
43. Yağlıoğlu, D., 2013. Akçakoca (Batı Karadeniz) Balıkçılığı ve Balıkçıların Sosyo-Ekonomik Analizi, Ormancılık Dergisi 9(1) pp: 35-42;
44. Zaharia T., Maximov V., Micu D., Nita V., Nedelcu M., Ganea G., Ursache C.M., Golumbeanu M., Nenciu M. 2012, Romanian Marine Fisheries and rhe Natura 2000 Network. Journal of Environmental Protection and Ecology 13, No 3A, 1792-1798;
45. Zaitsev,Yu and Öztürk, B (Eds). 2001. Exotic DSpecies in the Aegean, Marmara, Black, Azov and Caspian Seas. Pub. By Turkish Marine Research Foundation, İstanbul 267 pp.

REFERENCES

1. Akbal, F., Gürel, L., Bahadır, T., Güler, İ., Bakan, G., Büyükgüngör, H., (2011a) " Multivariate Statistical Techniques for the Assessment of Surface Water Quality at the mid-Black Sea Coast of Turkey", Water Air Soil Pollution, 216: 21-37;
2. Akbal, F., Gürel, L., Bahadır, T., Güler, İ., Bakan, G., Büyükgüngör, H., (2011b) " Water and Sediment Quality Assessment in the mid-Black Sea coast of Turkey using Multivariate Statistical Techniques ", Environ. Eart Sci., 64: 1387-1395;
3. Altas, L., Büyükgüngör,H., (2007). Heavy Metal Pollution in the Black Sea shore and offshore of Turkey, Environmental Geology, 52,469-476;
4. Antonidez,E. (2010) " ICZM in the Black Sea Region: experience and perspectives", J. Coast Coserv., 14:265-272;
5. Avaz, G., Ozer Erdogan P., Pekdemir E., Alecu L., Voina A., Devidze, M., Utkina, K., Utkina K., Iakovleva N., Kresin V., Godin E., Chory B., Komorin V., Chernaya T., PopovichI., Bondarenko V,.Mihneva. V., Velikova, Velichka and Velikova Violeta, 2013. State of the art of the Black Sea Hot Spots and ambient environment monitoring, relevance for identification of the areas under largest threat of pollution/eutrophication;
6. Bakan, G., and Büyükgüngör, H., (2000) " The Black Sea", Marine Pollution Bulletin 41 (1-6), pp.24-43;
7. Bakan, G., Özkoç, H.B., (2007) " An ecological risk assessment of the impact of heavy metals in surface sediments on biota from the Mid-Black Sea Coast of Turkey ", Journal of Environmental Studies , Vol.64, pp.45- 57;
8. Bakan, G., Arıman, S., (2004) " Persistent organochlorine residues in sediments along the coast of mid- Black Sea region of Turkey ", Marine Pollution Bulletin, 48/11 –12 , pp. 1031–1039;
9. Barale,V., Özhan,E. (2010) "Advances in Integrated Coastal Management for the Mediterrenean and Black Sea" , J. Coast Conserv. 14:249-255;
10. Baykal, C., Ergin, A., and Güler, I. (2012). " Intervention of Human Activities on Geomorphological Evolution of Coastal Areas: Cases from Turkey, Studies on Environmental and Applied Geomorphology, Dr. Tommaso Piacentini (Ed.), ISBN: 978-953-51-0361-5, In Tech;
11. Black Sea Transboundary Diagnostic Analysis. (1997). UN Publ. New York, 142 pp;
12. Boicenco L., Alexandrov L., Anton E., Coatu V., Cristea M, Diaconeasa D., Dumitrache C., Filimon A., Lazar L., Malciu V., Marin O., Mateescu R., Micu D., Mihailov M., Nicolaev S., Nita V., Oros A., Radu G., Spanu A., Stoica E., Tabarcea C., Teodor C., Tiganus D., Timofte F., Zaharia T., **2012**. *"Evaluarea initiala a apelor romanesti ale Marii Negre"*, cerinta a Directivei Strategia pentru Mediul Marin, pp. 219*(http://www.mmediu.ro/beta/wp-content/uploads/2012/07/2012-07-17_evaluare_impact_planuri_evaluareinitialamediumarin.pdf);*
13. Bondar C., Emanoil G., 1963 - "Contributie la studiul agitatiei Marii Negre pe litoralul R.P.R., Studii de Hidrologie, vol. IV, Bucuresti;

14. Bondar C., Micu T., 1965 - “Date asupra dinamicii litoralului Marii Negre”, Studii de Hidrologie, vol. IX, Bucuresti;
15. Bondar C., State I., Cernea D., Harabagiu E., Buta C., Udrea G., 1992 – “Rezultate privind morfologia litorala aferenta Deltei Dunarii”, Studii de Hidraulica, vol. XXXIII, Bucuresti;
16. Borysova, O., Kondakov, A., Paleari, S., Rautalahti-Miettinen, E., Stolberg, F. and D. Daler, 2005. Eutrophication in the Black Sea region; Impact assessment and Causal chain analysis. University of Kalmar, Kalmar, Sweden;
17. Bratescu, C. (1922) Delta Dunarii. Geneza si evolutia sa morfologica si cronologica. Bul. Soc. Reg. Geogr., 41, 3-39, Bucuresti;
18. Büyükgüngör,H., Bakan, G., & Akbal, F., (2013) “ Land-based Pollution Monitoring and Assessment of Black Sea Region of Turkey “, Turkish Black Sea Fisheries, pp.108-131, Turkish Marine Research Foundation, Publ. No. 40. İstanbul. ISBN- 978-975-8825-32-5.
19. BSERP,UNDP (2007) Black Sea Transboundary Diagnostic Analysis;
20. BS SAP (1996) Strategic Aciton Plan for the rehabilitation and Protection of the Black Sea. PCU GEF/BSEP, İstanbul, 29 pp;
21. BSC (2008) State of the Environment of the Black Sea (2001 - 2006/7). Edited by Temel Oguz. Publications of the Commission on the Protection of the Black Sea Against Pollution (BSC) 2008-3, Istanbul, Turkey, 448 pp;
22. BSC (2009) Implementation of the Strategic Action Plan for the Rehabilitation and Protection of the Black Sea (2002-207). Publications of the Commission on the Protection of the Black Sea Against Pollution (BSC), 2009-1, Istanbul, Turkey, 252 pp;
23. Caitlin M. Crain, Benjamin S. Halpern,c Mike W. Beck, and Carrie V. Kappelc, 2009 - Understanding and Managing Human Threats to the Coastal Marine Environment, A The Year in Ecology and Conservation Biology, 2009: Ann. N.Y. Acad. Sci. 1162: 39–62 (2009). doi: 10.1111/j.1749-6632.2009.04496.x c 2009 New York Academy of Sciences;
24. Carbognin L., Galavresi F., Marabini F., 1990 – “Safeguarding the coastal areas of particular interest and value”, Marine Sciences, Vol. 2, No. 2, China;
25. Ceylan, Eda Çaçta, The effectiveness of Turkish coastal legislation in ensuring the protection - utilization balance, July 2006, A Thesis Submitted to the Graduate School of Engineering and Sciences of Izmir Institute of Technology in Partial Fulfillment of the Requirements for the Degree of MASTER OF SCIENCE in City Planning, available at library.iyte.edu.tr/tezler/master/.../T000587.pdf;
26. Çevik,U., Damla, N., Kobya, A.I., Bulut,V.N., Duran,C., Dalgıc, G., Bozacı,R., (2008). Assessment of metal element concentrations in mussel (M. Galloprovincialis) in eastern Black Sea, Turkey. J. of Hazardous Mat’l., 160, 396-401;
27. Chiriac, M. (1960) Nota asupra depozitelor sarmatiene din Dobrogea, Com. Acad. R. P. R., 7, X, 613-623;
28. Church et al., ‘Sea-Level Change’; 2013, A. B. A. Slangen et al., ‘Projecting Twenty-First Century Regional Sea-Level Changes’,Climatic Change 124, no. 1–2 (2014): 317–32, doi:10.1007/s10584-014-1080-9; HELCOM,Climate Change in the Baltic Sea Area - HELCOM Thematic Assessment in 2013, Baltic Sea Environment Proceedings (Helsinki: HELCOM, 2013), http://helcom.fi/Lists/Publications/BSEP137.pdf.

29. Coman C., Golumbeanu M., 2001 - User Perception of Environmental Quality at Mamaia Beach, Edirne/Turkey, Journal of Environmental Protection and Ecology, vol. 3, no. 4, pp. 971-978, ISBN 1311-5065
30. Cüce, H., Bakan,G., (2011) " Water Quality and Trophic State Asment of Cernek Lake in the Kızılırmak Delta, at the middle-Black Sea of Turkey" 1st Int. Conference on SUSTAINABLE WATERSHED MANAGEMENT Proceedings, 19-22 Sep., 2011, İstanbul, Turkey, pp.159-160;
31. Delcour L., Manoli P., 2010, *The EU's Black Sea Synergy: Results and Possible Ways Forward* © European Parliament, Directorate-General for External Policies of the Union;
32. Demirkesen Ali C., Evrendilek Fatih, Berberoglu Suha, 2008, Quantifying coastal inundation vulnerability of Turkey to sea-level rise, in Environmental Monitoring and Assessment, March 2008, Volume 138, Issue 1-3, pp 101-106;
33. Dinçer, C. (2013) " Common Methods and Gears used in Turkish coast of the Black Sea", Turkish Black Sea Fisheries, pp.212-223, Turkish Marine Research Foundation, Publ. No. 40. İstanbul. ISBN- 978-975-8825-32-5;
34. Drumea D.A., Kuharuk E.S., Trombitskii I.D. (2002), The actual ecological state of soils in the Republic of Moldova, TRADE/WP.8/AC.1/SEM.7/2002/4/S.18;
35. Duzgunes Ertug, Erdogan Naciye, 2008 - Fisheries Management in the Black Sea Countries, Turkish Journal of Fisheries and Aquatic Sciences 8: 181-192 (2008);
36. Ergül,H.A., Topcuoğlu,S., Ölmez,E., Kırbasoğlu,Ç., (2008). Heavy metals in sinking particles and bottom sediments from the eastern Turkish coast of the Black Sea, Estuarine, Coastal and Shelf Science, 78, 396-402;
37. ESaTDOR, (2013) - Europeran Seqas and Territorial Development, Opportunities and Risks (2013) Annex 5 to the Final Report: Black Sea Regional Profile, ESPON Applied Research Version 16/1/2013;
38. Folk, R. L.; Word, C. V. (1957) Brazos River bar: a study of the significance of grain size parameters, Jour. Sed. Petrol., 27, 1, 3-26;
39. Giosan L., Bokuniewicz H., Panin N., Postolache I., 1997 - "Longshore sediment transport pattern along Romanian Danube Delta Coast", GEO-ECO-MARINA, vol. 2, Bucuresti;
40. Golumbeanu Mariana, Nenciu Magda, Teohareva Maria, Stepanova Kateryna, Dyachenko Alyona, Goriup Natasha, Gilca Adrian, Bilashvili Kakhaber, 2014 - Environmental Sustainable Tourism within the Black Sea Region, in Journal of Environmental Protection and Ecology, 15 (2): 574-579, ISSN 1311-5065;
41. Golumbeanu Mariana, Oros Andra, Nenciu Magda, Zavatarelli Marco, Drago Aldo, 2014 - Contribution of Environmental Indices in Meeting the Objectives and Principles of the Marine Strategy Framework Directive (MSFD), in Journal of Environmental Protection and Ecology, 15 (3): 1130-1138, ISSN 1311-5065
42. Golumbeanu Mariana, Nicolaev Simion, Costache Mihail, Mateescu Razvan, Zaharia Tania, Alexandrov Laura, 2013 – Integrated Coastal Zone Management in Romania, International Science Conference Reporting for Sustainability, Conference Proceedings, Funded by the Royal Norwegian Ministry of Foreign Affairs, Becici, Montenegro, 7-10 May 2013, pp. 301-306

43. Golumbeanu M., Vosniakos F.K., Avdimiotis S., Mentezelou P., Constantin C., Teohareva M., 2010– Upgrade Black Sea Scene. Developing a research infrastructure for the Black Sea, Journal of Environmental Protection and Ecology, vol. 11 (3): 1150-1157, ISBN 1311-5065
44. Gomoiu M.T., Skolka M., 1996 - "Changements recents dans la biodiversite de la Mer Noire dus aux immigrants' GEO-ECO-MARINA, vol. 1, Bucuresti;
45. Grigoras I., Constantinescu A. (1994) - GIS in sprijinul managementului in Rezervatia Biosferei Deltei Dunarii, Analele INCDDD Tulcea;
46. Günay, T. (1987), " The Managment of Coastal Areas: Development Pespectives, Turkey", United Nations Economic Commission for Europe, 14th Session, Portugal, Nov.1987;
47. Hay B. J., Arthur M.A., Dean W.E., Neef D.E., Honjo S. ,1991, Sediment deposition in the Late Holocene abyssal Black Sea with climatic and chronological implications. Deep Sea Res., 38, supl. 2., 51211-51235;
48. Heileman,S., Parr,W., and Volovik, G., (2009) The UNEP large Marine Ecosystem Report . A perspective on changing conditions in LMEs of the world's Regional Seas. (Sherman,K. and Hempel, G. (ed.)) UNEP Regional Seas Report and Studies No: 182, UNEP, Nairobi, Kenya;
49. Ielenicz, M., Visan, Gh., (2003), Morphology of the Romanian Black Sea shoreline. Comunicari de geografie, vol. 7. Ed Universitatii din Bucuresti;
50. International Ocean Institute (2006) "Evaluation of Integrated Coastal Zone Management (ICZM) in Europe", Germany, 360p;
51. Jipa D., 1974. Granulometria sedimentelor recente ale Dunarii de Jos. St.Geol.Cuaternar. Bucuresti;
52. Karsli Fevzi; Guneroglu Abdulaziz; Dihkan Mustafa, 2011, Spatio-temporal shoreline changes along the southern Black Sea coastal zone, J. Appl. Remote Sens. 5(1), 053545;
53. Katsman et al., 2011,'Exploring High-End Scenarios for Local Sea Level Rise to Develop Flood Protection Strategies for a Low-Lying Delta-the Netherlands as an Example',Climatic Change 109, no. 3–4 (24 February 2011): 617–45, doi:10.1007/s10584-011-0037-5;
54. Kennedy D.M., Stephenson W.J., Naylor L.A., 2014, Rock Coast Geomorphology: A Global Synthesis, in Geological Society Memoir no. 40, ISBN: 978-1-86239-684-5;
55. Khalilian, S.; Froese, R.; Proelss, A.; Requate, T. (2010). *"Designed for failure: a critique of the Common Fisheries Policy of the European Union"*. *Marine Policy* **34**: 1178–1182. Retrieved 16 July 2014;
56. Köse, S. (2013) " Seafood Processing Industry in the Turkish Black Sea", Turkish Black Sea Fisheries, pp.518-548, Turkish Marine Research Foundation, Publ. No. 40. İstanbul. ISBN- 978-975-8825-32-5;
57. Kuleli, T., et.al., (2011). " Automatic detection of shoreline change on coastal Ramsar wetlands of Turkey", Ocean Engineering, 38: 1141-1149;
58. Küçük, K., Bakan, G., (2013) "Water Quality Simulation of Lakes Cernek and Balık at the Kızılırmak Wetland of the Black Sea Region of Turkey ", Global Congress on Integrated Coastal Management : Lessons Learned to Address New Challenges, 30 Oct. – 3 Nov., 2013, Marmaris, Turkey;
59. Lanza, A., Markandya, A. and Pigliaru, F. (eds.) (2005). The Economics of Tourism and Sustainable Development. Edward Elgar, Cheltenham, UK, Northampton, MA;
60. Leah Tamara (2013), Soil Degradation and Conservative Technologies: Two Incompatible Realities for Republic of Moldova, in BIOFLUX, ProEnvironment 6 (2013) 136 - 143;

61. Liteanu, E.; Ghenea, C. (1966) Cuaternarul din Romania, St. Tehn. Econ., seria H, Com. Geol., Bucuresti;
62. Lowe et al.,UK Climate Projections Science Report: Marine and Coastal Projections (Exeter, UK: Met Office Hadley Centre, 2009), http://ukclimateprojections.defra.gov.uk/media.jsp?mediaid=87905&filetype=pdf.
63. Makarenko I., 2014, *The Black Sea Commission in the World Ocean Assessment' process Technical*, presented at the Workshop on Selecting Indicators for the State of Regional Seas 30 June - 02 July 2014, Geneva, Switzerland;
64. Manoli P., 2010. Reinvigorating Black Sea Cooperation: A Policy Discussion, Policy Report III, Commission on the Black Sea, Gutersloh;
65. Marcos M., Tsimplis M.N., 2008, 'Comparison of Results of AOGCMs in the Mediterranean Sea during the 21st Century',Journal of Geophysical Research 113, no. C12 (31 December 2008), doi:10.1029/2008JC004820;
66. Mateescu R., Diaconeasa D., Alina S., Malciu V., Hydro-Geomorphological Processes in the Transitional Romanian Black Sea Coast, their Consequences on the Masterplan for Coastal Protection Implementation, in J*ournal of Environmental Protection and Ecology* 13, No. 3A, 1664–1672 (2012);
67. Maximov V., Zaharia T., S. Nicolaev, State of the Fisheries, Stock Assessment and Management of the Black Sea Turbot (*Psetta maxima maeotica* P.) in Romania, in *Journal of Environmental Protection and Ecology* 14, No. 3, 913–921 (2013);
68. Mee, L., Friedrich, J. and Gomoiu,M.T. (2005) Restoring the Black Sea in times of uncertainty, Oceanography, 18 (2) : 100-111;
69. Moncheva, S., E. Racheva, L. Kamburska, and J. D'Hernoncourt. Ecology and Society 17(3): 35, *Environmental and management constraints on tourism in Varna Bay, Bulgarian Black Sea coast*, 2012;
70. Movchan Yaroslav, Protection and Rehabilitation of the Black and Azov Seas in Ukraine, in Saving the Black Sea, Issue 8/2005, available at *http://www.blacksea-commission.org/_publ-Newsletter08-EN-06.asp*;
71. Nichersu I. (2000) - Utilizarea tehnicii GIS pentru editarea Atlasului Rezervatiei Biosferei - teza de Doctorat, Universitatea Bucuresti;
72. Nicolae F., Golumbeanu M., 2007 – Environmentally acceptable sea transportation, the human and technical measures. Journal of Environmental Protection and Ecology, vol. 8, no. 1, pp. 146-150, ISBN 1311-5065;
73. Nicolaev S., 2014, AG FOMLRM Activities and Reporting for 2013-2014, 30th Regular Meeting of the Black Sea Commission - AG FOMLRM - Istanbul, Turkey;
74. Nicolaev S., Maximov V., Raykov V.S., 2013 - State of Small Scale Fisheries Practiced in the Romanian and Bulgarian Sectors of the Black Sea During the Past Decade, First Regional Symposium on Sustainable Small - Scale Fisheries in the Mediterranean and Black Sea 27 - 30 November 2013, St. Julian's, Malta;
75. Nikolov, K., Gültekin-Punsmann, B. 2007. Regional cooperation in the Black Sea area: analysis of the opportunities to foster synergies in the region, European Parliament, Policy Department External Policies;

76. Nurlu E., Erdem U. An overview of the Turkish coastal zone management within the framework of the European Union. In : Camarda D . (ed.), Grassin i L. (ed.). Coastal zone management in the Mediterranean region. Bari : CIHEAM, 2 002 . p. 1 07 -111 (Options Méditerranéenes : Série A. Séminaires Méditerranéens; n . 53);
77. Oaie Gh., Secrieru D., 2004, Black Sea Basin: Sediment, Sedimentation Processes, , GEO-ECO-MARINA 9-10/2003-2004, National Instituteof Marine Geology and Geo-ecology, Modern and Ancient Fluvial, Deltaic and Marine Environments and Processes Proceedings of Euro-EcoGeoCentre-Romania;
78. Oguz T. (Chief Editor), V. Velikova, A. Kideys, 2007 - State of Environment Report 2001 - 2006/7 (Chapter 12 - Overall Assessment of the Present State of the Black Sea Ecosystem), *http://www.blacksea-commission.org/_publ-SOE2009-CH12.asp*;
79. Oguz, T. (2013) " Long-term ecosytem changes and their implications for fishery management in the Black Sea", Turkish Black Sea Fisheries, pp.1-23, Turkish Marine Research Foundation, Publ. No. 40. İstanbul. ISBN- 978-975-8825-32-5;
80. Oğuz,T., (2005) Long term impacts of anthropogenic forcing on the Black Sea ecosystem. Oceanography, 18,2, 112-121;
81. Öztürk, B. (2013) " Illegal, Unreported and unregulated (IUU) fishing problems in the Turkish part of the Black Sea", Turkish Black Sea Fisheries, pp.200-211, Turkish Marine Research Foundation, Publ. No. 40. İstanbul. ISBN- 978-975-8825-32-5;
82. Özhan E. (2002) , " Experience of the The Bay of Izmir CAMP and suggestions fort he Future", Joint MAP/METAP Workshop on Coastal Area Management Projects: Improving the Implementation – Malta, January 17-18, 2002;
83. Palazov, Atanas, Stanchev, Hristo, "Human population pressure, natural and ecological hazards along the Bulgarian Black Sea Coast", SENS' 2006, Varna: http://www.space.bas.bg/astro/ses2006/Cd/E23.pdf;
84. Panin N., 1996 - "Danube Delta: Genesis, evolution and sedimentology", GEO - ECO - MARINA, vol. 1, Bucuresti;
85. PAP/RAC (2005) : Coastal Area Managment in Turkey, Priority Actions Programme Regional Activity Centre, Spilt, 70p;
86. Radulescu, M., Diaconu, V., Popa, A., Nedeianu, T., Roza, R., Chiochina, G., Malciu, V., Casian, D., (1975), Evolutia litoralului romanesc in zona Sfantu Gheorghe - Vama Veche (Manuscris);
87. River Plan Basin Management, 2009. *Planul de management al fluviului Dunarea, Deltei Dunarii, spatiului hidrografic Dobrogea si apelor costiere*, Administratia Nationala "Apele Romane";
88. Ross D.A., 1976, "Introducere in oceanografie", Ed. Stiintifica si enciclopedica, Bucuresti;
89. Ross, D. A. and Degens, E. T., 1974, Recent sediments of Black Sea. In: Degens, E. T. and Ross, D. A. (eds.) The Black Sea Geology, chemistry and Biology. AAPG, Memoir 20, Tulsa, Oklahoma, USA, 633 pp.;
90. Ross David A., Stoffers Peter, Trimonis E.S., 1978, Black Sea Sedimentary Framework, doi:10.2973/dsdp.proc.42-2.106, in DSDP Volume XLII Part 2;
91. Sesli, A.F., et.al. (2009) " Coastal legislation and administrative structure in Turkey", Scientific Research and Essay 4 (12) : 1445-1453;

92. Sesli F. Ahmet, Sisman Aziz and A. Aydinoglu Cagdas**,** Coastal legislation and administrative structure in Turkey, Scientific Research and Essay Vol.4 (12), pp. 1445-1453, December, 2009, Available online at http://www.academicjournals.org/SRE;
93. Sonmez, R. (2002) , " Coastal Area Planning: Basic Issues and Policies", Unpublished report submitted to Turkish Scientific and Technical Research Council for the Report on Integrated Coastal Managment in Turkey (in Turkish);
94. Stanchev H., Palazov A., Stancheva M., Apostolov A., 2011, Determination of the Black Sea area and coastline length using GIS methods and Landsat 7 satellite images, in Geo-Eco-Marina 17/2011, 27-31;
95. Tanık, A., et.al., (2008) " GIS based sectoral conflict analysis in a coastal distrcit of Turkey ", The Inter. Archieves of the Phot., Remote Sensing and Spatial Inf. Sciences, Vol. XXXVII. Part B8, 665-668;
96. Topcu, E.N., Öztürk, B. (2010) " Abundance and composition of solid waste materials on the western part of the Turkish Black Sea seabed", Aquatic Ecosystem Health and Managment 13 (3) : 301-306;
97. Topcuoğlu,S., Güven,K.C., Balkıs,N., Kırbasoğlu., (2003) Heavy metal monitoring of marine algae from the Turkish coast of the Black Sea, 1998-2000. Chemosphere, 52, 1683-1688;
98. T.R. Ministry of Culture and Tourism (2007) " Tourism Strategy ogf Turkey, 2023 ", T.R. Ministry of Culture and Tourism Pub. -3090, ISBN978-975-17-3281-1;
99. UNDP/GEF Black Sea (2008), "Final Evaluaiton of Black Sea Ecosystem Recovery Project", RER/01/G33;
100. Tsantoulis, Y. 2009. "Black Sea Synergy and Eastern Partnership: Different Centres of Gravity, Complementarity or Confusing Signals?", Policy Brief No.12, International Centre for Black Sea Studies, Athens, February;
101. Unsal, F., (2013) " Overview of Turkish Coastline Policy and Implementation", Bridging the Legal-Institiutional Gap in Med-Coastline Management, Mare Nostrum's Kickoff Meeting, Israel;
102. Uzun, B., Celik, N. (2014) " Sustainable Management of coastal lands: A new approach for Turkish Coasts, Ocean & Coastal Managment, 95: 53-62;
103. UNFCCC (2013) Turkey's Fifth National Communication Under the UNFCCC, Ministry of Environment & Urbanisation – UNDP, Tukey;
104. Ünlü,S., Alpar, B., (2006) Distribution and sources of hydrocarbons in surface sediments of Gemlik Bay (Marmara Sea, Turkey) , Chemosphere, 64, 764-777;
105. Urucu V., Buza M., 1999 - Black Sea Traffic and European Integration, Pro met- Traffic-Traffico, Vol. 11, 1999, No. 2-3, 109-118;
106. Vespremeanu, E., (2004), Geografia Marii Negre, Editura Universitatii din Bucuresti;
107. Vosniakos F., Gabriela Vasile, Petre J., Cruceru L., Nicolau M., Mitrita M., Iancu V., Cruceru I., Varga L.A., Golumbeanu M., 2008 - Assessment of the quality of the Danube Delta aquatic ecosystem - surface water and sediment, Journal of Environmental Protection and Ecology, vol. 9, no. 2, pp. 255-271, ISBN 1311-5065;
108. Zaharia T., Golumbeanu M., 2005 - Contributions for the promoting of the sustainable tourism in the coastal areas of Constanta County/Romania, Journal of Environmental Protection and Ecology, vol.6, nr.4, pp. 886-892, ISBN 1311-5065;

109. Zaharia T., Micu D., Todorova V., Van Elburg D., Nita V., Maximov V., Golumbeanu M., 2010 - The coherence of the Romanian marine protected areas network, Journal of Environmental Protection and Ecology, vol.1, nr.1, pp. 199-208, ISBN 1311-5065;
110. Zaharia T., Micu D., Nita V., Maximov V., Mateescu R., Spinu A., Nedelcu M., Ganea G., Golumbeanu M., Ursache C. M., Cristea M., Preliminary Data on Habitat Mapping in the Romanian Natura 2000 Marine Sites , in *Journal of Environmental Protection and Ecology* 13,No 3A,1776-1782 (2012);
111. Zonn,I.S., Fashchuck,D.Y., Ryabinin, A.I., (2008) "Handbook of Environmental Chemistry : Environmental Issues of the Black Sea ", (Hutzinger,O., ed.) Springer-Verlag Berlin Heidelberg, 5, Part Q , pp.423-437;
112. x x x, 2009 - Integrated Coastal Zone Management and the Ecosystem Approach, CEM Working Paper No 7, Pegaso Project: People for Ecosystem based Governance in Assessing Sustainable development of Ocean and coast. Funded by the European Union within FP7 - ENV.2009.2.2.1.4 Integrated Coastal Zone Management, Specific Programme FP7, Collaborative Projects, Large scale integrating Project, Grant agreement nº: 244170;
113. xxx - Bulgarian National Annual Report on Integrated Coastal Zone Management (ICZM) - 2013, available at *www.bsbd.org/.../ICZM%20Annual%20Report;*
114. xxx - Strategic Action Plan for the Rehabilitation and Protection of the Black Sea, Istanbul, GEF - BSEP, Turkey, 31 Oct., 29 pp (1996);
115. xxx - GFCM, Report of the ad hoc meeting on Black Sea aquaculture species diversification Trabzon, Turkey, 21– February 2013;
116. xxx - Black Sea Basin ENI CBC 2014-2020, DRAFT 5 November 2014 *http://81.12.208.42/index.php/eng/Media/Files/2014-2020/BSB-ENI-CBC-2014-2020_second-draft-strategy_Nov-2014;*
117. xxx - Joint Statement of the Ministers of Foreign Affairs of the countries of the European Union and of the wider Black Sea area, 2008. Retrieved at: *www.blacksea-cbc.net/;*
118. xxx, 2013. Report on the State of the Marine and Coastal Environment in 2012, in Cercetari Marine (Recherches Marines), Issue 43/2013, ISSN 0250-3069, pp. 5-138;
119. xxx, 2013, NIMRD Interim Report CE/CBS Strengthening the regional capacity to support the sustainable management of the Black Sea Fisheries - (SRCSSMBSF), 2013;
120. xxx, 2012 -"Review of the existing and planned protected areas in the Black Sea (Bulgaria, Romania, Turkey) with a special focus on possible deficiencies regarding law enforcement and implementation of management plans", 2012, EC DG Env. Project MISIS: No. 07.020400/2012/616044/SUB/D2;
121. xxx, 1998 Danube Pollution Reduction Program National Planning Workshop July 27-30, 1998, Kishinev *(www.icpdr.org)*
122. xxx, (2005) Executive Summary of the Project «Evaluation Study to Support Implementation of Management Plan for the Lower Prut Lakes Ramsar Site towards Wise Use and Sustainable Development», Ramsar Small Grants Fund (http://archive.ramsar.org/cda/en/ramsar-activities-grants-rsgf-small-grants-fund-23277/main/ramsar/1-63-68-159%5E23277_4000_0__)
123. xxx, (2012), Investing Guide Moldova 2012 (www.pwc.com/md)

124. xxx, 1994, Moldova. Moving to a market economy, World Bank Country Study, ISSN 0253-2123, Washington Library of Congress
125. xxx, County overview and assessment of climate change adaptation: Bulgaria / European Commission: http://ec.europa.eu/maritimeaffairs/documentation/studies/documents/bulgaria_climate_change_en.pdf
126. xxx, (2012), National Concept for Spatial Development for the period 2013-2025, The National Space – our common heritage for the future, European Regional Development Fund - project "Programming of Regional Development for the period 2014-2020", Sofia, 2012 http://www.bgregio.eu/media/files/Programirane%20&%20ocenka/Programirane%202014-2020/NKPR_28012013_Last_en.pdf
127. xxx, (1982), United Nations Convention on the Law of the Sea (UNCLOS) http://www.un.org/depts/los/convention_agreements/texts/unclos/unclos_e.pdf
128. xxx, (2009), Maritime Delimitation in the Black Sea (Romania/Ukraine), judgment of 3 February 2009, I.C.J., Reports, 2009.

Web resources:

http://www.blacksea-commission.org/
http://www.blacksea-commission.org/_tda2008.asp
http://www.bne.eu/content/landlocked-moldova-gets-international-port
http://www.booktr.com
http://www.bsec-organization.org/
http://www.bstdb.org/countries/the-black-sea-region
http://www.climateadaptation.eu/ukraine/coastal-erosion/
http://www.climateadaptation.eu/moldova/fresh-water-resources/
http://cmip-pcmdi.llnl.gov/cmip5/
http://www.coastlearn.org/intro/introduction.html
http://www.coconet-fp7.eu/
http://www.cosmomar.ro/.
http://www.cream-fp7.eu
http://www.coastalguide.org/icm/
http://www.coe.int/t/congress/activities/cooperation/Euroregion/default_en.asp
http://www.crpm.org/
http://www.csb.gov.tr/gm/mpgm/index
http://www.dmhi.ct.ro/introduction.htm
http://ec.europa.eu/environment/iczm/pdf/Final%20Report_progress.pdf
http://www.eea.europa.eu/data-and-maps/indicators/sea-level-rise-3/assessment
(EEA - Global and European sea-level rise (CLIM 012) - Assessment published Jul 2014)
http://www.emodnet-chemistry.eu/portal/portal/)
http://eur-lex.europa.eu/
http://ec.europa.eu/
http://ec.europa.eu/ourcoast/
http://envirogrids.ne

http://www.fao.org/fishery/area/Area37/en
http://geology.com/world/turkey-satellite-image
http://www.gifp.md/
http://www.grida.no
https://www.google.ro/maps/place/Giurgiulesti)
http://www.icpdr.org/
http://www.indexmundi.com
http://www.internationalwatersgovernance.com/
http://www.kultur.gov.tr/EN,33572/the-economy-and-trade-in-trabzon.html
http://www.mareframe.org
http://www.marine.odessa.ua/uni/index/mariupol
http://www.navbul.com/en
http://www.pegasoproject.eu/
http://www.perseus-net.eu/
http://www.port.odessa.ua/index.php/ua
http://www.portofconstantza.com/apmc/i.do?lan=en
http://www.port-varna.bg
http://ports.com/turkey/port-of-samsun/
http://www.plancoast.eu/index.php?id=1
http://www.projectsymnet.eu/
www.pwc.com/m
http://www.qualitycoast.info/
http://archive.ramsar.org/cda/en/ramsar-activities-grants-rsgf-small-grants-fund-23277/main/ramsar/1-63-68-159%5E23277_4000_0__
http://www.rmri.ro/
http://www.seadatanet.org
http://sinopbalatlar.net/
http://www.traveltill.com
http://www.unep.org/regionalseas/globalmeetings/Indicator_RS_meeting/Meeting%20presentation/Black%20Sea%20Commission%20World%20Ocean%20Assessment%20Process%20_I.%20Makarenko.pdf
http://www.un.org/depts/los/LEGISLATIONANDTREATIES/STATEFILES/TUR.htm
http://en.wikipedia.org/wiki/Moldova
http://www.worldportsource.com/countries.php
http://www.statistica.md/category.php?l=ro&idc=99.
http://www.statistica.md/public/files/publicatii_electronice/Mediu/Resurse_naturale_2013.pdf

Annex 1

ICZM step by step approach

Contents

Introduction

The goal of this document

Integrated Coastal Zone Management (ICZM) is a process for the management of the coast using an integrated approach, regarding all aspects of the coastal zone, including geographical and political boundaries, in an attempt to achieve sustainability. The goal is to preserve, protect, develop, and where possible, to restore or enhance the resources of the national coastal zones.

Maritime and coastal spatial planning is an ongoing process that can be improved all the time. This document can be a very important tool for professionals responsible for the planning and managing Black Sea area, both at international/regional or national level, which view the ICZM a process where continuous improvement is possible. Numerous attempts have been made in Europe but also in individual member countries to define an operational framework to maintain the marine biodiversity, while using the economic potential of the seas. Therefore, the development of spatial planning on land or at sea was set high on the agenda of all coastal countries in the Black Sea Region, including those participating in the project. During recent years there have already been various developments in spatial planning at sea and at the coast in countries targeted by this project, following the goals and objectives for marine areas. Various processes ran parallel to or followed on from each other.

This document gives a summary of what can happen in the future concerning spatial planning at sea and on the coast in Black Sea at both policy and project level.

Structure of the study

This document outlines in 10 steps a point of view that shows how ICZM can be functional for the Black Sea Area. Based on the analysis of some maritime and coastal planning initiatives around the world these 10 steps are described in this report. The guide contains measures with the wanted results as well as the proper tasks for each step.

This kind of planning process does not end in just one plan. The process is ongoing and can be evaluated and adapted all the time. To have a successful implementation of the ICZM process is important to follow 10 basic steps. These steps can be part of a cyclical process. During this process many facts can change including stakeholders that can influence in time the planning process. You can set a number of objectives that will adapt later with the benefits/costs determined by the management measures.

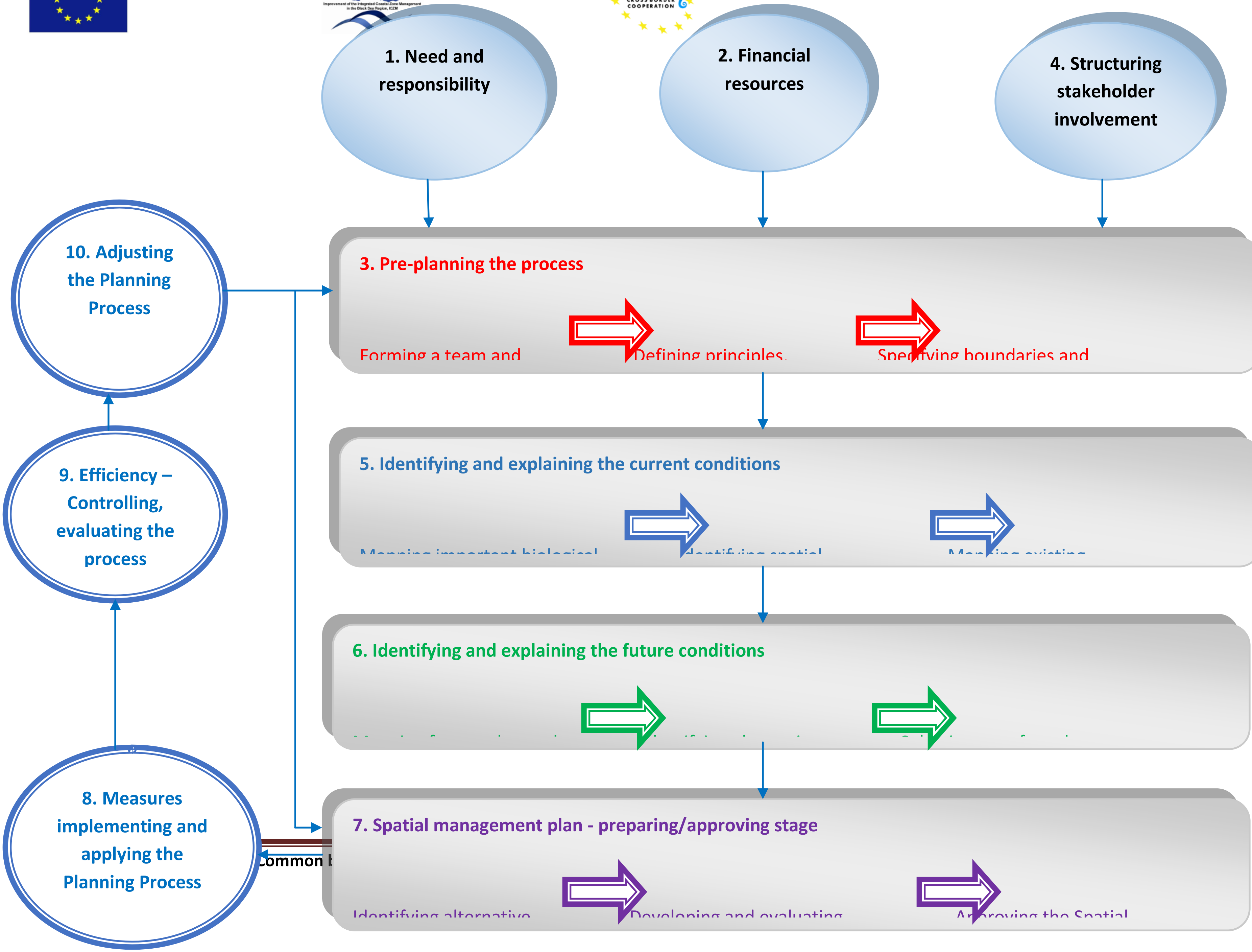
The ten steps can set out the direction for future projects regarding Black Sea Area. This document is in perfect harmony with the Black Sea Area situation following these 10 basic steps. The main goal and the content of each action is described for each part of the guide.

Criteria for integrating information in the study

The geographic demarcation of the Black Sea zone is also used in the “Regional Cooperation in the Black Sea” report. According to this document, the Black Sea region is delineated by the political structure of Black Sea Economic Cooperation and comprises twelve countries namely Albania, Armenia, Azerbaijan, Bulgaria, Georgia, Greece, Moldova, Romania, Russia, Serbia, Turkey and Ukraine.

It is very important not to limit integrated maritime spatial planning just to the seaside but to include also other components (land, harbors). This document adjusts the planning process on land and sea area. A lot of information is available on the Black Sea coast. The focus of this study is only to include the information, processes or research related to the whole Black Sea Area and to show a clear link with the development of spatial planning on land or at sea.

This document contains basic information in order to develop parallels for future planning process. Many lessons can be learned from the examples described in this study for the Black Sea Area.


1. Need and responsibility
2. Financial resources
4. Structuring stakeholder involvement
3. Pre-planning the process
Forming a team and
Defining principles,
Specifying boundaries and
10. Adjusting the Planning Process
5. Identifying and explaining the current conditions
9. Efficiency – Controlling, evaluating the process
6. Identifying and explaining the future conditions
7. Spatial management plan - preparing/approving stage
Identifying alternative
Developing and evaluating
Approving the Spatial
8. Measures implementing and applying the Planning Process

Step 1: What is the need and who is responsible?

Main aim

ICZM approach means that it is very important to establish the need of a integrated maritime spatial planning process and if the right authority to implement and develop such a process is present. Before starting this process we need to consider these criteria in order to be sure that the process is on the right track.

Delivered outputs

1. A list with specific problems that can be solved through integrated maritime spatial planning process;
2. The authority needed to implement/develop a integrated maritime spatial planning process.

Tasks for this first step

Task 1: Determining the need for integrated maritime spatial planning
Task 2: Detect the right authority for integrated maritime spatial planning

<u>TASK 1:</u> DETERMINING THE NEED FOR INTEGRATED MARITIME SPATIAL PLANNING

In order to understand the need for ICZM is better to look at the main causes for the present increase in spatial demand. We can consider a good reason for this situation that the long-standing Black Sea Area is becoming more intense. Shipping is a good example. This action has grown enormously both in terms of transport volume and frequency, with further growth expected in the Black Sea Area. Wind and wave power and marine nature reserves are examples of uses that are static as well as spatially intense these days. The facts are clear. The pressure on the Black Sea Area is growing on account of new types of use challenging at the same time the existing concepts on how to use the sea area. Another aspect is the environmental change - rising sea level that could lead to increased coastal squeeze.
The best way to start the process is to identify the need of a spatial planning in marine and costal area. The process can be used to support the ecological integrity of coastal and marine systems for the Black Sea Area. Uses can be sited, for example, where they cause least environmental impacts. This can be appropriate also for long-range impacts, some of which may not be immediately apparent.

The Black Sea Area is connected with the land and her uses have far-reaching impacts here. Shipping may well take place in the sea but needs land-based ports as well as transport infrastructure in order to function properly. Because the number and the intensity of uses grow the spatial forms of land-sea interchange become more intense.

Although the principle of sustainable development has become widely accepted, integration in terms of coastal and maritime spatial planning is still difficult to achieve.

Benefits of Integrated Maritime Spatial Planning:

1. A better point of view for existing and proposed uses of the Black Sea Area;
2. A better co-ordination of uses;
3. Offers a best possible co-existence of use;
4. Secures a greater acceptance of marine forms of use amongst principal actors-stakeholders by considering cumulative impacts and synergies between uses;
5. Provides greater security for possible investors;
6. Facilitates an equitable access to marine resources for all interested parts;
7. Long-term planning, by considering the demands of new and as yet unplanned forms of use regarding Black Sea Area.

A very important benefit of SP is that this process facilitates competitiveness, entrepreneurship and innovation, as well as assisting disadvantaged areas. For instance in rural areas or poor structurally areas of the coast the placement of some key industries can facilitate urban regeneration – port areas.

TASK 2: DETECT THE RIGHT AUTHORITY FOR INTEGRATED MARITIME SPATIAL PLANNING

In order to establish authority for a integrated maritime spatial planning is mandatory to make sure that the output - the integrated maritime spatial management plan - will be enforceable. There are many ways to establish authority. We can think about:
1. Create new legislation for this special purpose;
2. Depart form existing legislation or by re-interpreting the ones hat exist in the Black Sea Area;
3. Work with parts that can be added to present legislation, already in development or under consideration.

The process of integrated maritime spatial planning is very simple but faces some challenges. These aspects are:
1. Ensure a high quality for agriculture activity and satisfying the need for enough/well-equipped industrial areas for new economic activities;
2. Ensuring a good quality in recreational activities and enable a perfect recreational network.
3. Providing a good ease of access, accessibility and the livability;
4. Enhancing undeveloped land and safeguarding these areas (agriculture, nature and woodland).

Conclusions

The need for integrated maritime spatial planning was determined by some factors. These factors were: the delimitation process related to Natura 2000 areas and the determinations of the areas at sea for development of wind energy. It is obvious that exists a clear need to proceed with a maritime spatial planning process from policy sectors encouraged by the European Policy and Legislation.

An integral approach is missing for both sides: sea and land. The lack of a legal framework for spatial planning at sea makes some aspects (delimitations and spatial restrictions) vulnerable.

Step 2: Financial resources

Main aim

In order to implement an ICZM process is important to think about the financial resources in conjunction with setting the aims and objectives. This process is not possible if the financial resources does not exist. Is important to be able to identify adequate financial mechanisms for integrated maritime spatial planning.

Delivered outputs

1. How to obtain the financial resources – the means – for activities included in a ICZM process;
2. A plan with all estimative costs for those activities – included in a ICZM process.

Tasks for this step

Task 1: Establish alternative financial resources/financing mechanisms;
Task 2: Ensure the feasibility of these mechanisms

TASK 1: ESTABLISH ALTERNATIVE FINANCIAL RESOURCES/FINANCING MECHANISMS

This step is based on the next step – select aims and objectives. They are linked and is important to look through the whole study. Steps 2 and 3 are related and to establish the financing mechanisms is recommended to find all sources (Figure 1). Step 3 describes how to choose aims and objectives in order to organize the process. In Figure 1 are pointed some alternatives for potential alternative financing mechanisms. If the government revenues are not enough to develop and implement integrated maritime spatial planning process, you can find various alternative ways to attract financial resources.
A sustainable financing strategy for integrated maritime spatial planning should be conform to the specific financial, legal, administrative, social and political conditions in a particular place or country.

For each case/country is important to define the scope and the design of each mechanism related on the activities and management measures of the ICZM process. Is possible that one or more mechanisms may be good to obtain one type of management aim, but not so effective in reaching others. Because of the interrelated nature of a marine ecosystem, a financing plan should draw from many sources to be able to cover a range of integrated maritime spatial planning activities.

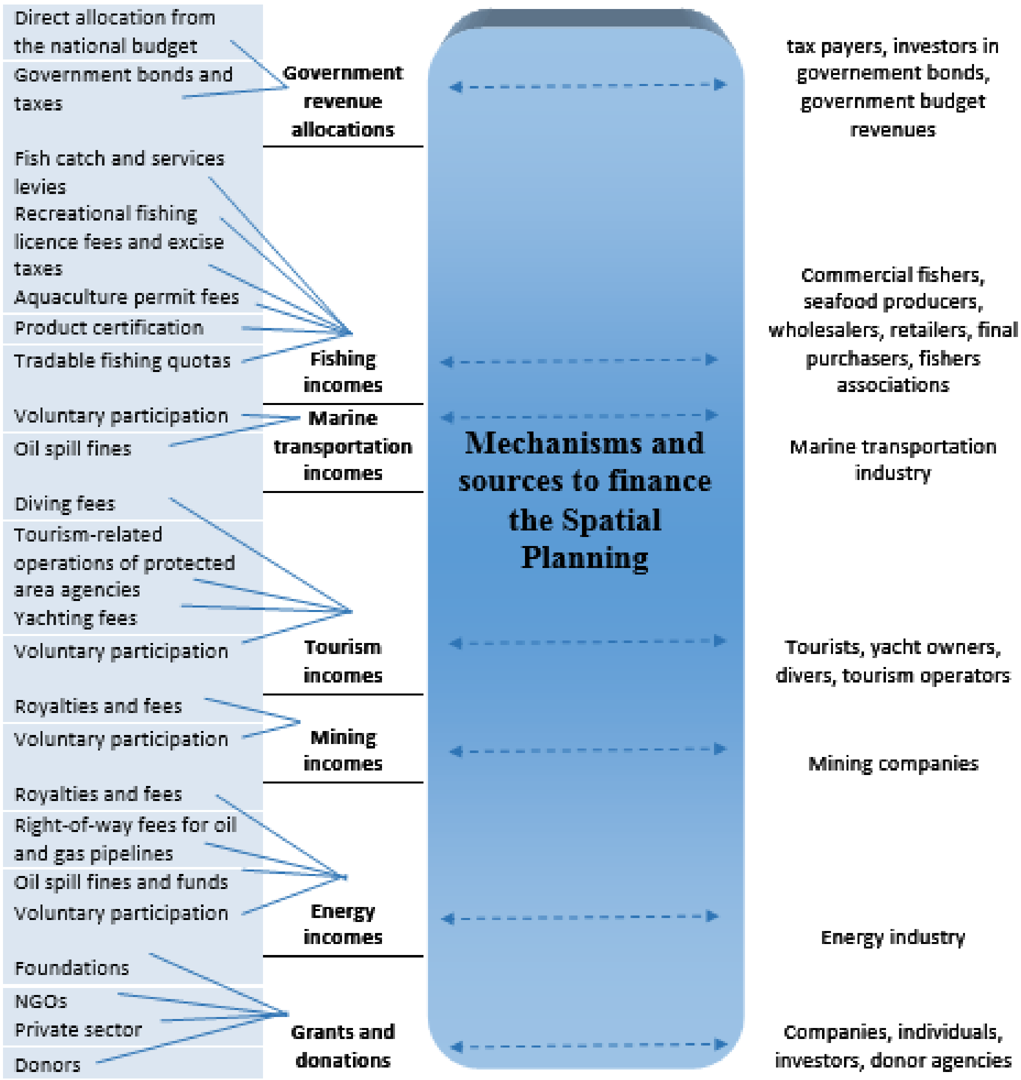


Fig. 1 Mechanisms and sources to finance the spatial planning

<u>TASK 2:</u> ENSURE THE FEASIBILITY OF THESE MECHANISMS

Before you draw the financing plan is important to consider some facts that depend on each country context because not all types of alternative financing mechanisms will be equally feasible. Which financial mechanism is appropriate to use can be chosen after you consider these aspects:

1. Environmental aspect – is very important to consider what will be the environmental impact of implementing any new financing mechanism for each situation;

2. Administrative aspect – on this matter you need to ask some questions like: Is difficult to enforce, design, collect or implement a type of fee/quota? Is difficult to administer? The people involved are prepared? Is it hard to train them? Including this kind of user fee will generate opportunities for corruption?

3. Social aspect – this aspect is related to social impact generated by implementing a system of financial mechanisms for the development of spatial planning on land or at sea. What is the impact after creating this kind of process? Who will be able to contribute and is willing to pay? You must think of this aspect is legit and equal for all actors.

4. Legal aspect – this matter is essential because of the legal nature of each country. Is important to know if there exists any legal system for the proposed mechanisms. If not, you can think about proposing new laws that include this kind of mechanisms. In order to achieve this purpose you need to think about how difficult and how much time is needed to pass such laws.

5. Political aspect – for each case is typed specific situation on political matters. Is critical to know if the government supports actions like introducing new financing mechanisms. The trust that the money from these mechanisms are used as planned is important. If the government is reliable in spending the funds on integrated maritime spatial planning activities is crucial to the process. Even other factors can be included into this process (media, courts, NGO`s) just to be sure that these funds are monitored correctly.

6. Financial aspect – the amount of funds needed to support the integrated maritime spatial planning activities. Is good to consider the sum you need each year to support this process and what other sources of funds can you find available.

Conclusion

A sustainable financing strategy for ICZM process should be tailored to the each country based on specific financial, legal, administrative, social and political aspects.

Step 3: Pre-planning the process

Main aim

The objective-based approach used implies that analysis conducted during the planning phases is related to aims and objectives. Also the identification of management measures, and the strategy for implementing such measures, are all carried out to achieve the aims and objectives. This approach implies that the analysis made during the planning process is appropriate to the aims and the objectives. This step is linked to Step 2. Based on the aims and objectives you can establish a good financial plan for each activity. The development of spatial planning on land or at sea will be successful in achieving results and outcomes as wanted if you use this approach. An aim based approach is organized around a hierarchy of purposes, objectives and indicators that evaluate the performance of management measures in achieving those aims and objectives.

Delivered outputs

1. A team with appropriate skills for implementing a planning process.
2. A set of aims and objectives for the management zone.
3. A set of boundaries and a time frame for analysis/management.
4. A work plan that identifies key work products and resources needed to achieve the outputs.
5. A set of principles to conduct the development of the spatial planning on land or at sea.

Tasks for this step

Task 1: Find the right persons and create the perfect team with the skills wanted/needed;
Task 2: Creating a work plan;
Task 3: Setting boundaries and defining timeframe
Task 4: Setting principles;
Task 5: Defining aims and objectives;
Task 6: Finding the risks and developing contingency plans - what might go wrong during the planning process.

TASK 1. FIND THE RIGHT PERSONS AND CREATE THE PERFECT TEAM WITH THE WANTED/NEEDED SKILLS

It is essential to organize and gather the right people and form a integrated marine spatial planning team. The experts must have studies in: biology, ecology, geography, economy and some others. Is important to form a multi-disciplinary team – planners. These desirable skills are crucial for a good SP plan and some of them can come from other actors like consultants, NGO`s, people from scientific community or other governmental ministries/agencies. Any stimulants to achieve these skills should be identified in task 2 - Creating a work plan.

TASK 2: CREATING A WORK PLAN

Is essential to put together a work plan that specifies what parts of the process should be done by whom, by what time, at what costs, and how the various parts relate to each other. You need to consider including time limited to produce the proper information for planning, developing and implementing the activities specified in the integrated maritime spatial plan. Also you need to evaluate if the management measures/actions will change the behavior of people activity towards the wanted results.

Steps to create a work plan:

- write the main activities in order to implement/develop the plan;
- group the activities by individual or more people needed and transform them into manageable task easy to see in terms of resources wanted and time needed.
- pick the right time for each activity considering the place (week, month);
- specify the relation between task – can you implement more then one task?
- think about the time needed for each task and estimate a start date. Include all essential activities and consider the fact that you may need more then one team member. Is good to keep in mind the amount of work and the possibility to get some additional assistance. Consider crucial to be realistic about the time you need to complete your tasks;
- find the milestones in order to monitor the progress of activities;
- assign responsibilities for tasks with all members.

An essential part of the work plan is a schedule that defines the time you want to spend on each step of the development of spatial planning on land or at sea process.

TASK 3: SETTING BOUNDARIES AND DEFINING TIMEFRAME

Setting boundaries

There are two kind of boundaries to consider is this case:

1. Management boundaries;
2. Analysis boundaries.

The management boundaries of the marine zone will not coincide with the boundaries of a single ecosystem, because often a number of ecosystems of varying sizes exist within, and may extend beyond, the selected management zone.

They will coincide with some parts from which demands are imposed on the resources of the marine zone for which you develop planning.

That is why the boundaries for analysis for the development of spatial planning on land or at sea often will not coincide with management boundaries. On the contrary, finding the analysis boundaries (planning) broader than management boundaries (implementation) will enable you to detect main sources of influence (pollution sources) that have an effect in your management zone and includes the authorities/institutions responsible for those sources in the implementation of your spatial plan.

Defining the time frame

This faze contains 2 parts:

1. Base year/period for finding present conditions in order to provide a standard basis;
2. Wanted year/period that shows the period you intend to plan for and lets you see future conditions for the development of spatial planning on land or at sea.

Often the time frame will have to coincide with other national planning periods for planning.

From a management point of view, the boundaries are settled by the different policy aspects. Many case studies set different boundaries depending on the theme being studied.

TASK 4: SETTING PRINCIPLES

A principle is a basic and essential quality element determining the intrinsic nature or characteristic behavior of integrated maritime spatial planning.

The ICZM is guided by a set of principles that determine the nature/characteristics of the integrated planning process and reflects the outputs you want to obtain through integrated planning process.

Some examples: transparency, public trust, integration, precautionary, ecosystem integrity, polluter-pays.

These principles can be shown by a number of sources like international agreements, policies, good practice examples, national legislation. You must reflect these principles throughout the integrated spatial planning process.

Many organizations and institutions have already defined principles for integrated maritime spatial planning and you can see that they are diverse and often represent a thin line between principles and aims.

TASK 5: DEFINING AIMS AND OBJECTIVES

This part is crucial in order to help you focus and find your spatial planning efforts towards obtaining outputs. Defining aims and objectives will help you stay on the right track and find the right solutions. These facts must come from the identified problems and conflicts – focus on Step 1 of this document. You must consider that each aim and objective is different from one another. The difference between them are:

a. aims can’t be measured; objectives can;
b. aims are abstract; objectives are concrete;
c. aims are general intentions; objectives are precise;
d. aims are intangible; objectives are tangible.

Aims provide the support for development of all other objectives and reflect the principles upon which subsequent objectives are based.

Examples of SP aims:

- Preserve ecological structure to maintain biodiversity and natural resilience of the marine area and ensure the sustainability of economic uses of marine zone;
- Protect ecologically valuable zones and protect/conserve marine resources;
- Promote adequate uses of marine space and restore degraded zones;
- Prevent/resolve conflicts between current and future human activities and nature.

Characteristics of good objectives are that they are specific, measurable, achievable, relevant, and time-bound - SMART.

Evaluating or monitoring the progress toward the achievement of desired results can only be measured when objectives are specific. Objectives will be preliminary and indicative when you name them for the first time, and firmer when re-examined later in the maritime and coastal spatial planning process.

TASK 6: FINDING THE RISKS AND DEVELOPING CONTINGENCY PLANS - WHAT MIGHT GO WRONG DURING THE PLANNING PROCESS

The need for contingency planning emerges from a thorough analysis of the risks that your SP plan faces. It's also useful in thinking about new and ongoing approaches: what happens when 'Plan A' doesn't go as you believe? With more sophisticated risk management plans, Plan A is your first response to deal with an identified risk – and when Plan A doesn't work, you use your contingency plan. All pre-planning should include an assessment of the risks of what could go wrong during the planning process. Aspects to consider include what could delay/undermine key steps and tasks in the development of spatial planning on land or at sea process.

What is the critical path among steps that should be taken, and what contingency measures might be available to address identified risks?

Step 4: Structuring stakeholder involvement

Main aim

Stakeholders are persons or organizations that are involved or influenced (positive or negative) by the ICZM process. The stakeholder participation may be influenced by: culture, legal requirements or politics. To achieve a ICZM process is essential to increase stakeholder participation and to structure their involvement considering a variety of objectives and interests, to the benefits of the decision-making process. The main aim in structuring stakeholder involvement is to better reflect the opportunities, threats and incompatibilities in the Black Sea Area.

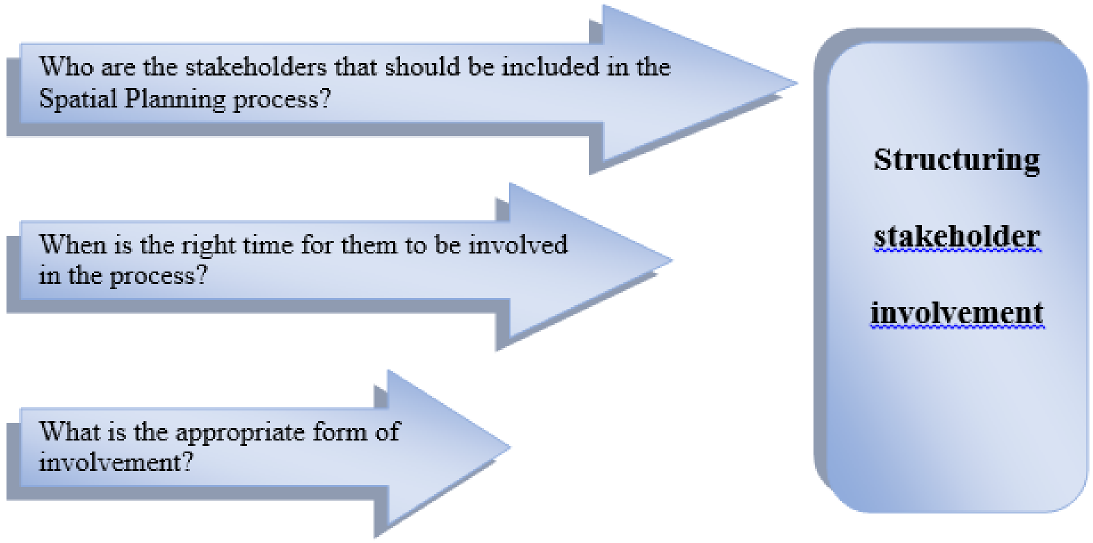


Fig. 2 Stakeholder involvement

These questions are related to:

- The decision-making power of each stakeholder in the ICZM process;
- The degree of responsibility in planning and organizing the process.

Delivered outputs

The delivered output of the step 4 is a consistent document that includes the answers to the questions mentioned above. The plan will structure stakeholder involvement by indicating who are they, when is the right time for them to be involved in the ICZM and the development of spatial planning on land or at sea process and what is the appropriate for of participation.

Tasks for this step

TASK 1: IDENTIFYING WHO ARE THE STAKEHOLDERS THAT SHOULD BE INCLUDED IN THE MSP PROCESS

The key element at this stage is to identify who are the major stakeholders in developing and implementing the ICZM. Stakeholders refers both to individuals and organizations that are influenced positively or negatively by the impact of ICZM. The complexity of the ICZM depends on the various stakeholders and their interests, perception in solving problems or opportunities identified in Black Sea Region. Stakeholders interest in ICZM process declines from decisions taken in the integrated spatial planning that will affect their activity or resources dependency from the maritime area. On the other hand, some of these stakeholders performs in sectors that affect the Black Sea coastal zone and can influence the marine environment.

Considering the importance of stakeholders in the management area, we distinguish three basic categories of stakeholders:

- ❖ stakeholders of *primary* importance;
- ❖ stakeholders of *secondary* importance;
- ❖ stakeholders of *tertiary* importance;

Because stakeholders are not equally important in ICZM process, it is useful to assess them through "stakeholder analysis". This will emphasize each stakeholder potential (supportive or rejection attitude), their claims, intentions, interests and will find the most appropriate ways to empower them. Stakeholders from the Black Sea Coastal Zone may include scientific insights and administration, the authorities at the international, national or regional level, the academic world, as well as the Black Sea users like fishermen or boat owners. We also must include NGOs, people who practice water sports, civil society or local politicians.

Close cooperation with different types of stakeholders at the entire process of drafting the plan or just in some stages lead, through consultations and participative meetings leads to an increased level of acceptance and has some essential benefits:

- ❖ First of all, the point of view of approved experts offer authenticity and added value to the integrated spatial planning, while providing integrated solutions for the development of Black Sea coastal zone;
- ❖ Secondly, the human resources are a very efficient way to promote and raise the acceptance degree among the interest zone;
- ❖ Finally, public consultations is a convenient way of communication to avoid possible conflicts between stakeholders.

TASK 2: IDENTIFYING WHEN IS THE RIGHT TIME FOR THEM TO BE INVOLVED IN THE ICZM PROCESS

It must be taken into account that stakeholders are not involved in the same time in all stages of the ICZM process, they have different manners of participation and their interest varies depending on the numerous factors. During the consultation process or in the approval stage, stakeholders are the key stakeholders that can amend the ICZM process by minor or major adjustments. The most important stages in the Integrated Coastal Zone Management process that include stakeholders participation are the following:

Pre-planning and planning

Consulting various opinions with different interests provide the basic data for the process. The inventory of initial data will consist in collecting and mapping all relevant data from different types of stakeholders (from various economic sectors, culture, financial possibilities, adaptability) to ensure the framework in achieving the goals of the ICZM process. There is a direct link between the number of stakeholders participating at the setting goals process and the legitimacy of the entire integrated spatial planning, because they can adjust the content in accordance with their own vision.

Integrated Spatial Planning development

At this stage are relevant public consultations and stakeholders will be encouraged to comment and express their own analysis (with strengths, weaknesses, opportunities and threatening) and to adjust the integrated spatial planning initiative following the key directions identified in the previous stage (Pre-planning and planning).
The stakeholders will also identify possible alternative plans and discuss different consequences and risks according to the objections, organizing the entire process based on the measures that will be taken.

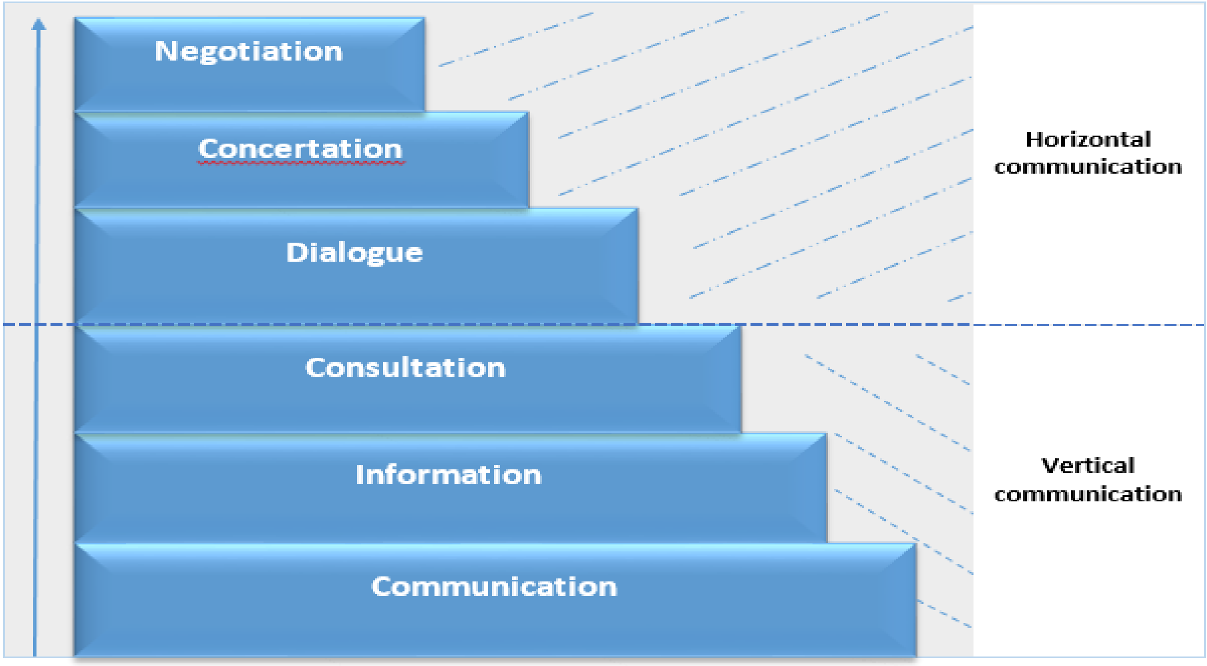
ICZM implementation

Stakeholders must view the ICZM implementation as a form of reward, because their agreement in ICZM process is a benefit they can explore. The active participation of stakeholder sector through bilateral consultation represent a confirmation of the initiated plan, offering both scientific insight and legal framework.
The challenge is to involve international stakeholders with a unique main objective and to strength their capacity to implement the plan, encouraging in the same time their ability to communicate. It is essential to keep a permanent and multilateral relationship between different categories of stakeholders.

The assessment of the integrated planning process

In order to realize a correct integrated spatial planning process, stakeholders must be involved in the assessment stage, comparing the achieved results with the predicted ones. In the monitoring phase stakeholders can adapt the entire process depending on the real situation, being able at the end to evaluate the effects and the general level of the main objective achievement.
Understanding the progress made in achieving the outcomes and the efficiency of decisions during the process, stakeholders can appreciate the efforts and compare the draft plan with the final integrated spatial planning.

TASK 3: IDENTIFYING WHAT IS THE APPROPRIATE FORM OF INVOLVEMENT FOR THEM



How stakeholders will be involved in the process is a crucial question for the success of the ICZM – they can be either consulted or informed, or both. The passive process includes an one-way communication (communication, information) and the active process includes bilateral communication (consultation, dialogue, concentration or negotiation). The most participative form of involvement is the negotiation, in which stage the decision-making power is the distributed among groups of stakeholders or individuals. Forms of involvement:

- **Communication** – this form of involvement is the most basic way to convey the massage to the public, in order to get approval for what the communications implies: decisions, objectives, scope.
- **Information** – The information transmitted are objectives, without trying to get an answer. Their primary role is to provide a correct overview to stakeholders, to take the best possible decisions.
- **Consultation** – represent an active form of involvement, in which the stakeholders express their intentions and interests. Information given by stakeholders may influence the plan, but don't assure them that their opinion will be taken into account by the responsible of ICZM and integrated spatial planning process.
- **Dialogue** – this is a form of communication that implies a better understanding of stakeholder's opinions, by expressing different points of view in an equity sense. Stakeholders clarify their positions in a horizontal communication, in a mutual cooperation for a better ICZM and integrated spatial planning process understanding.
- **Concertation** – even if this form of involvement represents an horizontal communications, among equal parties, the main goal is to a achieve a common perspective and a unique manner to implement the ICZM. After the previous stage (the dialogue), when each stakeholder understand the other position, the concentration phase emphasizes the importance of establishing an unique ICZM vision.

- **Negotiation –** The most common form of stakeholder's involvement in order to reach a decision is the negotiation. This is a specialized communication that implies decision-makers with equal powers, in a dynamic manner. Various stakeholders with prior objectives, mediate their positions to reach a common goal.

Conclusions step 4 - Structuring stakeholder involvement

- To avoid misunderstandings, there is necessary a clear participating process including different tools of communications, from the passive ones to the active ones. Establishing the proper participation way for each stakeholder eliminates frustration and conflicts and ensures a valuable feedback in the ICZM process.

- There is also essential to use the right participation tools in accordance with the right profile of stakeholders, supporting them to enhance their involvement in the process. The dynamic involvement lead to a continuous adjusting of the plan, with the general approval of people interested in/affected by the ICZM.

Step 5: Identifying and explaining the current conditions

Main aim

The main aim of this step – Identifying and explaining the current conditions - is to get an initial overview of the current conditions in the marine area by collecting different basic data. It will be required an inventory that should take account any relevant data and trends and developments necessary to assess spatial pressures, included in another stage of the plan. The inventory will provide the useful information to structure the Costal and Maritime Spatial Planning, because not all the data collected is relevant for integrated spatial planning.

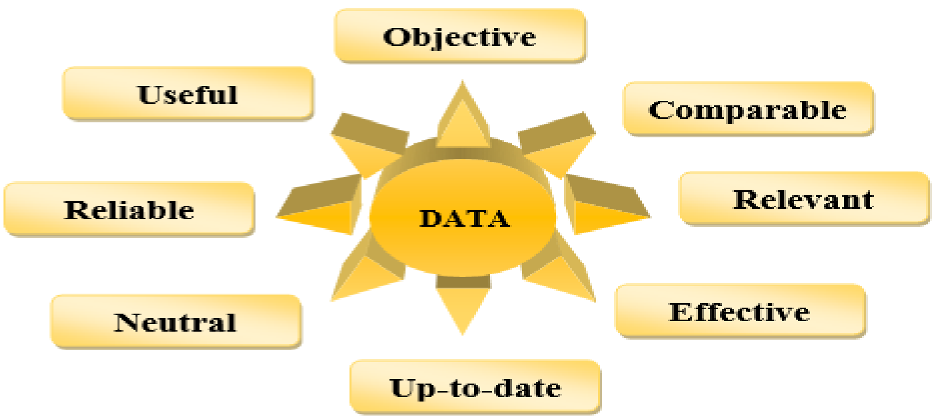


Fig. 3 Information characteristics

We must consider the following general categories of spatial information that are relevant:

- ❖ spatial data referring to human activities;
- ❖ biological and ecological zones;
- ❖ maritime and other physical environmental features.

In order to reduce the most time consuming aspects of the planning activities and for correct review of available data, will be searched spatial data that covers most of the marine area. To identify and explain the current conditions will be considered the projects that cover the Black Sea coastal zone and that are relevant to spatial data regarding ecological, biological, environmental features, maritime or human activities.

Delivered outputs

- ❖ An inventory and maps of:
  - ✓ current human activities and constraints determined by human activity in the marine zone;
  - ✓ relevant biological and ecological areas in the marine zone.
- ❖ Identify compatibilities and incompatibilities:
  - ✓ among current human uses;
  - ✓ between current human uses and the marine environment.

Tasks for this step

<u>TASK 1:</u> INVENTORY OF DATA ABOUT ECOLOGICAL, ENVIRONMENTAL AND MARITIME CONDITIONS

For a successful Integrated Coastal Zone Management it is essential for specialists to clearly understand the diversity of the sea system, in terms of time and space. The sea is very diverse when time is concerned: some important processes taking place in a few hours, days or months and others during several years or centuries. On the other hand, it is particularly necessary to understand which places are most important to conserve on the sea, as well as the spatial diversity in terms of: water stratification, bathymetry, biodiversity and the effects of human activities. To identify important biological and ecological areas that need special protection, are used some scientific criteria:

- ✓ Importance for threatened, endangered or declining species and/or habitats;
- ✓ Naturalness;
- ✓ Rarity;
- ✓ Vulnerability;
- ✓ Biological variety and productivity;
- ✓ Special importance for life history stages of species.

In order to achieve this task, it will be useful to complete a Bioregional profile for Black Sea Area, describing areas that have high ecological or biological significance for each country from the project. Identifying regional priorities for actions will also help the decision-makers to develop strategic plans.

TASK 2: COLLECTING AND MAPPING INFORMATION ABOUT HUMAN ACTIVITIES

The second task is about collecting and mapping the important human activities in the marine management area. From this point of view, the most important human uses can be distributed into several categories:

- Commercial and recreational fishing – e.g. nets, hook/line, pots/traps, spears/harpoons, trawls/dredges, beach seines, hook/line, pots/traps, sellfishing, spearfishing;
- Marine transportation – e.g. cargo vessels, tankers, cruise ships, liquefied natural gas carriers;
- Renewable energy and non-renewable energy production – e.g. wind farms, tidal, currents, wave parks;
- Sand and gravel mining.

Even if the human dimensions of the marine environment are widely recognized as important, it is vital for the development of spatial planning on land or at sea to summarize, list and map the activities related to the human-marine environment system.

TASK 3: DETERMINING THE CURRENT COMPATIBILITIES AND INCOMPATIBILITIES

Usually, there are spatial overlaps between maps showing important biological areas and those important to human activities. Determining the incompatibilities or the compatibilities may lead to the conclusion that even if the overlaps discovered will usually be incompatible, they may indicate real or potential compatibilities, depending on various factors. It is essential to compare the data into the marine spatial management plan to indicate that some overlaps between important biological areas and human activities may be compatible (e.g. areas for offshore wind farms and certain types of shellfish aquaculture; areas designated for offshore wind farms and marine transportation, if it happens in different time periods).

Conclusions step 5 - Identifying and explaining the current conditions

- In recent years the scientific research in marine areas has been substantial improved. The ICZM includes a special part to visualize what the spatial incompatibilities in a given area may be, and to do an initial checklist to mark conflicts and compatibilities between maps showing important biological areas and those important to human activities.
- The diversity of the Black Sea Area should be seen from two different points of view: time and space. Defining and analyzing existing conditions, by researching, collecting and mapping useful and relevant data must be complete by an integration of all these information and results in a strategic policy. The major impact of this policy will be a better management and development of Black Sea coastal zone. We can identify a long-term profit for the Black Sea Area by implementing the policy mentioned above.

Main aim

While the previous phase determines the current conditions in order to better understand the Black Sea Region, the relevance of this step is to establish a future targets to achieve in particular situations. What do we want to achieve and where do we want to position in future conditions. To fix a realistic possible position it is necessary to realize a spatial sea use scenario based on alternative future forecasts and future assumptions. The development of spatial planning on land or at sea must be done in a prospective way, including future alternatives and revealing a desirable future in accordance with stakeholders and a long-term vision.

Delivered outputs

- ❖ Projecting trends to represent the Black Sea area from the ICZM in the present condition, without any other intervention;
- ❖ Creating alternative spatial sea use scenario to demonstrate the changes in the context of new objectives proposed, emphasizing on the opportunities and compatibilities and determine measures against incompatibilities;
- ❖ Selecting an appropriate scenario that includes the best options concerning the future actions, resources and management solutions.

Tasks for this step

<u>TASK 1:</u> ESTABLISHING PRESENT EVOLUTION IN THE SPATIAL AND TEMPORAL REQUIREMENTS OF PEOPLE ACTIVITIES

This evolution represents the initial scenario, without any other intervention and reflects what effects will occur if there will not be any interference with the existing management sea area. To make exact forecasts it is useful to fix a time frame that can be followed continuously during the ICZM process, in order to allow a precise comparison of people activities across sectors.

<u>TASK 2:</u> PREVIEW OF SPATIAL AND TEMPORAL REQUIREMENTS FOR NEW DEMAND OF MARINE AREA

This task is direct linked to the previous one, with the selected time framework. New demands of marine area is conditioned with the technology progress and the estimated area will be established by analyzing public authorities position, licenses application and industry sectors recommendation. On this basis will be fixed new human uses for the Black Sea Region, in total accordance whit the stakeholders and the future trend. All this information will be integrated in maps that will reflect a general conclusion. According to this, the final demand for marine space will be larger than the current one, hence the present need of management improvement. Another aspect of prior importance is that is a valuable means of determining some incompatibilities between human use and the marine environment.

<u>TASK 3:</u> WHAT ARE THE FUTURES OPTIONS FOR THE TARGETED SPACE?

After an appropriate selection of time framework, choosing the right options is a key phase in planning process that will influence decisively the final development of the area targeted by the

ICZM. There is relevant to create various scenarios depending on complex combination of objectives and their importance in the final result. Grouping the objectives and goals in representative categories may help to choose a right direction to follow (E.g. objectives that refers to human development, culture and civil society, industry sectors or ecology).
In order to determine the spatial sea use scenario it is necessary to establish some “decision rules” that may result from:

- ❖ International and national policies that can influence the Black Sea Space;
- ❖ Economic constraints in different sectors;
- ❖ Technology progress;
- ❖ Environmental circumstances.

<u>TASK 4:</u> CHOOSING A SPATIAL SEA USE SCENARIO

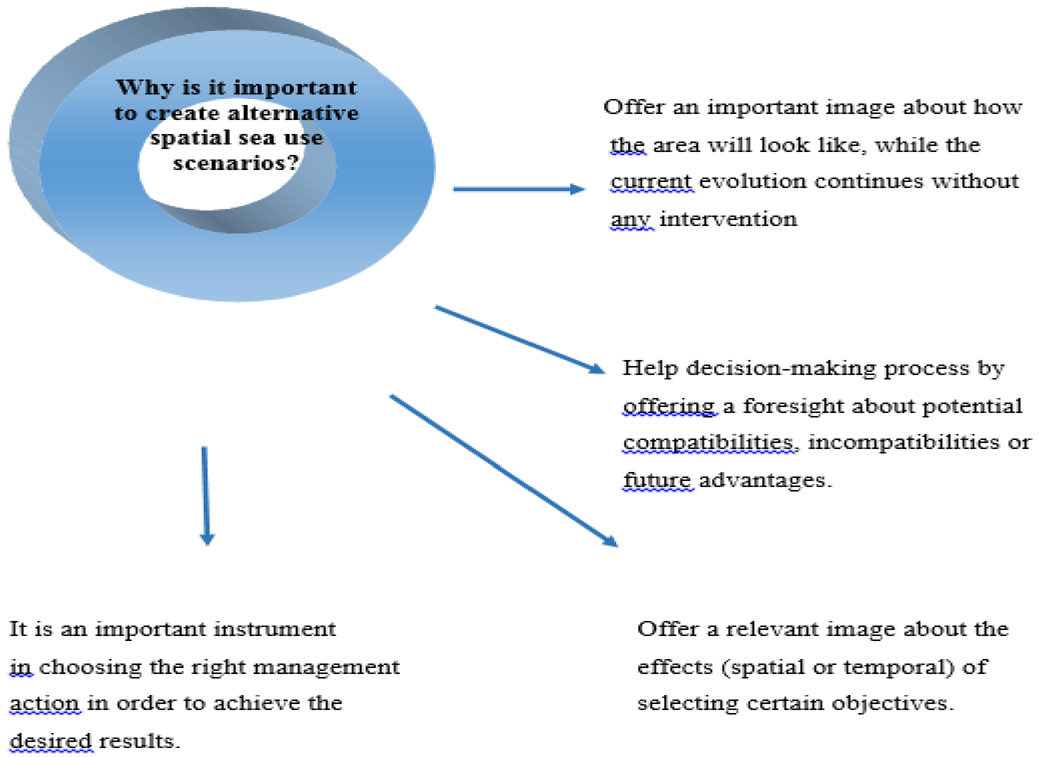
Selecting the right scenario depends on certain objectives and outcomes, revealing a specific vision of how human uses can be assigned into specific time and space. The scenario will constitute the foundation for the implementation stage, establishing an harmony between selected types of objectives into a consolidated ICZM process. The spatial sea use scenario chosen must produce outcomes in the most effective manner, will be cost-efficient and the results must be splited on an equitable basis.

In order to choose a spatial sea use scenario, there must be take into account the following criteria:

- ❖ Economic influence and the effects;
- ❖ Political regulations;
- ❖ Financing;
- ❖ Time framework;
- ❖ Biological, physical and chemical effects.

Figure 4.

<u>Alternative spatial use scenarios</u>



Step 7: Spatial management plan - preparing/approving stage

Main aim

This stage is very important for the development of spatial planning on land or at sea process. A spatial management plan should be developed to identify specific management approaches that will induce the desired future through real decisions about the place and timing of people activities. This plan is not an end but a beginning toward the realization of desired aims and objectives.

It is considered that this plan should be a statement of policy from the responsible management authorities, in partnership with other key factors (agencies and authorities) responsible for single areas-sectors. The plan must show an integrated vision of the spatial aspects like policies in the areas of economic development, marine transport, environmental protection, energy, fisheries and tourism.

The marine spatial management plan should point where marine policies come together and where they do not. This plan can be integrated in public programs of investments and should highlight the spatial dimension of integrated management.

Generally a Spatial management plan contains:

a. Description of the boundaries of the coastal and marine special planning zone;

b. Base year and time period of the plan;

c. Spatial management aims/objectives;

d. Description of a preferred future;

e. A timetable for the formal actions needed to implement the plan;

f. Financial plan and funding requirements of the comprehensive with financing sources.

Purpose of this spatial management plan is to set the line and coordinate proposals for future development. The spatial management plan should provide direction for further zoning and regulations, as well as the use of other management measures, but the degree of prescription has to be dependent upon each country condition. The spatial management plan should adopt a minimalist point of view concentrating on: priorities, key challenges, and others.

Delivered outputs

a. Identification/evaluation of alternative management approaches for spatial management plan;

b. Selected alternative management measures based on a formal criteria;

c. A comprehensive management plan-zoning plan if needed.

Tasks for this step

This stage includes the following tasks:

1. Finding alternative spatial and temporal management measures/resources;
2. Pointing criteria for choosing spatial management measures
3. Creating a zoning plan
4. Evaluate - spatial management plan
5. Approve - spatial management plan.

TASK 1 - FINDING ALTERNATIVE SPATIAL AND TEMPORAL MANAGEMENT MEASURES/RESOURCES

Once you have a desired future spatial scenario (Step 6) has been identified, then specific spatial management measures will have to be fixed that can lead to that future vision.

Some other types of management measures must also be used in the management of human activities including: (1) input measures; (2) process measures; and (3) output measures.

Examples of spatial and temporal management measures:

- Establishing areas closed to fishing or other human activities;
- Designation of marine protected areas and of precautionary areas or security zones
- Zoning of areas for specific uses by aims and objectives.

A fundamental component of a marine spatial management measure involves the need of incentives to implement the management measures and achieve results. Economic incentives include: grants from national and/or state or provincial governments, surcharges on inputs (such as fertilizer and energy, user fees, access fees, license fees, right-of way fees, development fees and others).

Non-economic incentives: (a) regulatory; (b) technical assistance; (c) public education and information; and (d) enforcement sanctions.

Coastal and marine spatial planning involves many human activities and typically involves more management agencies.

TASK 2 - POINTING CRITERIA FOR CHOOSING SPATIAL MANAGEMENT MEASURES

It may be possible that exist some differences among stakeholders about the relative importance of issues/objectives to be achieved through marine spatial planning process.

Also you can find differences in their views of the criteria to be used in evaluating alternative management measures that will represent the substance of the management plan. Is important that they can emphasized that the decisions about both criteria and their weights may well be different, in the views of the stakeholders, during the course of planning.

TASK 3 - CREATING A ZONING PLAN

The most important management measure used to develop and implement this kind of plans - comprehensive integrated marine spatial management plans – is ZONING. A zoning plan is often included in the management plan.

Elements of the ICZM zoning:

- locating/designing zones (upon topography, oceanography and distribution) and designing systems of permits, licenses, and use rules within each zone;
- establishing the right mechanisms and creating programs to: monitor, review, adapt the system.

Zoning is often in the form of a legal paper. The format of a zoning plan will depend on its legislative basis and on the procedures of the institutions responsible for this plan.

A zoning plan is based on the means through which the purpose for each part/parts of a marine management area can be used.

The final zoning product in a large multiple use marine management area will be the output of compromise, accommodating a range of needs and political requirements.

TASK 4 - EVALUATE - SPATIAL MANAGEMENT PLAN

Is important to consider the description and evaluation of any substantial impacts on the marine environment that are likely to be caused by the implementation of the spatial plan, using the existing description and assessment of the marine environmental status as a basis. At the same time, measures that described any substantial impact on the marine environment is good to prevent, reduce, or compensate as best possible any damage.

TASK 5 - APPROVE - SPATIAL MANAGEMENT PLAN

The last task in this phase of planning is approval of the spatial management plan through a formal adoption process. This task is different in every management context for each country. Any new legislation required to implement the plan may 1-2 years, minimum.

This task will usually entail at least the following considerations that may take a considerable time to concrete: adoption of the spatial management plan, its aims and objectives, steps, and spatial management measures; new institutional arrangement; new changes in management boundaries and allocation of new funds to implement, monitor and evaluate the spatial plan.

Conclusion

Continuous planning is necessary because of the dynamic context of ICZM. The focus of the planning process should be on “planning” rather than on producing a plan. The people that plan this process should always keep in mind that their function is to generate information for decisions makers, not to make decisions.

Is important to establish and maintain continuous planning for spatial management and will not be achieved unless all actors and stakeholders (decision-makers, politicians, resource managers, bureaucrats, and general public) understand the net benefits of planning.

Step 8: Measures in implementing and applying the SP management

Main aim

The first stage in the implementation phase - step 8, represents the appropriate means to transform plans into actions using an operational plan, taking place continuously during the existence of the development of spatial planning on land or at sea process. This is a transition phase which marks the progress from the provisional plan (planning) to the effective action and in the same time a key stage in the planning success.

Delivered outputs

- Applying the spatial management plan
- Establish the necessary actions to implement the plan
- Correlate the actions with the planning process

Tasks for this step

TASK 1: APPLYING THE SPATIAL MANAGEMENT PLAN

The implementation phase take place after the national or international legal framework is accomplished and will be designate a lead marina agency which can survey and organize the development of spatial planning on land or at sea process. The entire process will become operational only after these institutional structures began to function in a normal way, using some instruments like: the comprehensive plan and the zoning plan. The costal and marine spatial planning implementation depends on single-sector management institutional structures.

<u>TASK 2:</u> ESTABLISH CONSISTENCY WITH THE PLAN

Consistency takes place when all requirements are realized, like those in which certain incompatibilities do not occur (people activities are not in conflict with the environmental place). There is a direct relationship between the specific requirements and their consistency with the right outputs. The bad points appear when the requirement are not clearly specified and this will lead to a misunderstandings in outputs understanding.

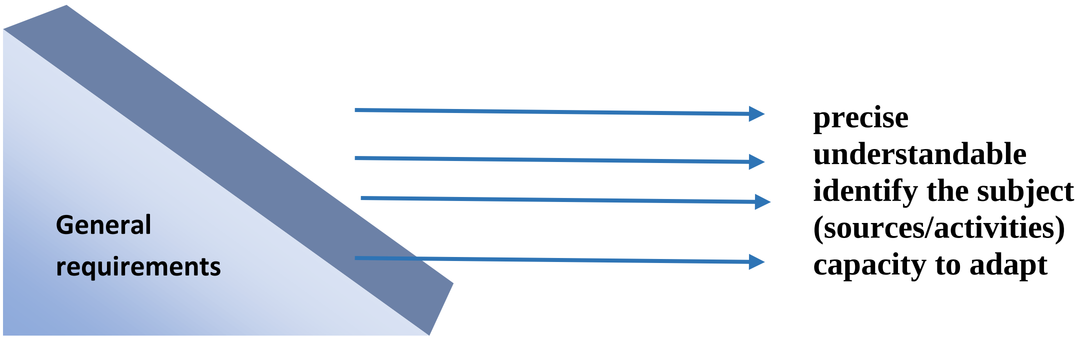


Fig. 5 General requirements' characteristics

The main principles in the rule of law are: consistency and imposing, but unfortunately they are considered weak points in the development of spatial planning on land or at sea process. If general requirements respects the rules mentioned, the planning process will gain in effectiveness. In this respect, it is useful to establish evident and precise requirements, but also their exceptions and methods to adapt them to the specific situations.

In accordance with the consistency principle, single sector management authorities that will implement the plan are also engaged to create their own plan in direct correlation with the spatial management program. There are various actions that emphasize a voluntary consistency:

- ❖ using educational methods;
- ❖ dividing existing stakeholders into groups'
- ❖ offering training to general public or different categories of stakeholders in terms of planning or legal framework;
- ❖ protect the important sea areas using attention markers (e.g. buoys);
- ❖ creating a technical support mechanism for developing spatial management plans.

<u>TASK 3:</u> IMPOSING THE SPATIAL MANAGEMENT PLAN

Imposing the spatial management plan refers to a set of actions that governments take to obtain conform to regulations involving human activities in order to correct/halt possibilities that endanger the environment or the public.

These actions may contain measures like:

- ❖ Legal status - to impose some consequence for violating the law or posing a threat to public health - environmental quality, including monetary;

- ❖ Verifications to establish the conform status of the regulated human activities and to prevent/detect violations;

- ❖ Negotiations with persons/managers of activities that are out of compliance to create mutually agreeable schedules and approaches;

Another way is to involve NGO`s to conform by detecting noncompliance, negotiating with violators, and commenting on government enforcement actions.

Certain industries may be indirectly involved in enforcement by requiring the assurance of compliance with planning requirements before issuing a loan or insurance policy to construct. The integrated marine spatial planning will be effective as its ability to enforce the agreed upon plans, rules and regulations because is a fundamental requirement of the process.

An important task in relation to enforcement is to ensure that strategies, plans and regulations are not too forbidding. They should be integrated across sectors, and be shown in a clear, concise manner to the public and private sector. Important factors and stakeholders will participate effective in enforcement if the rules and laws are consistently applied on the basis of transparent policies and procedures.

Step 9: Efficiency -Controlling and evaluating the process

Main aim

In order to provide general and useful information for evaluating the process you need to monitories the whole process from the beginning. That means you have to include the costs in the budget. A productive and effective performance monitoring system starts with a clear set of well-specified planning objectives. After you agree on the monitoring objectives, there also have to be an agreement on the results.

Factors that affect a monitoring process are:

1. Resources (proper ones) included are needed for both data collection and a detailed evaluation/analysis on long term;
2. A careful attention must be paid to managing, analyzing and interpreting the data gathered;
3. Objectives of the controlling process/program have to be clearly articulated in terms that pose questions that are meaningful to the public and that provide the basis for measurement.

Is important to point some key performance indicators to evaluate/monitor and report the progress in achieving the aims and objectives of planning.

The stage of monitoring is an integral/critical part of spatial planning and includes activities needed to provide proper information to integrated marine spatial planning. This phase (monitoring system) is integrated and coordinated with the specified aim of producing predefined spatial planning information.

Delivered outputs

1. A complex system to measure the performance indicators of spatial planning measures.
2. Basic and important information on the performance of integrated maritime spatial management measures that will be used for evaluation
3. Documents designated to decision makers, stakeholders, and the public about the performance of the spatial management plan.

Tasks for this step

Task 1: Establishing the efficiency monitoring program
Task 2: Evaluating efficiency monitoring information
Task 3: Reporting outputs of efficiency evaluation

TASK 1: ESTABLISHING THE EFFICIENCY MONITORING PROGRAM

Part 1. Re-confirming the objectives of the integrated marine spatial planning.

Because spatial planning is a complex subject during the process (Steps 4-7) may change some objectives – modified. A proper efficiency monitoring system starts with a clear set of well-specified planning objectives. Objectives should be re-confirmed with stakeholders and decision makers.

Part 2. What outcomes to measure?

Identify the outcomes is the most important part of this process. These outcomes are crucial to governments and other actors to measure. The problems should be reformulated so that they become positive outcomes. The outcomes helps to obtain the information about what kind of measures work or not. Helps build transparency and accountability into the planning and management process.

Part 3. Find efficiency indicators to monitor

These indicators include the ability to monitor and assess conditions and trends, forecast changes and help evaluate the effectiveness of management measures.

The general purpose for establishing indicators is to: measure, monitor and report on progress. Indicators have many uses and potential for improving management.

Part 4. Baseline information on indicators

Baseline information can be gathered from: reports, interviews, and direct observations, one-time. These phase is critical in determining current conditions and measuring future efficiency. After this phase decision makers can determine whether they are on track with respect to achieving objectives.

Part 5. Choosing outcome targets

The targets are based on outcomes, indicators and baselines. These targets should be selected through a participatory process with important actors. They should be determined by adding wanted levels of improvement to baseline levels.

TASK 2: EVALUATING EFFICIENCY MONITORING INFORMATION

Evaluation is the key element of management in which the important learning should happen. This process must be a continuous in which measures or indicators of efficiency are defined and systematically compared with program aims and objectives.
Evaluation is known as a management activity that assesses achievement against some predetermined criteria (usually a set of standards or management objectives).
The evaluation process can be conducted only if the objectives of the development of spatial planning on land or at sea program were stated in unambiguous terms and if indicators for achieving improvement were identified in the preparation phase, and observed afterward. Baseline data are essential. Many evaluations yield unclear results because these prerequisites for assessing efficiency do not exist.
Evaluation consists of look over the outcomes of actions taken and assessing whether these actions have produced the desired results. The link between action and outcome is often not noticeable.
Natural and social experts have important parts to play in evaluation. They should assess the significance, consistency and cost-effectiveness of scientific information generated by exanimating and monitoring, and advice on the suitability of control data.
Many marine monitoring and evaluation efforts to date have focused on the bio-physical pieces/settings in a few selected areas. Not so many are wide-ranging assessments of management effectiveness, including social or economic aspects.

TASK 3: REPORTING OUTPUTS OF EFFICIENCY EVALUATION

Efficiency information should be described in comparison to earlier data and to the baseline. In examining and reporting data, the more measurements there are the more certain one can be of leanings, guidelines, and results. A good communications strategy is crucial for disseminating and sharing data with key actors - stakeholders. Sharing data and outcomes with important actors and stakeholders helps bring them into the business of government and can help generate trust. The evaluation process should be open, clear as crystal and accessible to all stakeholders.

Step 10: Adjusting the spatial management plan

Main aim

In order to achieve the previsioned results, the development of spatial planning on land or at sea can be adjusted using the information generated by the monitoring and assessment stage. Using the "Learning by doing" principle and realizing systematic evaluation by comparing the intended results with the final outcomes, we can transform an adaptive management into an efficient sea area development tool.
Unfortunately, a flexible type of management that can be easy adjusted in accordance with the real and dynamic conditions of the Black Sea Region is rare in practice and very common in theory. The accent in the adaptive management is on generating a sustainable development in the Black Sea area and to ensure the positive effects for a long period.
An adaptive management has many basic characteristics:

- analyze many options to reach the proposed goals;
- forecast the results of the analyzed options, in accordance with the present evolution;
- implement one or more options

- ❖ continuously emphasize the effects, at every stage of development, in order to compare the outcomes
- ❖ establish the most appropriate way to adjust the plan;

Delivered outputs

- ❖ suggestions for adjusting management objectives, results and strategies for another planning rounds;
- ❖ obtain a realistic image about applied research needs.

Tasks for this step

<u>TASK 1:</u> RETHINKING THE SP PROGRAM

A key point, frequently omitted, in the development of spatial planning on land or at sea process is a permanent monitoring and assessment. This misunderstanding of the process has negative effects on the long term, which cannot be solved by a superficial vision.
To rethink a valuable planning process in the future and to improve the general management, these questions are essentials:

- ❖ What are the obtained outcomes of the planning process?
- ❖ What are the lessons that we have achieved after the implementation of the planning process?
- ❖ Has the general environment changed after the initial plan implementation?

Management can be adjusted by changing:

MSP OBJECTIVES AND PURPOSE
EXPECTED RESULTS OF THE MSP PROCESS
MANAGEMENT ACTIONS

The adjustments of the integrated spatial planning should be made in a realistic and professional way, not in a intuitive way. The changes are viewed like an integrated part of a complex and permanent process, in which the next step is represented by a next planning round. The management actions can influence people decisions and attitudes an improved future. We must mention that there are consistent differences between the development of spatial planning on land or at sea measures, in terms of temporal dimension (long time/short time).

TASK 2: DEFINE THE APPLIED RESEARCH NEEDS

The role of applied research can be represented in the following way:

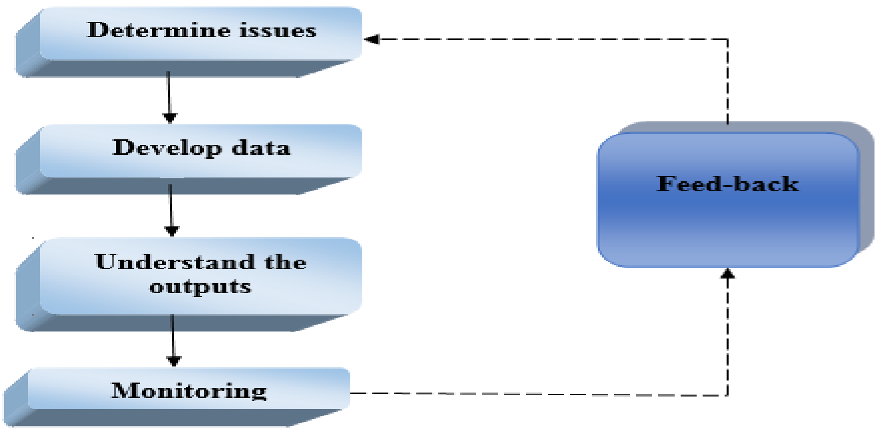


Fig. 6. The role of applied research

The integrated spatial planning on land or at sea process implies a lot of uncertainties, but an adequate spatial planning must have a correct and realistic inventory, with up-to-date data collection, in a long or short time. On the other hand, it is also necessary a professional research to emphasize the relationship between a type of habitat and the environmental productivity.
The generation of an appropriate spatial planning is constraint by the existence of the long time data, even if they are frequently unavailable. Usually, the maritime development process is extended by a long period of time and the information collected provide a good image of differences between natural and human influence. An accurate Spatial Planning depend on the caution in interpreting the results and any collected data.

TASK 3: BEGINNING A NEW PROCESS OF SPATIAL PLANNING

The future round of spatial planning will contain adjusted results, objectives, strategies and management actions to improve the effects. It will be taken into account the past management result, the key stages (monitoring, assessing and implementing) of the previous process and the modified general circumstances (economy, politics and technology).

In conclusion, the entire document emphasizes the importance of using the adaptive management.

Annex 2

Types of measures to take and instruments to use

Strategic measures **A cross-sector approach to planning and management; horizontal and vertical integration**	A cross-sector methodology for planning and management is needed. Viable development of the coastal zone is more that "inaccessible ideal" and significant efforts have to be assumed and investments made. Constructed on observing results, adaptations have to be initiated in sector policies and plans. The first step to developing ICZM must be the setting of development aims and objectives. These aspects (coastal development objectives and response actions) should be fully integrated into each country broader national planning process. Coordination has to be pursued to monitor and pilot developments into the right direction and prevent the environment from degradation. These facts are very important and must be closely monitored in order to keep actual developments on the ground. Because setting sector goals, formulated in isolation from correlated sectors, will without doubt lead to complications of sustainable development, the 3rd step should be the adoption of a cross-sector approach. This cross-sector approach should substitute the normal practice of a single-sector approach to planning/implementation.
Management instruments	The process of integrated coastal zone management is a constant, interactive, adaptive and participatory process, comprised of a set of connected responsibilities, meant to achieve an anticipated set of aims. A difference is made among the strategic levels for which "national bodies"- agencies are responsible and the implementation level for which mainly regional and local level organizations will be in charge. Crucial strategic management responsibilities includes: 1. An agreement on a Strategy for the Integrated Management of the Coastal Zone and any following update or revision; 2. Including the strategy for the coastal zone into the broader national planning process of each country; 3. Supervision and steering, advertising and co-ordination, and strategic monitoring and control to monitor progresses on the ground. a. Promotion through recommendation on co-financing engagements between central public authorities and regional/local sector agencies and between private sector and regional/local sector agencies for all countries that agree with

	this form; b. Direction and steering through expert assistance, consultation and influence; 4. Introduction of actions to enable and promote cross-sectorial planning and preparation /finishing of integrated policies and action plans (programs of measures) by sector agencies from all interested countries These operational guidelines and specific management instruments are needed to be enlarged in order to achieve an integrated coastal zone management.
Legislative instruments	**The legal system** Procedures, laws and other methods that belong to the legal system are important regulative tools in coastal zone management and in society in general. This category of political instrument differs from other tools because it implies norms with positive and negative sanctions. The law gives a system of rules, usually enforced through a set of bodies. It shapes politics, economics and society in numerous ways and serves as a primary social mediator of relations between people and between the people and the rulers. Each country has often its own legal system but and underlines the state sovereignty. **Legislations and regulations** There are numerous generally accepted values and characteristics of the implementation of ICZM. One of these is legal support, which provides application of law as the regulative mechanism of coastal management. Instructions and legal regulations can suggest different measures from the dimensions of fisher boats to water directives. It is meant to regulate activity that affects the sustainability of a coastal zone. The legislative measures are related to bans, directives, rights and procedures. The use of sanctions when breaking rules, make them effective, but also politically controversial. Harmful environmental impacts are largely controlled through the compulsory environmental permits that cover all kinds of potentially risk activities. Other environmental legislations have been enacted to prohibit the use of certain harmful substances, to set limits on emissions, to enforce certain technical standards, to make producers responsible for their products as waste, to limit certain activities in special areas such as nature reserves or car-free areas in cities, and to control land/coast use planning. Access control measures like licenses for fisheries or other activities in the coastal area are also a type of legal instruments used in ICZM. The effect of rules and regulations are based on its how legitimate it is. Legitimacy is assumed by public support. .Laws and legislations are in sum a highly predictable instrument. **Special laws, regulations, directives and international**

	agreements/conventions Within the legislation of the European Union (EU) frameworks for the implementation of ICZM have been established. The EU is one of the parties of the Barcelona Convention, so that through common policies, legislation, strategies, programs and projects of the EU and international organizations a framework for the development and implementation of ICZM initiatives at the national level is created (Protocol on ICZM in September 2010). The zones of the marine environment and coastal areas are topic to a wide range of EU policies and regulations, including: • The Water Framework Directive (2000/60/EC) • Marine Strategy Framework Directive (2008/56/EC) • Environmental Impact Assessment Directive (85/337/EEC) • Strategic Environmental Assessment Directive (2001/42/EC) • INSPIRE Directive (2007/2/EC) • The Habitats Directive (92/43/EEC) • The Birds Directive (79/409/EEC) • Management of Bathing Water Quality Directive (2006/7/EC) • The Nitrates Directive (91/676/EEC) • Urban Waste Water Treatment Directive (91/271/EEC) • Integrated Pollution Prevention and Control Directive (IPPC, 96/61/EC) and other regulations in relation to hazardous substances. Additional significant regulations and policies in the EU, which are relevant to coastal zone management: Recommendation on ICZM from 2002, the network of ecologically valuable areas, Natura 2000 for environmental sea and coastal areas, and the revision of the Common Fishing Policy (CFP), with the integration of environmental issues. New EU policies were formulated on the basis of the ecosystem approach through documents such as the EU Marine Strategy from 2005, the Blue Book: Integrated Marine Policy of the European Union from 2007. Is important to approach intergovernmental collaboration and coordination and to facilitate synchronization in development policies and plans for the coastal zone to achieve established goals and objectives which should be derived from the coastal zone management strategy. Planned institutional set-up is consequently based on the identification of the coordinating bodies (or entities) needed, the tasks/activities that need to be carried out by these forms as already identified in the existing coastal zone management legislation (E.O. 202/2002). Marine Strategy Framework Directive has the aim to gather good environmental status (GES) in European seas until 2020

	and protection of the resource base upon which marine/maritime economic and social activities depend. This Directive is the first legal tool of the EU relating to the protection of marine biodiversity as it contains explicit goal of "conservation of biodiversity by 2020" as one of the key necessities for achieving GES. The Directive includes the ecosystem method to management of human activities that have an impact on the marine environment into the legal system, so that in this sector and combined approach it is matching to the ICZM Protocol. To achieve GES to 2020, Member States should adopt strategies for their marine waters (marine strategies) and inform them every 6 years. In one more step towards the integration of policies relevant to management of the sea and coast, the EU (also in 2008) adopted **Integrated Maritime Policy** (IMP), which aims to provide a more coherent approach to maritime issues, with emphasizing better coordination among the various sectorial policies. IMP mainly deals with issues that are not covered by specific policies (such as, for example, "blue growth" or growth based on different maritime sectors) and those that require coordination among different sectors and parties (such as, for example, knowledge of marine processes). The horizontal issues which this policy deals with are blue growth, data, and knowledge of the seas, maritime spatial planning, integrated monitoring of marine processes and strategies of marine basins. **Green Paper on a marine policy** was adopted in 2012. This document aims to stimulate growth and create jobs in the maritime regions, and provides guidelines for increasing economic and social benefits of activities at sea. Taking into account the demographic changes in coastal regions where significant part of the population live, and the key role of coastal and maritime tourism, the policy emphasizes the need for ICZM strategy, through careful selection of projects in shipping which would be financed from the EU funds. The European Commission (EC) has launched a process of revision of **ICZM Recommendations** with an intention to formulate a proposal for a new act. The evaluation of potential social, economic and environmental consequences which may arise as a result of the new EC initiatives in this area was carried out. EU Marine Strategy which was adopted in 2005 aims at the protection of marine ecosystems, the gradual reduction of pollution, ensuring sustainable use of marine services and products through the application of the principles of responsible management. This strategy introduces regional spatial management plans, which must be made within 5 years from the date of the Strategy adoption. These plans consist of the assessment of the current situation

	and the human impact, a series of summaries of the environmental objectives and programs to achieve these objectives and programs for achieving and monitoring and evaluation of these objectives. In accordance with the trend for improving marine policy, the Marine Strategy Framework Directive and guidelines for integrated maritime policy (also from 2008) was adopted. Also, it is recognized that more attention should be given to adaptation to climate changes and other risks in coastal areas than it has been the case so far.
Technical instruments	❖ **spatial planning** ❖ **land-use planning** ❖ **environmental administration** ❖ **water resources administration** Actions to protect the coastal zone: Using the relevant information and the workshops conclusions of the ICZM bodies, there were formulated complex national or international strategies for the Black Sea coastal zone. Negotiating rounds among stakeholders outline the following directions: ❖ A correlation of legislative framework and a consistent transfer of marine information is necessary. In order to achieve this goal, it is essential to create central responsible authorities with the development process coordination of the Black Sea coastal area. ❖ In the Black Sea Synergy – A new regional cooperation initiative, the focus is on establishing a coherent policy guidance, providing in the same time the Community support for particular initiatives. ❖ On the other hand, the current coastline position shall be adjusted, mainly in those where exist the industry, infrastructure and hotels. The controlled retreat is passable in those regions where the erosion process has a negative evolution. ❖ It is also necessary minimum coastal protection interference and a minimum number of coastal structures (e.g. reefs, jetties). Will be preferred another solutions, with a less negative impact and are more attractive for the tourism sector – e.g. replenishments with offshore or land-borrowed sand. ❖ The Black Sea Synergy also propose to generate a network of clusters of maritime cross-sector collaboration among industries, services and scientific bodies. Actions to fight against Black Sea coastal erosion: ❖ Engineering analyse; ❖ Initial designs; ❖ Feasibility evaluation; ❖ Priority ranking;

	❖ Complex designs; ❖ Tender documentation; ❖ Implementation stage; ❖ Monitoring and maintaining.
Financial instruments	The ICZM in the European Community is to be funded on: ❖ the EU recommendation; ❖ the Water Framework Directive (WFD). ❖ public investments; ❖ environmental fund; ❖ credits (internal or external); ❖ sponsorships; ❖ donations; ❖ non-reimbursable money. To ensure the long-term resources, the main responsibility has: ❖ the budget allocations; ❖ local taxes and particular charges. At the present applying a "coastal zone management tax" was considered a difficult solution, because of the living standards and political aspects, but this idea can be implemented in a future context. One of the most relevant stakeholder is represented by the private sector, because their investments represent a valuable source to improve the coastal area image. The private sector can influence all economic fields in the coastal area (from agriculture, to industry or tourism), in buildings and constructing the area. It is relevant to emphasize on decision-making process and the involvement of private sector in this process, in order to consolidate a strong acceptance position and an open view from one of the key type of stakeholders.
Investment programs for Black Sea countries, to accomplish the measures (strategy and the action plan)	The Black Sea is bordered by 6 countries and has found a regional cooperation in order to apply a adaptive management to the current conditions. The main document to organize the regional collaboration is The Black Sea Synergy, that was launched by the European Union. The document set an adaptive framework to an integrated policy, providing the basic data and regulations to reach the common goals. There are also two regional bodies that ensure the viability of the programs initiated in the Black Sea Region: ❖ The Black Sea Economic Cooperation (BSEC) ❖ The Commission for the Protection of the Black Sea Against Pollution Investments in the Black Sea Area, to accomplish the strategic measures and the operational plan are: ❖ Various EU funds related to marine and maritime area,

	while the most important are: - the Instrument for Pre-accession Assistance (IPA) - the European Neighborhood and Partnership Instrument (ENPI). These programs offer the financial support to implement the projects from the analyzed area. ❖The Black Sea Basin Joint Operational Programme has the main goal to realize a more sustainable development in the Black Sea Region (economic and social). The key-objectives of the programme mentioned are: - creating a local collaboration; - cooperating in order to achieve common goals; - encouraging a sustainable development in the border zones – economic and social point of view. ❖ The EU Horizon 2020 contains also a specific call for the Black Sea area and distributes considerable funding amounts to encourage the applicants.
Public participation instruments	The general public can be involved in an active way in the decision making process, through participation at different stages – developing strategy, creating the policy, planning. To improve the decisional process and the dissemination phase, it is necessary to share the data and to properly communicate information among different categories of stakeholders.
National and regional initiatives	***1. The Advisory Group on the Development of Common Methodologies for Integrated Coastal Zone Management – Permanent Secretariat of the Black Sea Commission*** The Advisory Group on Advisory Group on the Development of Common Methodologies for Integrated Coastal Zone (AG ICZM) gives advice to the Black Sea Commission on proper management of the coastal zone and elaboration and implementation of regionally coordinated integrated coastal zone management strategies, methodologies and instruments in the context of sustainable development (Annex I, BS SAP, 1996). **Legal Status and Institutional Structure.** The Advisory Group on the Development of Common Methodologies for Integrated Coastal Zone is an integral part of the Black Sea Commission institutional structure and constitutes its subsidiary body: a) The AG ICZM is comprised of the national focal points nominated by the member of the Black Sea Commission, a director of activity center and is responsible for facilitation of links between the Black Sea Commission, the relevant national authorities and regional and national scientific expertise; the national focal points are responsible for the accurate and timely delivered national information on ICZM as it deems necessary for the Black Sea Commission;

	b) The Advisory Group on the Development of Common Methodologies for Integrated Coastal Zone is supported by the Activity Center on the Development of Common Methodologies for Integrated Coastal Zone which provides the necessary programmatic and technical support for the work of the AG ICZM. The Activity Center is based upon the one created following the Resolution of Bucharest Diplomatic Conference 1992 and with the assistance of BSEP and shall function with in-kind contribution by the Government of the Russian Federation with additional financial assistance from donors where possible and necessary. The members of the Advisory Group shall elect its chairperson among themselves for two years; c) Following the Rules of Procedure of the BSC the AG ICZM may propose that any individual, able to provide expertise related to the ICZM and assist in producing the recommendations required by the BSC as well as assist the training activities within the work program of the Group, could be invited to the events within the work plan of the AG ICZM. **Main responsibilities** The AG ICZM acts in advisory and information capacities for the regional purposes of the Black Sea Commission by: 1. Drafting recommendations and policies for the Black Sea Commission for the following: a) formulating the regional policies and proposing regional strategy and actions for Integrated Coastal Zone Management; b) strengthening integration among different sectors at the local, national and regional levels, relevant institutions, governmental bodies and international organizations, the private sector and other stakeholders; c) harmonization of already applied ICZM instruments at the regional level in the Black Sea coastal countries; 2. acting as the BSC consultative body for regionally important activities related to ICZM in close cooperation with relevant national authorities; 3. coordinating the regional scientific studies and training activities in ICZM as it deems necessary; 4. drafting proposals and advising the BSC in attracting the international financial assistance for solving regionally important environmental problems related to integrated coastal zone management; 5. developing and applying environmental decision support systems based on the GIS technologies. ***2. PEGASO Project*** PEGASO's main objective was to support the implementation of the UNEP-MAP Integrated Coastal Zone

	Management Protocol for the Mediterranean and to support the development of a similar policy instrument in the Black Sea. PEGASO was successful in bridging the gap between science and policy-making by providing easy-to-use tools for the final users, to help them make science-based decisions that promote the sustainable development of the coastal and marine areas of the two basins. The ICZM processes had recognized several research gaps for which a number of tools were needed. The main goal of the PEGASO project is to construct a shared Integrated Coastal Zone Management (ICZM) Governance Platform with scientists, users and decision-makers linked with new models of governance. The ICZM Governance Platform will facilitate the application of the **ecosystem approach** to the Mediterranean and Black Sea coasts, to support the implementation of the **ICZM Protocol** - linking the knowledge and information of the different elements required for the equitable and sustainable management of both coastal land and water. Indicators are quantitative/qualitative statements or measured/observed parameters that can be used to describe existing situations and measure changes or trends over time. A structured approach to Integrated Coastal Zone Management (ICZM) calls for indicators to measure progress in, and effects of, ICZM policies. Initiating, monitoring or evaluating an ICZM process, requires a set of governance, environmental, and socio-economic indicators that should relate to the specific management issues that triggered the initiation of the ICZM process, such as multiple conflicts, ecological degradation, community interest or the need for implementing a specific legislation (IOC-UNESCO, 2006). The purpose of using indicators in ICZM processes includes: 1. Monitoring key characteristics of coastal and marine ecosystems against desired conditions. 2. Evaluating coastal management options. 3. Tracking progress and effectiveness of implemented measures and actions. 4. Taking into consideration the short, and the long-term objectives of the plan. 5. Guiding adaptive management. 6. Helping in implementing the ecosystem approach. 7. Helping providing, and helping communicating relevant information to decision-makers. ***3. Ramsar Regional Initiative on Black Sea Coastal Wetlands –BlackSeaWet*** The idea behind this initiative was born in 2007 during the International Conference “Stopping the loss of Black Sea Coastal Wetlands: the establishment of a regional initiative”,

	held on 30th -31st October 2007 in Odessa, Ukraine. Participants representing government ministries, national and international nongovernment organizations, international conventions and scientific institutions from Bulgaria, Georgia, Romania, the Russian Federation, Turkey and Ukraine discussed the basis for future cooperation in the field of wise use of coastal wetlands along the coast of the Black and Azov Seas. The workshop was organized by Wetlands International Black Sea Program in cooperation with the Ministry of Environmental Protection of Ukraine and financed by the Dutch Ministry of Agriculture, Nature Management and Food Quality and the Dutch Embassy in Kiev, Ukraine. ***4. Coastlearn Project*** CoasLearn is an initiative of **Coastal & Marine Union – EUCC** (Leiden) and the **EUCC Mediterranean Centre** (Barcelona), involving a large international partnership CoastLearn is an internet based distance vocational training package on Integrated Coastal Zone Management (ICZM). This self-learning tool targets primarily coastal managers and planners working at local, sub-national, and national levels. The secondary target groups are university students and NGOs. While CoastLearn is tailored to the training and technical needs of countries in transition, it has proven to be of value for non-target countries as well. The programme is accessible on-line free of charge. CoastLearn is divided into thematic modules that can be studied independently. Although not all possible modules have been developed yet, it is already a powerful training tool and a starting point for the ICZM learning process. For those users who want to know more, each module contains a list of related links and references for further in depth study. Coastlearn is a multilingual tool, available fully or partly in 13 languages so far. It promotes the exchange of knowledge and experience by providing practical examples and case studies illustrating the most important issues. CoastLearn is not meant to become a final product. It has continued growing ever after its conception. New modules have being added and existing CoastLearn modules continue updating, upgrading and being translated into new languages. Its development depends on the availability of funding and for that reason some versions are more developed or updated than others. We intend to make efforts to keep CoastLearn growing as long as the need for

	it persists. *5. Project: "INTRODUCING ICZM FOR STRENGTHENING LOCAL COMMUNITY INVOLVEMENT IN SUSTAINABLE DEVELOPMENT"* **Project's aim** is to improve opportunities for the local communities to move towards the sustainable development of the coastal areas of Ovidiopol District, Odessa Oblast, through introducing Integrated Coastal Zone Management (ICZM). To achieve this, the project will develop intersectoral co-operation and provide a framework for public participation in coastal zone management and in the control of the use of its natural resources. In broader terms, the project aims to develop a model for Integrated Coastal Zone Management as a tool to strengthen local community involvement in sustainable development and to improve peoples' livelihoods and quality of life in the coastal zone of Ukraine. The **objectives** of this project are therefore: • Building the human capacity of the local government bodies so they can develop efficient coastal zone management processes and strategically plan the development of local communities. This will be achieved due to education and training of local officers. • Analysing the state and problems of, and the opportunities for, the development of Ovidiopol District's Coastal Zone. This is necessary for the strategic planning of the coastal zone and provides the foundation for introducing a holistic approach to coastal zone management. Local officers will be involved to improve their information base and their management skills. • Adopting ICZM as a tool for the sustainable development of local communities and for the improvement of the environment considering the local context and needs. • Raising public awareness of the value of the coastal zone for the development of local communities and introducing a participatory approach to coastal zone management. Promoting the implementation of the Aarhus Convention. • Fostering the introduction of ICZM at local community level in Ukraine through dissemination and free access to methodical and educational materials that will be produced within the project.
Action plan with funding solutions	Innovative, resilient, no-regret measures are needed in order to sustainably develop the coastal zone in the future and to respond to the impacts of anticipated climate change Required actions should focus on the identification and implementation of measures to prevent or to solve coastal problems. However, for effective ICZM application a number

	of essential management and implementation conditions need to be met. Therefore firstly some main conditions are briefly discussed. Secondly attention is paid to the identification and implementation of promising measures in relation to country specific conditions and possibilities for expanding international cooperation. Studies in ICZM show that technologies can contribute to effective implementation of ICZM. Therefore, the potential of available technologies must be taken into account to achieve best practice. Marine and coastal ecosystems provide the valuable natural capital as a basis for the economy and living environment of the Black Sea regions. Data to describe the current use and trends in the use of natural capital included measuring natural and semi natural areas, species and habitats of conservation importance, protected areas, natural capital degradation, ecosystem vulnerability, and the cost of natural-capital depreciation. **The first step** is to develop a long-term vision on expected coastal management actions and developments to ensure continuity within a longer time perspective. Short and medium term coastal management plans and activities for designated regions or coastal areas are to be developed, merging concrete no-regret actions and nearby targets with long-term activities such as drawing up a strategy and action plan. Water management and coastal development should be considered as leading or guiding principles in integrated spatial planning of low lying coastal and marine areas. **Secondly** is important to develop and facilitate the possibilities to exchange and share knowledge and learning experiences in order to better address the main triggers for ICZM: population growth, unsustainable economic development and anticipated impacts of climate change. Increasing food, health and livelihood security and education will contribute to an early stabilization of the world population. Coastal zone management is an important mechanism for sound economic development and ecological and environmental security. Regional cooperation in flood and drought management is already essential and will become even more critical for dealing with the impacts of climate change effectively in the future.
Disaster Preparedness and Management	Disaster preparedness is a necessary point that must be included in the Black Sea management. The existence of the coastal ecosystems provides several advantages for human communities from the area, offering them a lot of services, food or construction materials. In order to keep safe the local

	communities by using the coastal structures and ecosystems as natural means of protection, will be improved the resilience of local people in the region. Reducing disaster risks in the Black Sea Region implies an active participation of different stakeholders, with a large public consultation and the efforts of the national authorities. The main measure in disaster preparedness is to consolidate the coastal zone management capacity to generate and implement projects that implies the human protection while increasing environmental quality. A good and realistic disaster preparedness and management involve the following actions: ❖ Determine risks from natural hazards that influence ICZM projects; ❖ Find negative costal development processes; ❖ Form a clear idea about risk reduction theory; ❖ Identifying major actions to reduce the risks in the Black Sea Region; ❖ Put the theory in practice, by using appropriate instruments; ❖ Integrate the Disaster Preparedness and Management measures in ICZM plans and programs; ❖ Generate a list of current measures to decrease the risks in the Black Sea Area.

Annex 3

Assessment study of the potential polluters in the Black Sea and qualitative monitoring status on the Romanian Black Sea Sector

Luminita LAZAR, Andra OROS, Daniela TIGANUS, Valentina COATU

INTRODUCTION

Currently, Romania reports to the Black Sea Commission, through the focal point and the national representative in the Advisory Group – Land Based Sources and Activities, LBSA) emissions from four types of sources: rivers (1) - the Danube, industrial (2) - Rompetrol Refinery and Constanta Port and municipal (4) – the waste water treatment plants (WWTP) Constanta Sud, Constanta Nord, Eforie and Mangalia. These sources are on the list of the Hot spots from the Black sea Romanian littoral.

In order for a marine strategy to be effective, it must be drawn on a solid understanding of the status of the marine environment, which requires the establishment of a suitable framework at national level for marine research and monitoring activities, to ensure the scientific foundation for development of protection measures of marine waters.

As Contracting Party of the Convention for the Protection of the Black Sea against Pollution (Bucharest Convention), Romania has established and carries on a program of water pollution monitoring and assessment of the transitional national coastal and marine areas (Article XV 4).

As a member of European Union, Romania has the obligation to harmonize and implement European legislation: Water Framework Directive, Directive of bathing waters, Shellfish Directive, Birds and Habitats Directives and NATURA 2000 Network, Integrated Maritime Strategy, Marine Strategy Framework Directive (2008/56/CE).

As Contracting Party to other European and international conventions: INSPIRE Directive containing the water component of WISE, Initiative Global Monitoring for Environment and Security (GMES), Common policies on fisheries, European maritime policies, including maritime spatial planning, ACCOBAMS Convention.

The integrated marine monitoring system in Romania was designed in agreement with the Water Framework Directive, Shellfish Directive, Directive of bathing waters, Birds and Habitats Directives and NATURA 2000 Network, Integrated Maritime Strategy, Marine Strategy Framework Directive and regional (BSIMAP) and national requirements. Actual integrated marine monitoring system responds to the majority of characteristics and descriptors as follows:

1. Marine pollution monitoring;
2. Shellfish water monitoring;
3. Monitoring and control of dangerous substances in dredged sediments from ports and maritime shipping channels;
4. Monitoring of the ballast waters;

5. Monitoring of the coastal erosion;
6. Monitoring of the biological diversity, including marine mammals populations and marine habitats in the protected areas;
7. Monitoring of the dolphins' accidental catches and stranding;
8. Monitoring of the bathing waters and beaches quality (collaboration with Sanitary Directorate);
9. Monitoring of the extreme marine phenomena (extreme surges, tsunamis);
10. Monitoring of the accidental oil pollution (when needed);
11. Monitoring of the marine litter.

The monitoring programme of the transitional, coastal and marine waters from the Romanian Black Sea area is based on the analysis of water, sediment and biota samples, collected from a network of 44 stations located between Sulina and Vama Veche (research vessel "Steaua de Mare 1", 4 times/year).

The ecological status of the Romanian Black Sea transitional, coastal and marine waters is assessed on the basis of the physical, chemical, biological and hydromorphological indicators recommended by the Water Framework Directive and Marine Strategy Framework Directive:

PHYSICAL AND CHEMICAL PARAMETERS:
-annual and seasonal temperature regime, sea currents velocity, wave exposure, turbidity;
-spatial and temporal distribution of salinity;
-spatial and temporal distribution of nutrients, dissolved oxygen and saturability, BOD5, total organic carbon (TOC), chlorophyll a, total suspended matter, pH;

CONTAMINATION PARAMETERS (in water, sediments, biota):
- total petroleum hydrocarbons (TPH), heavy metals, organo-chlorinated pesticides, polyaromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs);

MICROBIOLOGICAL PARAMETERS:
- Microbial pathogens;

BIOLOGICAL PARAMETERS:
- phytoplankton (species, seasonal and geographical variability);
- macrozoobenthos (species composition, biomass and annual/seasonal variability));
-zooplankton (species, seasonal and geographical variability);
- macro-algae (species composition, biomass and annual/seasonal variability);
- information on the structure of fish populations, including the abundance, distribution and age/size structure of the populations;
- marine habitats status assessment.

STUDY AREA

The receiving area of the freshwater from rivers and anthropogenic input it is along the entire Romanian coastal zone being directly influenced in the northern part by the Danube and other rivers from the NW Black Sea and in the central and southern areas by the input from the channel Danube-Black Sea and municipal and industrial land-based sources.

The main abiotic components of the receiving area will be detailed taking into account the eutrophication indicators – nutrients and the pollution indicators – contaminants (heavy metals, polynuclear aromatic hydrocarbons, organochlorinated pesticides and PCBs).

The study of the receiving zone was done on data collected in the national monitoring program of the Black Sea during 2006-2011/2013. Thus, were selected surface samples from stations nearby Danube's mouths (Sulina 10m, Sulina 20m and Sfantu Gheorghe 5m, 20m and 30m) and stations in the neighbourhood of the main municipal and industrial sources – Gura Buhaz 5m (corresponding to the impact of the area Navodari – Rompetrol Refinery), Constanta Nord 5m (corresponding to the impact of the WWTP Constanta Nord), Constanta Sud 5m and Eforie 5m (corresponding to the impact of the WWTP and Constanta Port), Costinesti 5m (corresponding to the impact of the WWTP Eforie Sud) and Mangalia 5m (corresponding to the impact of the WWTP Mangalia and Mangalia Port) (Fig.1).

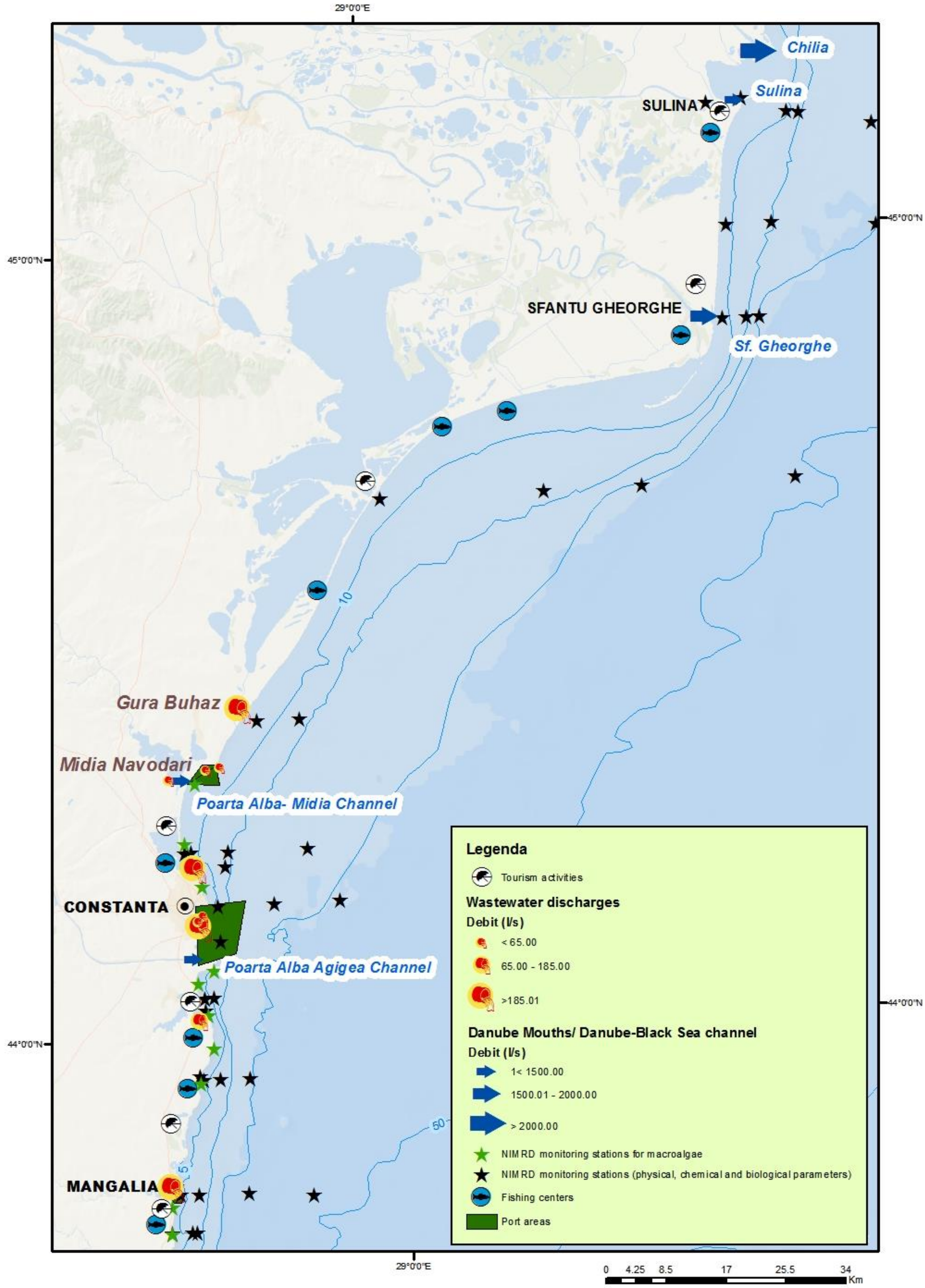


Fig. 1 Map of the main land-based pollution sources and monitoring stations from the Black sea Romanian littoral *(original map)*

RESULTS

Nutrients

Until 60s, the Black Sea was known as one the most productive seas, with pelagic luxuriant fauna done by *Phyllophora* red algae fields, benthic abundance (*Mytilus, Modiolus* and others) and ideal places for grazes of some commercial fish species coming from the Mediterranean Sea. The Black Sea was an example of the natural eutrophic ecosystem due to the permanent nutrients input (Gomoiu, 1981).

Afterwards, with the intensification of the anthropogenic activities from the whole Black Sea basin, increasing of the fertilizers use, untreated waters discharge, etc. the nutrients regime from the Danube's basin suffered major change. Within 1950-2005, the total nitrogen input from the Daube's increased 400 kt/year (1950) to 900kt/year (1985-1990) followed by the reduction up to 760 kt/year (2000-2005). The major contribution of this input came from agriculture and other diffuse sources. Regarding phosphorus, the input was of less magnitude, due to its availability, but with the same trend: increase from 40 kt/year (1950) to 115 kt/year (mid 90s) and decrease up to 70 kt/year (2000-2005) (BSC, 2008). In its case, the major contributors came from the human settlements, most probably due to the detergents use. In 2005, both discharges (total nitrogen and total phosphorus) were approximatively 1.5 times higher than 50s specific values (ICPDR, 2005). The changes were found in the fluvial input as well (Mee, 1999, Cociasu et al., 2008) and led to changes in the NW Black Sea ecosystem.

The seasonal analysis of the phosphates data from the Romanian littoral (2006-2011) showed, during the winter time, the isoline 0.20 µM marking, at the surface a slight gradient between the transitional and coastal waters. Anyhow, the mean values are enough homogenous and do not allow to distinguish the fluvial input from the coastal sources. In the spring, the concentrations decrease, being the lowest of the year due to the biological consumption. In the summer, the fluvial input of the inorganic phosphorus become, as average, more significant but with concentrations in the limits of the natural variability. At the end of the warm season, the areas from the Constanta and Mangalia settlements are delineated by the highest yearly mean concentrations.

Thus, at the Romanian Black Sea littoral are highlighted two comparable sources (as concentrations in the seawater) of inorganic phosphorus: the Danube's input and WWTPs and Ports Constanta Sud and Mangalia. Taking into account the significant difference between flows we consider as predominant de fluvial discharges (Fig.2).

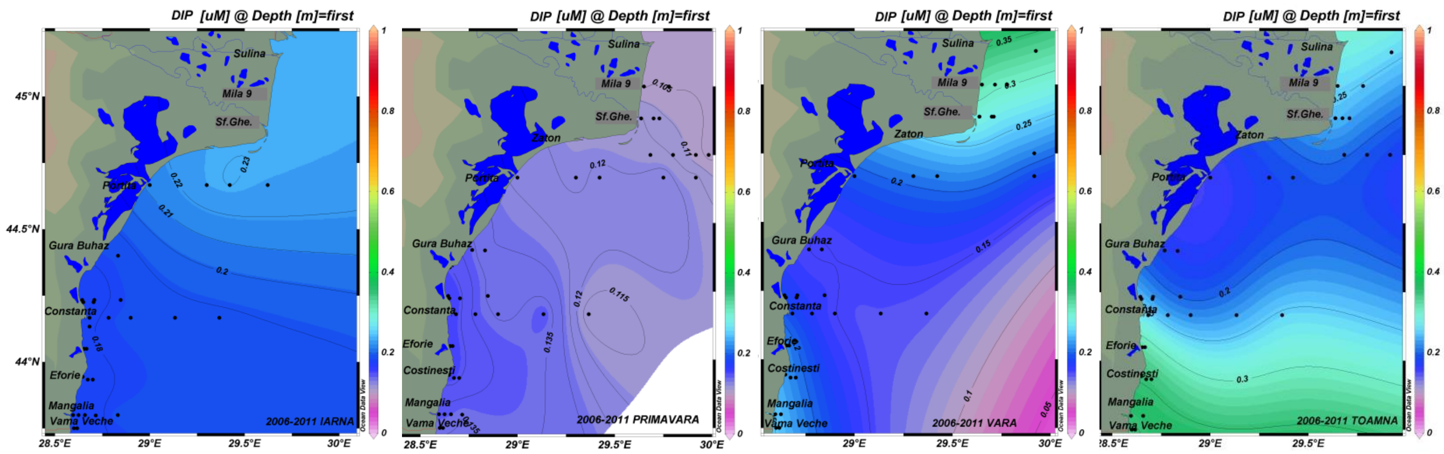


Fig. 2 The spatial and temporal distribution of the inorganic phosphorus in the surface waters - Black Sea Romanian littoral

The inorganic phosphorus concentrations from the surface waters are influenced by the Danube's input and WWTPS and ports Constanta Sud and Mangalia, where, either permanent or seasonal, has higher values (Fig. 3).

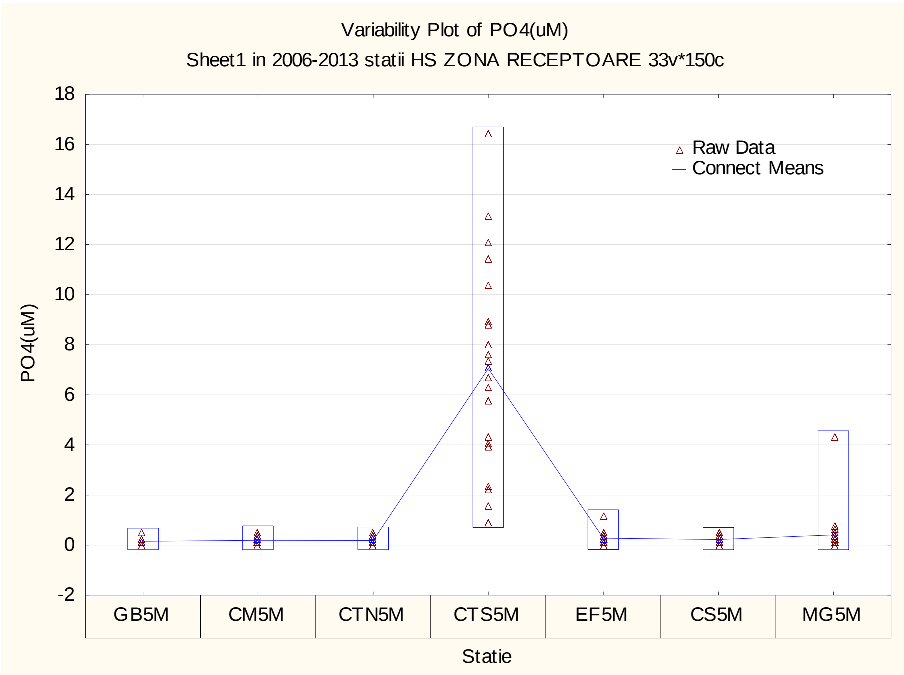


Fig. 3 The mean concentrations of the phosphate in the marine areas neighbouring the land based sources from the Romanian Black Sea coast

The increasing of the phosphate concentrations in the marine waters from the last years are due to annual mean increased concentrations from the Danube, very well correlated (r=0.64) and, possible, due to other northern coastal sources (Fig. 4).

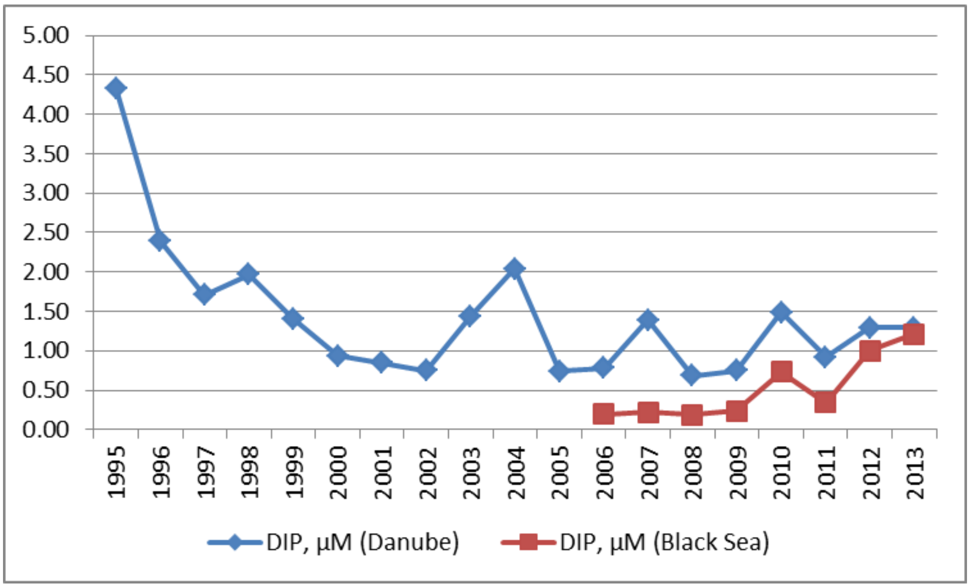


Fig. 4 The mean concentrations of the phosphate in Danube (1995-2013) and Black Sea (Danube's mouths, 2006-2013)

Besides the high chemical stability of the molecular nitrogen, the nitrogen from the sea answers rapidly to the enzymatic activities and, hence, could occurs in any of nine different oxidation states (NO) (from -3 to +5). The reduced nitrogen could occurs in the ammonium form, $(NH_4)^+$ (NO = -3) and the organic compounds in the dissolved or particulate form. These substances are generally final products of the assimilation by plants or marine bacteria and represents approximately 35% from the total nitrogen of the combined nitrogen from the sea. The oxidized forms of the marine nitrogen are nitrite, $(NO_2)^-$ (NO = +3) and nitrate, $(NO_3)^-$ (NO = +5), former representing approx.65% of the combined nitrogen. Because nitrogen from nitrate has the final oxidation state, it considers that could occur following oxidative processes therefore the inorganic nitrogen dominance depends on the redox potential of the seawater (its oxygen content). So, as oxygen is in the higher amounts, the nitrate will dominate. Additionally, the atmospheric precipitation, the continental drainage and the migration of the organisms that excrete nitrogen compounds are the main driving factors for the nitrogen supply and distribution (Riley and Skirrow, 1965). In this assessment, the DIN concentrations (dissolved inorganic nitrogen) are the sum of nitrate, nitrite and ammonium.

Generally, throughout the year, the mean concentrations highlighted the highest DIN values in the northern part, under the significant and direct influence of the Danube. However, in the surface layer occur seasonal variations as result of the biological activity with pronounced changes in the coastal area. In the spring, the isoline 18.00 µM marks the front between transitional and coastal waters. Unlike phosphate, the inorganic nitrogen input is better delineated in spring and autumn, due to the higher precipitations and hydrological changes. These concentrations decrease due to the biological consumption (still limited by the phosphorus) and in the summer, the gradient decreases from north to south. In the coastal waters, in the summer, the ammonium is the dominating form originating from the treated and untreated water discharges, phytoplankton decomposition, zooplankton and fish excretions, etc. In the winter, the DIN mean concentrations are homogenous on the entire littoral and quite low (Fig. 5).

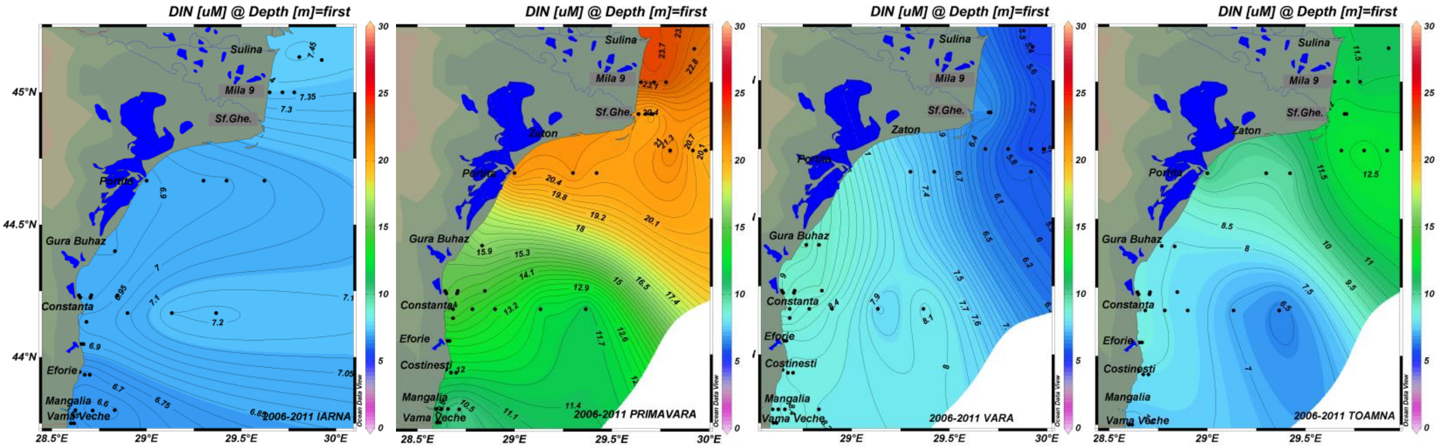


Fig. 5 The spatial and temporal distribution of the inorganic nitrogen in the surface waters - Black Sea Romanian littoral

The inorganic nitrogen content of the surface waters is also influenced by the Danube's input, more than phosphorus. Seasonally and local, the areas neighbouring WWTPs and ports have higher ammonium values. If, for phosphorus, are observed significant decreases of the Danube's annual mean concentrations, for nitrogen is not available even if is pointed a slight decreasing trend (Fig. 6**Fig.**).

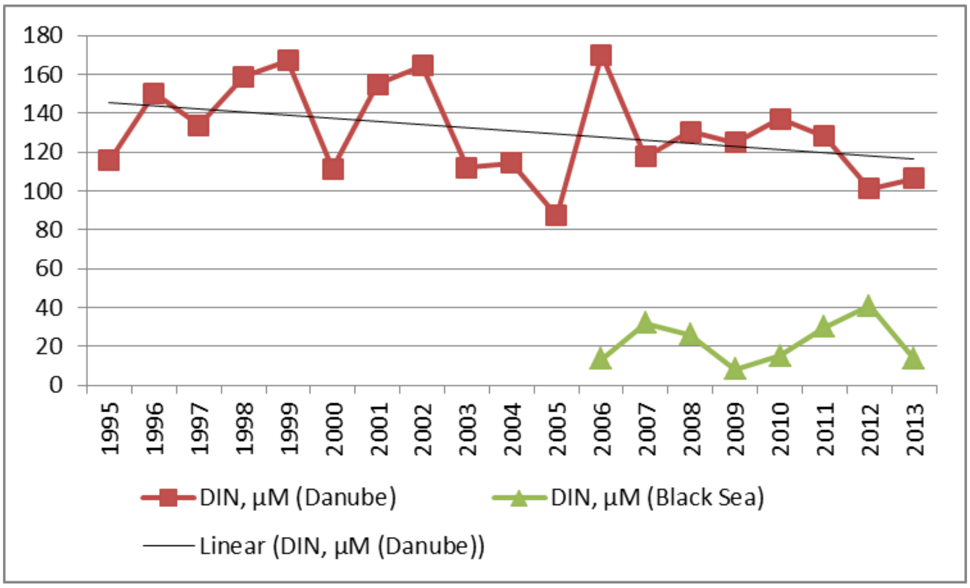


Fig. 6 The mean concentrations of the inorganic nitrogen in Danube (1995-2013) and Black Sea (Danube's mouths, 2006-2013)

Values exceeding the target value for a good ecological state, 11.25 µM, were usually recorded in the Constanta Sud 5 m (Fig. 7).

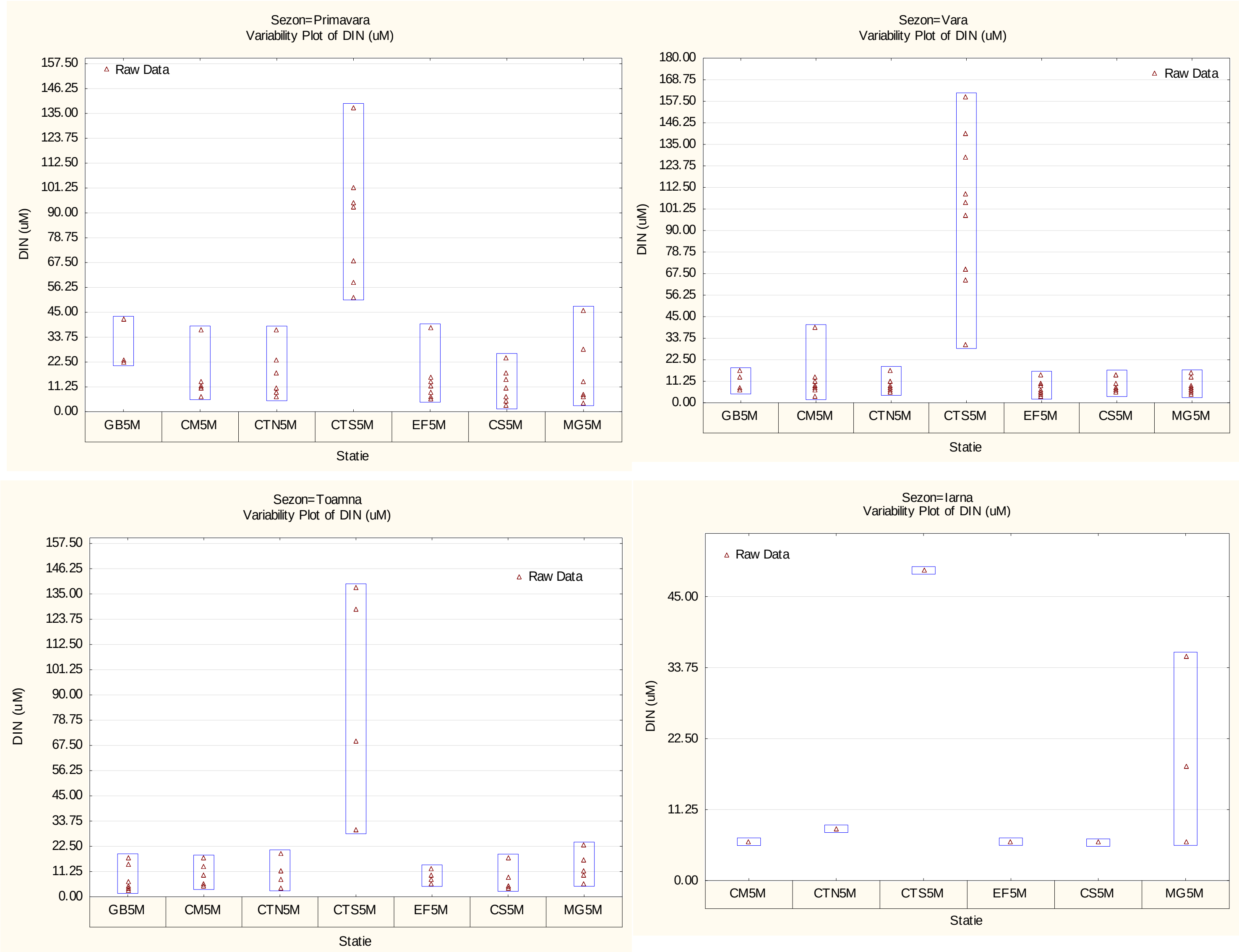


Fig. 7 The mean concentrations of the inorganic nitrogen in the marine areas neighbouring the land based sources from the central and southern Romanian Black Sea coast – spatial and seasonal

As regards nutrients, were generally observed mean concentrations higher in the central and southern part of the area, permanent in the neighbourhood of the Constanta Sud and seasonal, Mangalia.

Thus, it is worth mentioning that only the huge difference between flows makes the differences between the nutrients input in the Romanian coastal zone. Hence, it is required a better management of the land based sources from that area which can drive to the improvement of the quality of the waters discharged into the Black Sea.

Heavy metals

Heavy metal contamination of the marine environment can be correlated with urban and industrial sources such as factories, power plants, port facilities, sewage plants. Influence on coastal rivers is significant, constituting a major source of metals, especially in particulate form, extreme hydrological events (floods) contributing to increase this contribution. Atmospheric fluxes of metals, showing influences both natural and anthropogenic, are also considered to be an important for European seas, both in coastal and basin-wide, and depending on weather and climatic local variability.

The biogeochemical processes and natural levels of metals in the marine environment depend on many factors such as type of sedimentary rock, oxygen, currents, salinity, pH, etc. Spreading metals in water, sediments and atmosphere is resulting from their presence in Earth's crust. In their natural concentrations, metals plays an essential role in many biochemical processes in the body, but any concentration that exceeds the background as a result of human activities, can become toxic (OSPAR, 1992).

General sources of marine pollution are: cities and industries, coastal sewage and industrial waste, domestic waste and storm water, navigation, waste discharge from the sea, shipwrecks, ammunition lost or thrown intentionally, marine rigs, atmospheric deposition (UNEP, 2002; 2006). Terrestrial sources that generate heavy metals are mainly represented by wastewater treatment plants, industry, mining, and agriculture. Metals are transported dissolved in water or as part of the suspended sediment. Once in the aquatic environment can result in several ways: dissolved in the water column, stored in sediments, volatilised to the atmosphere, up-taken by biota.

Metals are also generated through natural processes of erosion of rocks. This process is boosted by mining and quarrying activities that expose various minerals containing metals. Runoff from waste dumps and tailings introduce substantial amounts of metals in water resources. Any activity involving the extraction or processing of metals is a source of metal fine particles dispersed in the atmosphere. Rust and other corrosion lead to metals spreading into the environment during use or storage of various metal equipment. Burning fossil fuels or various types of waste released into the atmosphere also produces metals.

Most metal particle deposition occurs obviously in the vicinity of mines, foundries, and other types of metal processing activities, which are major sources of emission. But most of the particles are so small that they can be transported enormous distances by wind. And road transport is responsible for significant emissions of lead from the use of fuels containing lead compounds as additive. Metals released into the atmosphere are deposited in the soil, where they remain long term. Under certain conditions, e.g. lower pH, metals are leached from the soil and reach the nearby water resources.

Apart from diffuse sources, coastal waters can be directly affected by local sources of pollution (municipal and industrial wastewater). As observed in many marine areas, even if emissions are reduced or even stopped, metals from sediments in close proximity to polluted sources remain long after cessation of emissions, ecosystem restoration being a long process. In addition, metals in sedimentary layers can be resumed in the water column.

Evaluation of temporal trends of heavy metals in marine waters in front of the Danube mouths during 2006 - 2013 highlights significant annual variations for certain elements, probably correlated with fluctuations in water flow and pollutant load of the Danube, and other diffuse sources (Fig. 8).

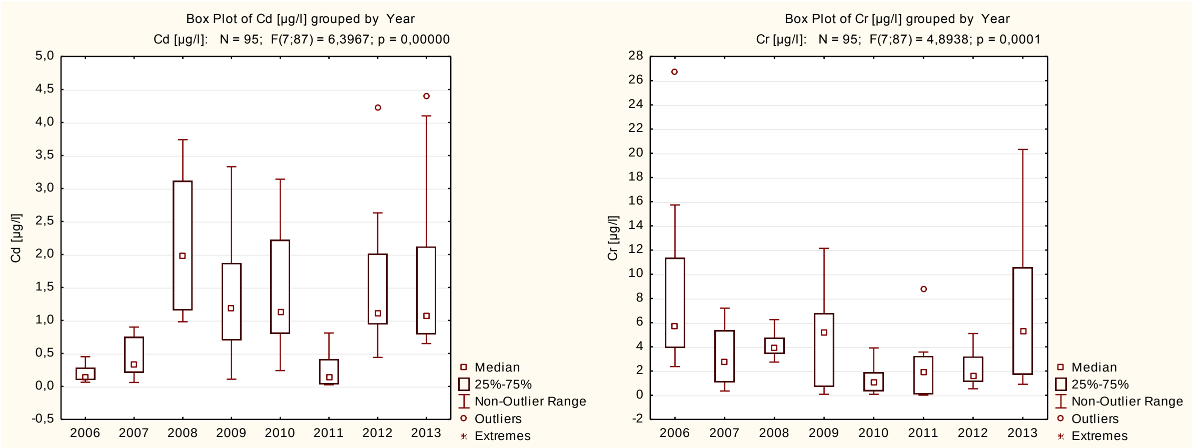


Fig. 8 Temporal variation of the concentrations of cadmium and chromium in marine waters in front of the Danube mouths (Sulina and St. Gheorghe), 2006-2013

Gradient of heavy metals concentrations in front of the mouths of the Danube, on bathymetric strip between 5-30m, is not significantly evinced, Danube influence being felt usually up to 20 or 30 m. Some differences may be possible represented by a reduction in frequency of occurrence of the extreme values in the open sea area (Cu, Ni) (Fig. 9 and Fig.10).

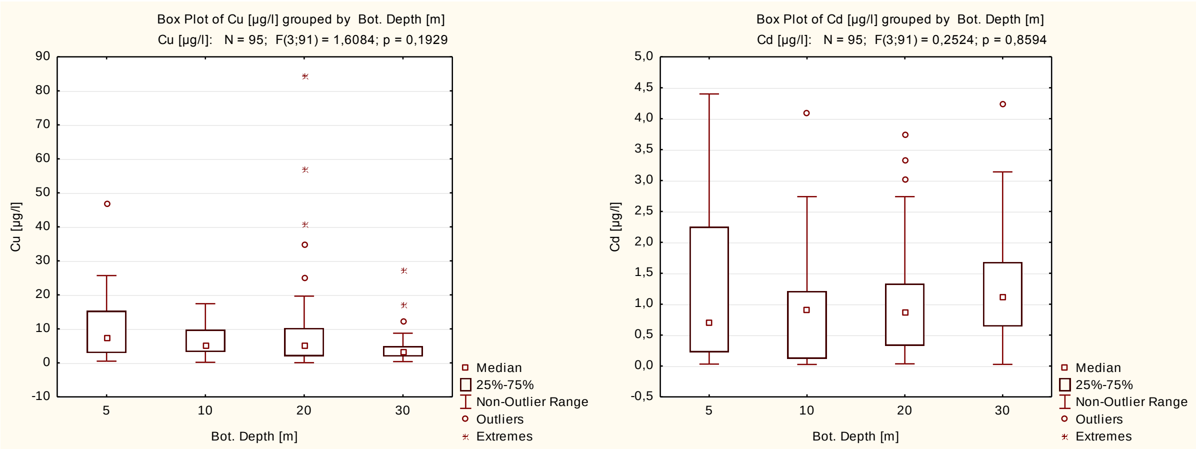


Fig. 9 Spatial distribution of copper and cadmium concentrations in marine waters in front of the Danube mouths (Sulina and Sf. Gheorghe) on bathymetric strip 5-30m, 2006-2013

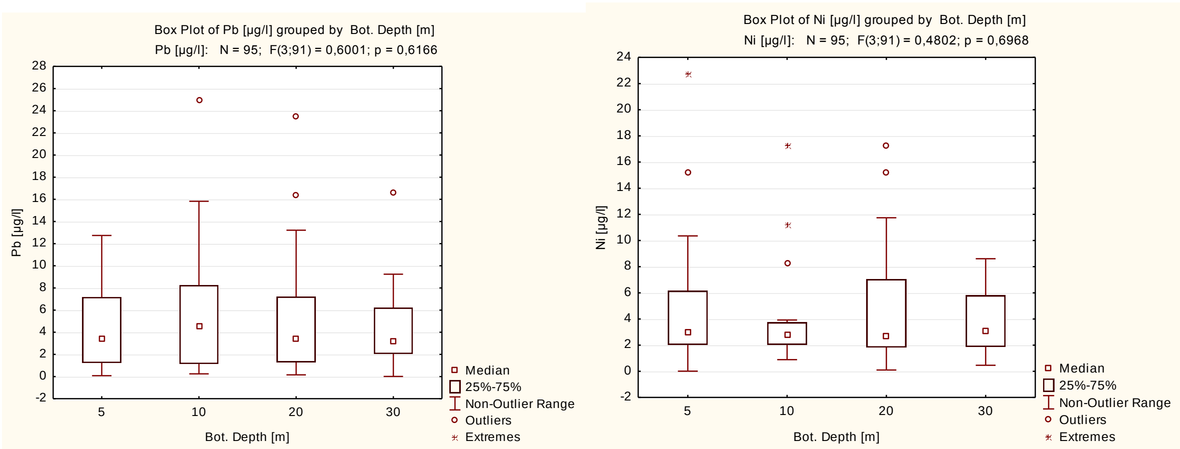


Fig. 10 Spatial distribution of lead and nickel concentrations in marine waters in front of the Danube mouths (Sulina and Sf. Gheorghe) on bathymetric strip 5-30m, 2006-2013

Distribution of heavy metals in marine waters along the 5 transects investigated in 2006-2013 shows no significant differences between areas, but it is noticeable higher incidence of extreme values in Eforie Sud and Constanta South areas, although in other areas (Gura Buhaz, Constanta North, Mangalia) also were occasionally noted extreme values over the studied period (Fig. 11, Fig. 12 and Fig.13).

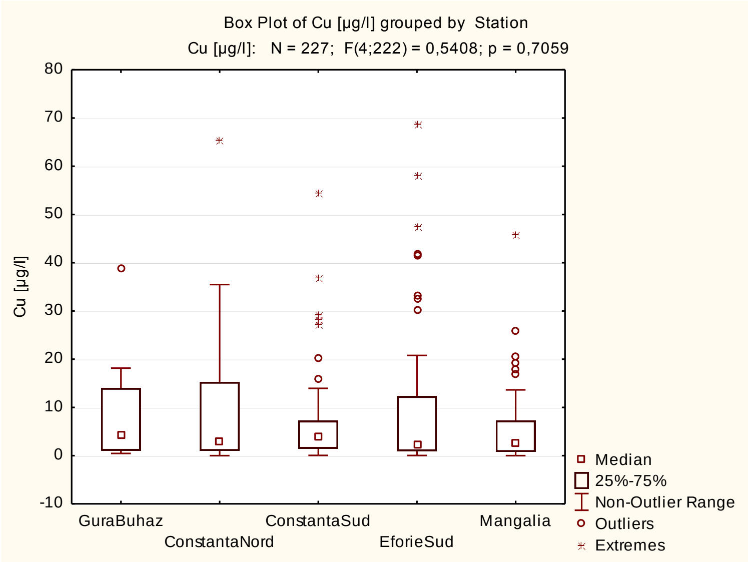


Fig. 11 Concentrations of copper in sea water along transects in front of anthropogenic sources, 2006 -2013

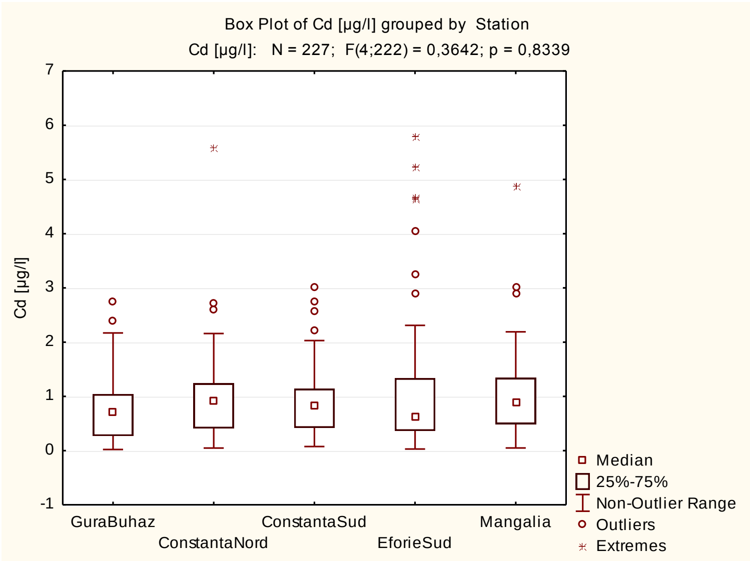


Fig. 12 Concentrations of cadmium in sea water along transects in front of anthropogenic sources, 2006 -2013

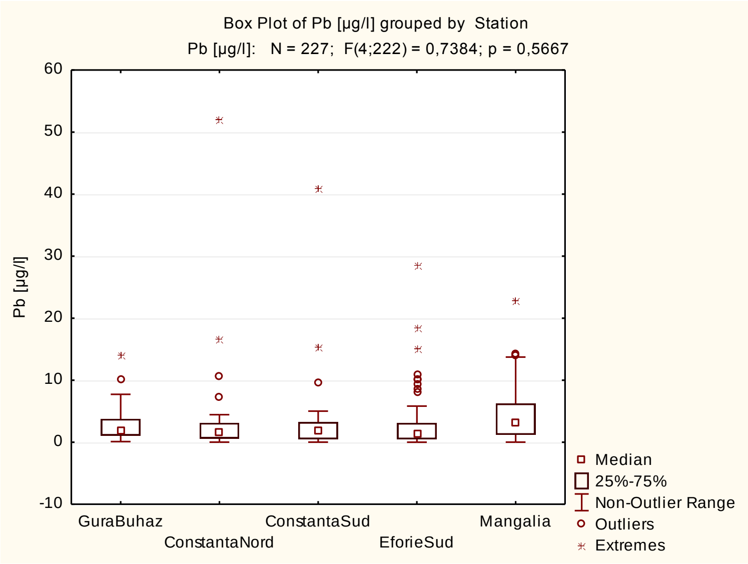


Fig. 13 Concentrations of lead in sea water along transects in front of anthropogenic sources, 2006 -2013

No significant gradient of concentrations of heavy metals in marine waters from the southern littoral with increasing distance from the shore was observed, perhaps only a slight decrease in the incidence of the extreme values and of variability range (Fig. 14 and Fig.15).

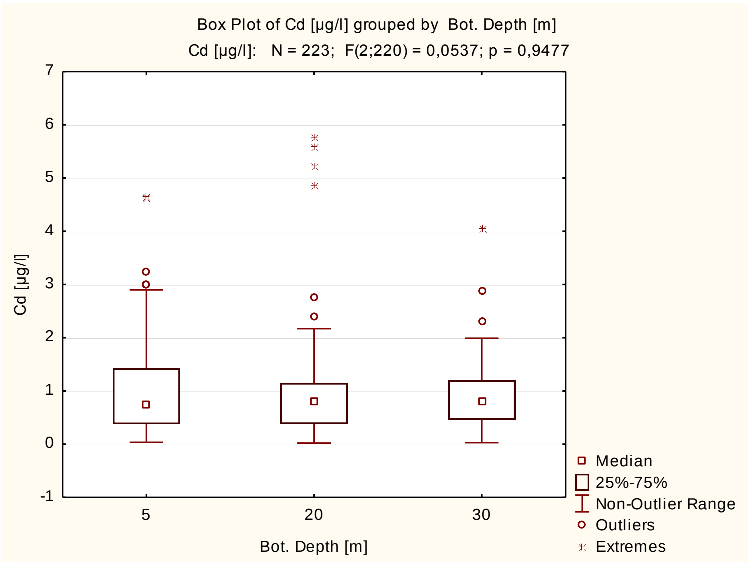


Fig. 14 Cadmium concentration gradient in the southern littoral (2006 - 2013)
on the bathymetric strip 5 - 30m

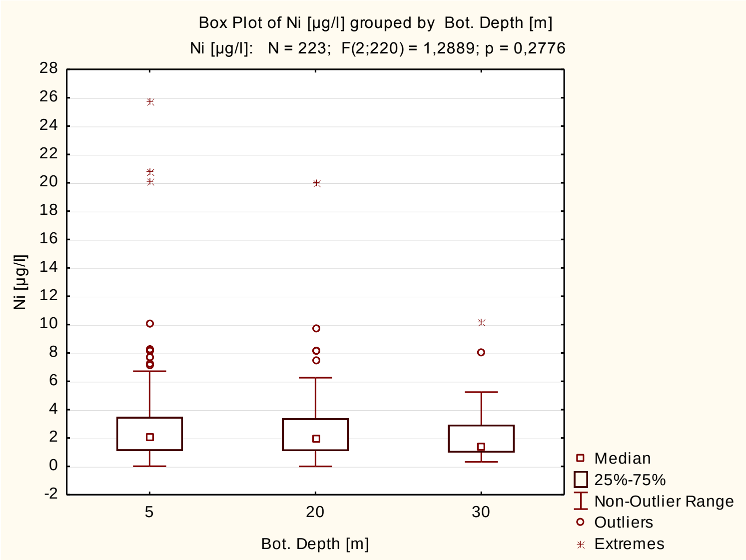


Fig. 15 Nickel concentration gradient in the southern littoral (2006 - 2013) on the bathymetric strip 5 - 30m

Evolution of annual concentrations of heavy metals in marine waters from the 5 impacted areas showed significant fluctuations, probably related, but not exclusively, with variations in discharge loads from sources. However, as a general observation, in 2013 there has been a decrease in the measured concentrations (Fig. 16).

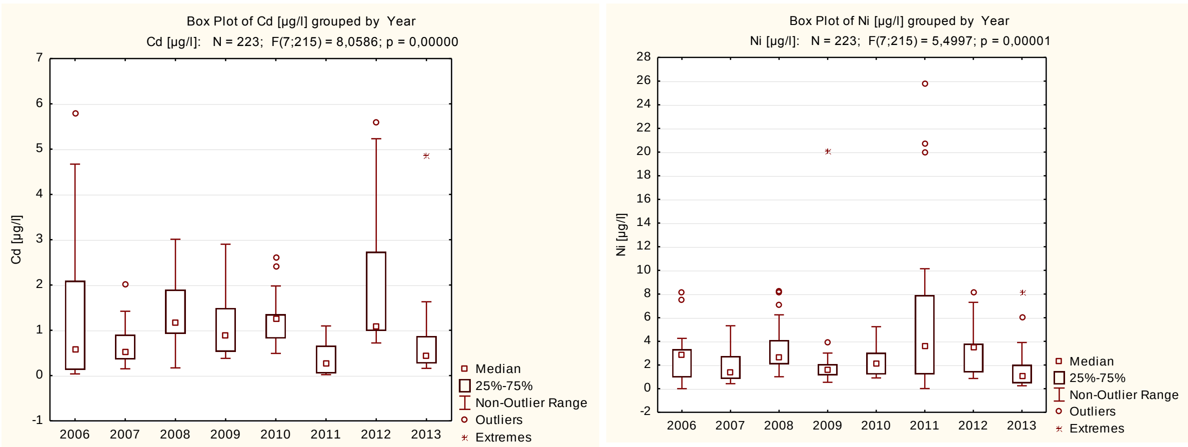


Fig. 16 Temporal variation of cadmium and nickel concentrations in marine waters of the southern littoral, 2006 – 2013

The distribution of heavy metal concentrations in sediments is influenced by natural and anthropogenic sources contribution and depends on the mineralogical and granulometric characteristics of sediments (OSPAR, 1992). Finer grained sediments with a high content of organic matter tend to accumulate higher concentrations of heavy metals in comparison with coarser sediments near the shore.

Data on concentrations of heavy metals in surface marine sediments from the Danube front (Sulina and Sf. Gheorghe) and areas with human impact (treatment plants, ports) (Gura Buhaz, North Constanta, Constanta Sud, Sud Eforie and Mangalia) resulted from monitoring program in the last 8 years (2006-2013) (328 observations) highlights the following averages and variation ranges: copper 30,58 ± 27,77 (<LD – 147,84) µg/L; cadmium 0,96 ± 1,32 (<LD-9,73) µg/L; lead 22,25 ± 21,61 (<LD -181,01) µg/L; nickel 39,08 ± 27,35 (0,28 -134,56) µg/L; chromium 42,85 ± 31,02 (<LD -231,05) µg/L.

In relation to environmental quality standards (national legislation Ord. 161/2006), exceeding of heavy metal concentrations in marine sediments, which can be correlated with anthropogenic contribution, but in the same extent with the background of the area, depending on sedimentary characteristics, were as follows (percentage of total samples analysed): 30% copper; 30% cadmium; 5% lead; 40% nickel; 5% chromium.

The trend of slight increase in concentrations of heavy metals in sediments in front of the Danube mouths with depth is typical for sedimentation areas; fine grained material rich in organic matter deposited is accumulating high concentrations of heavy metals from the water column (Fig. 17).

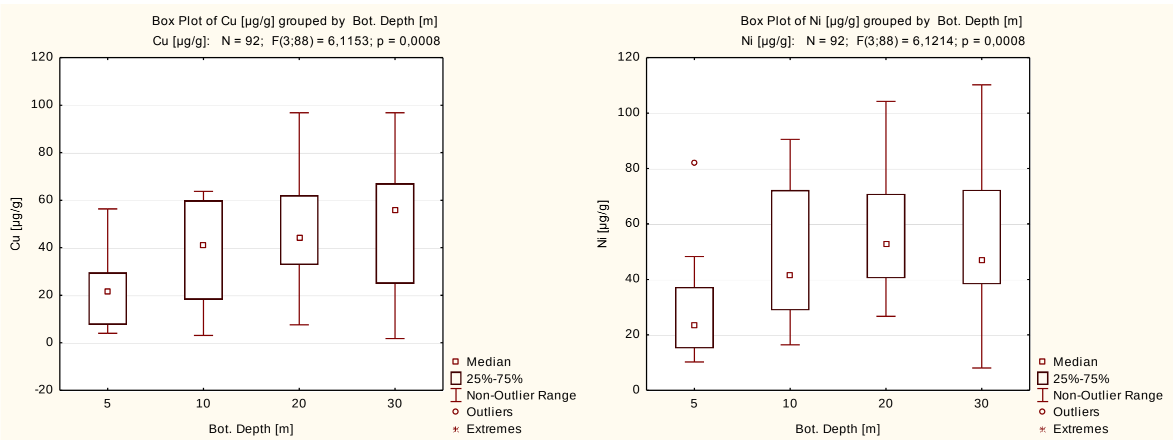


Fig. 17 Spatial distribution of concentrations of copper and nickel in marine sediments in front of Danube mouths (Sulina and Sf. Gheorghe) on bathymetric strip 5-30 m, 2006-2013

Distribution of heavy metals in marine sediments along the 5 transects during 2006-2013, highlights, better than in the case of water, significant differences between different studied areas. Constanta South Station evinced the highest median values and variation ranges, human influence being stronger here, adding the impact of port activities, followed by Eforie and Mangalia (Fig.18).

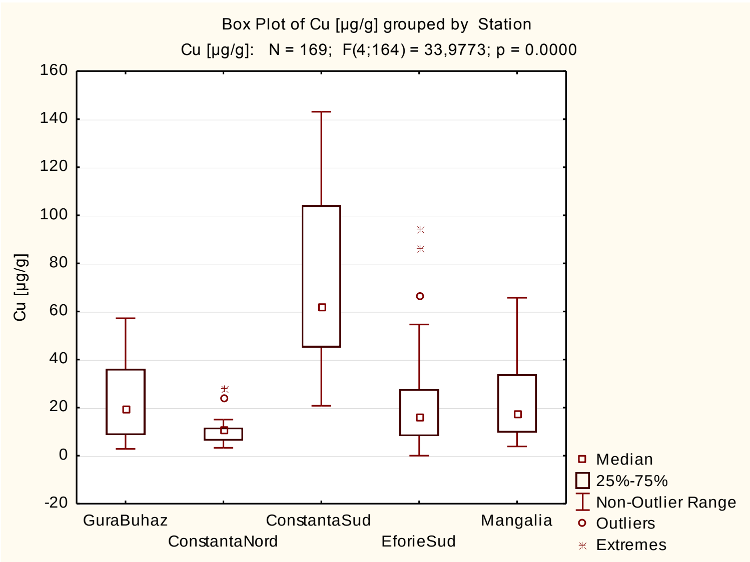


Fig. 18 Copper concentrations in marine sediments along transects in front of anthropogenic sources, 2006 - 2013

The concentrations of heavy metals are normally correlated with the textural characteristics of the sediment, accumulating in combination with the fine fraction, well represented at greater depths, so it is expected the gradient to increase with the depth, while the coarse sediments near the shore have normally reduced metal content. However, in studied areas sediments from the 5 m isobath had comparable values and, moreover, was observed for some metals a higher incidence of extreme values near the coast, compared to offshore sediments (20, 30 m), which can be attributed to anthropogenic impact (Fig. 19).

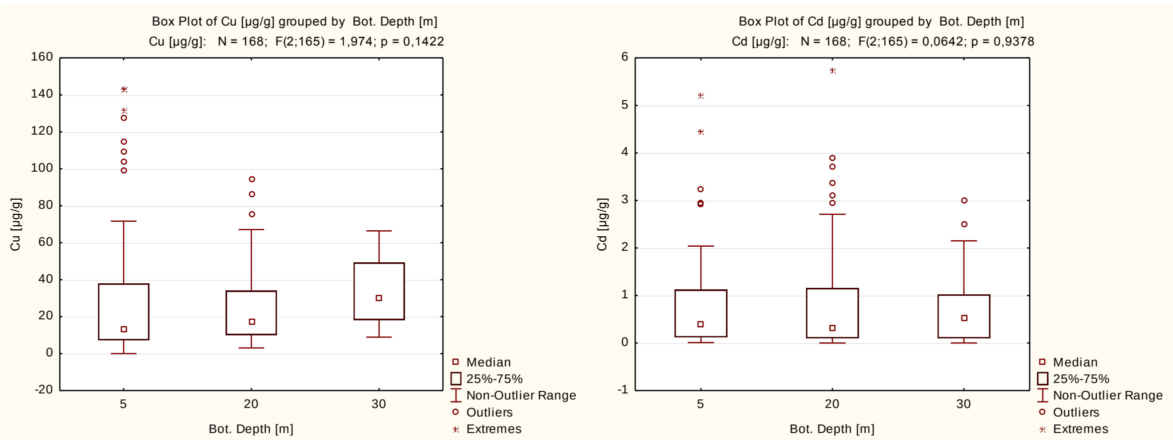


Fig. 19 Spatial distribution of copper and cadmium concentrations in marine sediments of the southern littoral on bathymetric strip 5-30 m, 2006-2013

Polycyclic Aromatic Hydrocarbons - PAHs

Analysis of the polynuclear aromatic hydrocarbons PAHs in marine waters for the period 2006-2013, indicates the presence of 16 priority hazardous organic contaminants (naphtalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo [a] anthracene, crysene, benzo [b] fluoranthene, benzo [k] fluoranthene, benzo [a] pyrene, benzo (g,h,i) perylene, dibenzo (a,h) anthracene, indeno (1,2,3-c,d) pyrene) in all samples.

The total polycyclic aromatic hydrocarbon (Σ_{16}PAH) content of the water samples (n=182) has ranged from 0.001 to 15.8654 (µg/L) with a mean of 2.3445 ± 2.9982 (µg/L). 19% of the concentration values varied from 4.153 to 15.865 (µg/L), this range is described in the literature as characteristic discharges of oil spills and oil products (Table 1). Extreme values of $\sum_{16}$PAHs, occasional registered in the analyzed period are not included in the statistical analysis of data. In 38% of the samples analyzed, concentrations are < 0.6 (µg L^{-1}), the amount accepted as an indicator of a moderate pollution (J.J.Gonzalez, 2006 Zakaria, 2002). The distribution concentrations in marine waters highlights the extreme differences significant ($p < 0.05$) between the average of 1.7132 ± 0.9696 (µg/L) from the vicinity of Constanta South and Mangalia treatment plants (n = 36) with a high levels of pollution and the average of 0.9521 ± 0.9114 (µg/L) determined in the other areas (n = 113) (Fig.20).

78% of the total content of polycyclic aromatic hydrocarbons (Σ_{16}PAHs) indicates pollution with hydrocarbons (low molecular weight, 2-3 aromatic rings) specific for oil an oil products. It was found that PAHs of petroleum are more abundant in the water column due to their solubility (Farrington et al., 1983). The results of this study, in agreement with previous conclusion shows that the anthracene - HAPMm (3 aromatic rings) is the dominant compound in marine waters with elevated concentrations within the range from 0.0008 to 2.2550 (µg/L).

High concentrations were determined for phenanthrene, anthracene, benzo [a] anthracene, benzo [k] fluoranthene and benzo (g, h, i) perylene, the average values of these compounds exceeding the maximum levels of Order No.161/2006 (Table 2). Thus appears that in the period 2006-2013, anthracene, naphthalene and phenanthrene are the dominant compounds in the marine waters of the Danube mouths areas and the neighboring of Rompetrol Refinery and the watstewater treatment plants. The highest pollution levels were recorded in marine water of Constanta South and Mangalia treatment plants.

Table 1 Representative levels of PAHs in marine waters polluted with oil

Area	Total concentration of PAHs	References
Galicia coast (NW-Spain)Prestige oil spill	$\sum_{16}$HAP= 0.29–5.8 µg/l, decemb.2002 $\sum_{16}$HAP= 0.02–1.5 µg/l, febr.2003	J.J. Gonzalez(2006)
Prince William Bay, Alaska, ''Exxon Valdez'' oil spill	$\sum$HAP = 10–29.3 µg/L	Neff (1995)
Point Judith Pond, NY, ''North Cape' oil spill	$\sum$HAP = 13.7–49.7 µg/l,, 4 days after the oil spill $\sum$HAP = 18.6–22.0 µg/l, 7 days after the oil spill $\sum$HAP= 0.3 µg/l, 32 days after the oil spill	Reddy (2001)
Bahıa Blanca, Argentina	$\sum$HAP = 7.5–18 µg/l	Lara (1995)
Paraıso Bay, Antarctica	$\sum$HAP = 50–100 µg/l, values after the oil spill	Kennicutt (1991)
Daya Bay, China	$\sum$HAP = 4.23–29.33 µg/l	Zhou (2003)
England and Wale	$\sum_{15}$HAP =DL -0.26 µg/l, continental shelf $\sum_{15}$HAP =DL -10.72 µg/l, estuary	Law et al. (1997)

Table 2. PAHs that exceed the maximum admissible values stipulated by Ord.no.161/2006 in marine waters of the Danube mouths and Rompetrol Refinery areas and from the neighboring of watstewater treatment plants, 2006-2013

Compound	MAC* ($\mu g\ L^{-1}$)	Concentration ($\mu g\ L^{-1}$) n	Average	Min.	Max.
Naphtalene	2.400	131	0,6300	0,0162	2.3140
Phenanthrene	**0.030**	**97**	**0.2036**	**0.0008**	**1.3373**
Anthracene	**0.063**	**88**	**0.3610**	**0.0008**	**2.2550**
Fluoranthene	0.090	96	0.0567	0.0002	0.8977
Benzo[a]anthracene	**0.010**	**73**	**0.0302**	**0.0002**	**0.6028**
Benzo[b]fluoranthene	0.025	46	0.0187	0.0005	0.1197
Benzo[k]fluoranthene	**0.025**	**61**	**0.0247**	**0.0005**	**0.1489**
Benzo[a]pyrene	0.050	65	0.0381	0.0009	0.3588
Benzo (g.h.i)perylene	**0.025**	**38**	**0.0245**	**0.0008**	**0.2050**

***** MAC - maximum admissible concentration stipulate by the Minister Order.no.161/2006 –"Normative classification of surface water quality in order to establish the ecological status of water bodies".

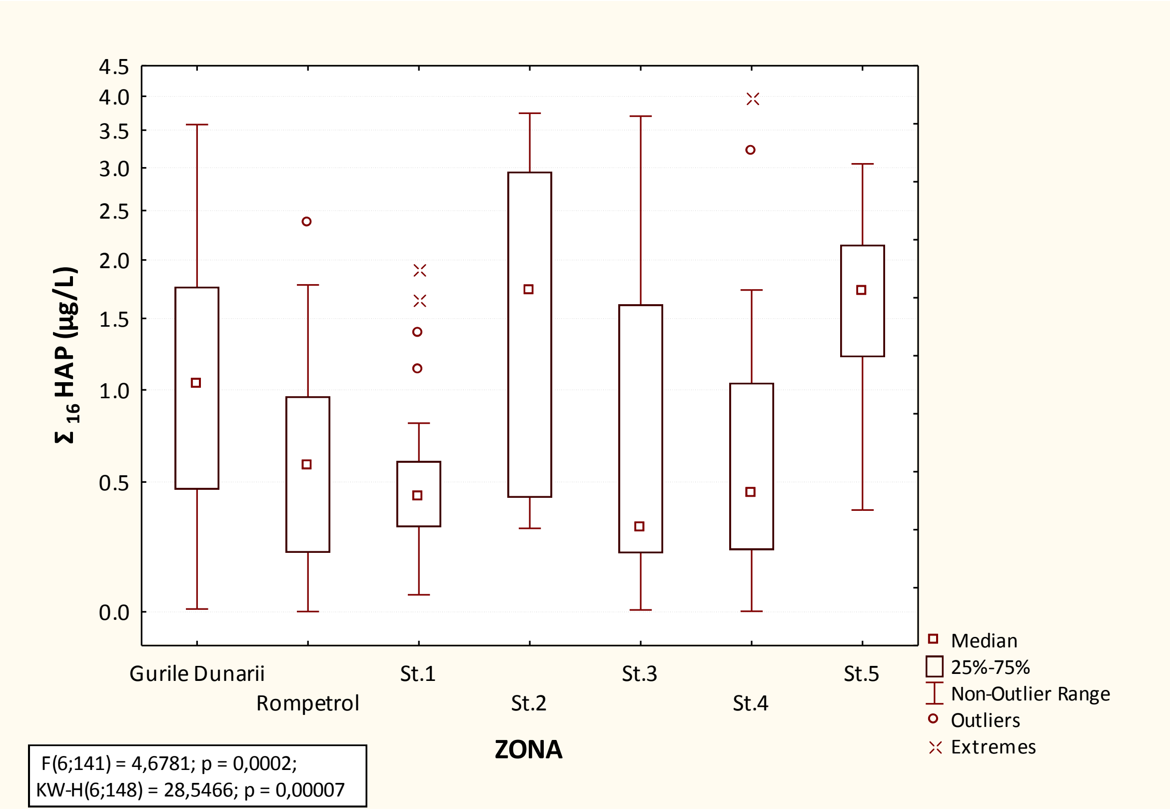


Fig. 20 Spatial distribution of $\sum_{16}$PAHs (µg/L) in marine waters from the Danube mouths and Rompetrol Refinery areas and the neighboring of watstewater treatment plants and ports, 2006-2013

Analysis of polynuclear aromatic hydrocarbons PAHs in sediments for the period 2006-2013 indicates the presence of 16 priority hazardous organic contaminants (naphtalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo [a] anthracene, crysene, benzo [b] fluoranthene, benzo [k] fluoranthene, benzo [a] pyrene, benzo (g,h,i) perylene, dibenzo (a,h) anthracene, indeno (1,2,3-c,d) pyrene) in all samples.

The level of contamination by polycyclic aromatic hydrocarbons - PAHs in sediments from mouths of the Danube and Rompetrol Refinery areas and from the neighboring of wastewater treatment plants is shown in Table 3. Of the total content of polynuclear aromatic hydrocarbons - Σ_{16}HAP (µg/kg dry weight) were calculated: Σ_{7}carHAP / Σ_{16}HAP·100 - the carcinogenic PAHs percentage to the total PAHs, LMW/HMW - the ratio of low molecular weight PAHs (2-3 rings) to high-molecular weight PAHs (4-6 rings)and, B(a)Peqv - the total equivalent of toxicity by benzo(a) pyrene (µg/kg) and Total PAHs index (µg/kg). During 2006-2013, the total PAH concentrations in sediments (n=163) has varied from 12.6 to 171 413.0 (µg/kg). Extremely high PAH levels, in the range 4 351.9- 171 413.0 (µg/kg), were found for 13% of sediments samples. These extreme values of $\sum_{16}$PAHs, occasional registered in the analyzed period are not included in the statistical analysis of data (Table 4).

In 73% of sediments, the total $\sum_{16}$PAH content was found below 1000.0 (µg/kg), the amount accepted as an indicator of a moderate pollution - Minister Order.no.161/2006. The distribution of concentrations shows extremely statistically significant difference ($p<0.0001$) between the averages of 1 161.4 ± 1 086.1 (µg/kg) and 578.0 ± 522.9 (µg/kg) in sediments from the vicinity of watstewater treatment plants (n = 56) with a high levels of pollution and those from the others areas (n=84) (Fig.21). Quality assessment in sediments from the Danube mouths areas and Rompetrol Refinery and the neighboring of watstewater treatment plants during 2006-2013 period according to the total content of PAHs indicates a moderate pollution for the most of samples.

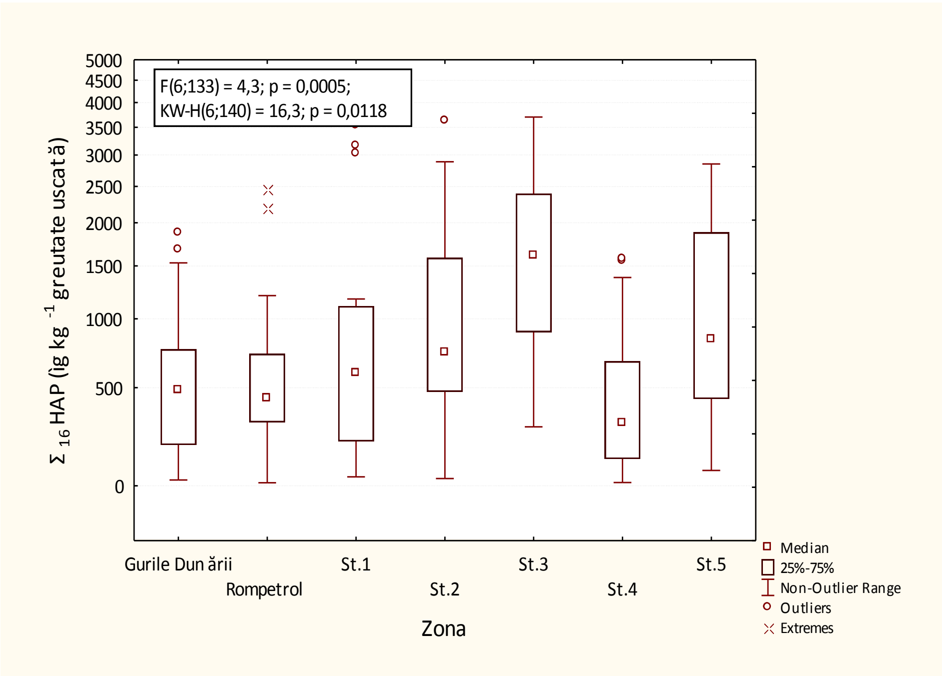


Fig. 21 Spatial distribution of $\sum_{16}$PAHs (µg/kg) in marine sediments from the Danube mouths and Rompetrol Refinery areas and the neighboring of sewage treatment plants and ports, 2006-2013

Table 3 Total content of Σ_{16} PAH (µg/kg dry weight) and toxicity indices in sediments from the Danube mouths and Rompetrol Refinery areas and the neighboring of WWTPs and ports, 2006-2013

Area	Pollution indices – sediments							
	$\sum_{16}$PAH (µg/kg)		∑CHAP %		Total-B(a)Peqv (µg/kg)		LMW/HMW	
	range	mediane	range	mediane	range	mediane	range	mediane
Danube mouths	24,0-1877,0	484,4	1,4-83,7	41,5	0,1-483,5	18,3	0,2-68,0	1,4
Rompetrol Refinery	12,6-2462,9	434,6	6,2-64,0	26,8	0,3-54,2	7,0	0,6-15,1	2,7
Constanta North	37,0-3535,7	595,0	1,1-77,9	17,9	0,5-218,8	11,0	0,3-88,3	4,5
Constanta South	115,6-3629,0	*737,7*	2,4-93,4	12,8	0,1-481,5	*79,3*	0,1-39,9	*6,7*
Eforie	274,0-3699,0	*1612,75*	1,4-33,4	*8,5*	1,1-8,3	*3,0*	2,0-71,5	*10,8*
Costinesti	13,6-1575,9	295,8	1,7-91,5	28,0	0,3-16,4	4,9	0,1-56,6	2,5
Mangalia	65,0-2850,5	836,3	4,6-95,6	45,9	4,3-343,9	17,6	0,2-20,9	1,4

Table 4 Extreme values of $\sum_{16}$PAHs (µg/kg dry weight) in sediments from the Danube mouths and Rompetrol Refinery areas and the neighboring WWTPs and ports, 2006-2013

Station	Impact source	depth (m)	year	Sediment $\sum_{16}$PAH (µg/kg)
Sulina	Dunarea	5	2006	
Sf. Gheorghe	Dunarea	20	2007	4 351,9
Gura Buhaz	Rompetrol rafinare	5	2007	6 890,9
Constanta North (St.1)	WWTP Constanta North	20	2007	9 793,0
Constanta South (St.2)	WWTP Constanta South and Constanta harbor	5	2008	6 1260,0
Constanta South (St.2)	WWTP Constanta South and Constanta harbor	5	2012	8 8140,2
Eforie (St.3)	Constanta Sud-Agigea harbors	20	2007	5 463,6
Mangalia (St.5)	WWTP Mangalia and Mangalia harbor	5	2007	1 6425,0

The determination of good environmental status - GES for polycyclic aromatic hydrocarbons (PAHs) in sediments from the Romanian Black Sea coast was based on the evaluation criteria used in the methodologies OSPAR (BACs values, BCs), US-EPA (ERL- Effect Range Low value - 10 percentile concentration of a contaminant which biological effects are small, unlikely) and those provided for in national legislation - Order no.161 / 2006 (Boicenco si colab. 2012, 2013). PAH levels, the concentrations of individual compounds in sediments are compared with the limits ERL values -Effect Range Low (10^{th} percentile), the concentration of a contaminant which biological effects are minimal and represents the difference between good and bad ecological status. Sediment quality is assessed based on exceedances of these limits: Good (GES- green) $\sum_{16}$PAHs (μg/kg) are in the range 150 -1000 (μg/kg) and the concentrations of PAHs, the individual compounds do not exceed the ERL (μg/kg); Bad (BES, red) - PAH concentrations exceed ERL values (Table 5). For an area to be considered as having good ecological status in terms of polycyclic aromatic hydrocarbons, for a given matrix (sediment) must, more than 75% of measured values for this compound in that area to be under ERL value mentioned in the table below.

In 2013, sediment quality assessment based on evaluation criteria indicates good environmental status (GES-green) in sediments from mouths of the Danube and Rompetrol Refinery areas and the neighboring watstewater treatment plants, the depth of 5, 20 m, with a moderate level of pollution of polycyclic aromatic hydrocarbons in which biological effects are reduced unlikely.

Also during 2006-2012, evaluating the level of contamination with polycyclic aromatic hydrocarbons indicates a bad ecological status (BES-red) for marine sediments from immediately adjacent area of pollution sources (5m) and for those from marine areas (depth of 20 m).

Table 5 Statistical results of the total content of polycyclic aromatic hydrocarbons –Σ_{16} PAH (µg/kg dry weight) in sediments from the Danube mouths and Rompetrol Refinery areas and the neighboring of watstewater treatment plants and ports, 2006-2013

		years 2006-2012						**year 2013**					
		depth 5 m			depth 20 m			depth 5 m			depth 20 m		
Compound (µg/kg)	**ERL* (µg/kg)**	median	percentile 25	*75*	median	percentile 25	*75*	median	percentile 25	*75*	median	percentile 25	*75*
Naphtalene	**160**	135,5	58,1	*465,1*	***119,3***	41,0	*250,0*	14,0	7,6	118,1	5,2	3,9	10,4
Acenaphthylene	**44**	7,1	0,9	22,5	3,4	2,3	7,3	2,2	1,6	3,4	2,0	1,8	2,1
Acenaphthene	**16**	3,2	1,0	17,7	3,8	1,1	12,8	2,7	2,5	3,6	2,9	2,7	3,2
Fluorene	**19**	22,2	7,3	*60,0*	18,1	7,0	*44,5*	4,3	2,5	9,1	6,0	2,4	7,0
Phenanthrene	**240**	56,8	18,3	96,8	52,8	16,4	129,0	19,4	10,0	46,1	16,6	9,0	26,8
Anthracene	**85**	88,9	47,5	*294,5*	76,3	16,2	*210,1*	*6,6*	3,3	*9,7*	*8,5*	2,2	*16,7*
Fluoranthene	**600**	37,2	17,8	65,5	37,0	13,8	95,0	4,5	2,5	*17,3*	7,2	3,4	*20,3*
Pyrene	**665**	45,0	25,1	76,8	42,0	21,2	75,0	7,9	4,0	23,0	18,6	7,1	61,0
Benzo[a]anthracene	**261**	13,2	3,5	29,5	18,6	5,1	29,0	2,0	0,7	8,0	4,0	0,5	25,9
Crysene	**384**	8,7	3,4	17,0	9,4	5,7	20,7	1,6	1,3	*2,9*	1,9	1,8	*10,0*
Benzo[b]fluoranthene	**-**	9,6	4,6	21,2	6,1	3,8	14,4	1,3	0,3	2,8	3,1	2,2	12,4
Benzo[k]fluoranthene	**-**	6,8	3,0	18,7	8,4	4,9	19,4	3,2	2,8	*4,0*	4,7	4,0	*5,2*
Benzo[a]pyrene	**430**	15,5	3,6	59,8	18,4	1,3	70,0	3,0	1,7	*3,7*	3,1	2,5	*6,4*
Benzo (g.h.i)perylene	**85**	4,1	0,6	9,1	3,3	0,5	4,1	1,9	1,5	2,4	2,7	1,7	3,0
Dibenzo(a,h)anthracene	**63**	5,3	1,5	22,3	2,1	0,6	4,9	2,4	1,4	2,9	3,2	2,3	4,6
Indeno(1.2.3-c.d)pyrene	**240**	2,4	1,2	5,8	2,0	0,6	6,7	1,2	1,2	1,6	2,2	1,2	3,1
Σ_{16} PAH (µg kg $^{-1}$)	**1000**	**668,9**	**364,0**	***1380,3***	**636,6**	**319,4**	***1002,0***	**130,1**	**61,5**	***297,0***	**86,6**	**64,7**	***256,9***
Ecological status				**BES****			**BES**			**(GES) *****			**(GES)**

*ERL values (μg/kg dry sediment) established by the US-EPA (1998) for polycyclic aromatic hydrocarbons in marine sediments and adopted by OSPAR (2008)

** BES- bad ecological status (red): the individual PAH concentrations exceed the ERL values

***GES- good ecological status (green): the total -Σ_{16} PAH content falls in the range of 150 - 1000 (μg/kg) and the individual PAH concentrations do not exceed the ERL values

Organochlorine pesticides and polychlorinated biphenyls

Coastal area between Sulina and Vama Veche is dominated by the presence of organochlorine pesticides: HCB, lindane, heptachlor and aldrin whose concentrations varies in water between detection limit and 0.35 µg/L, and the sediment between the detection limit and 0.07 µg/g dry sediment.

The concentrations of other compounds investigated (dieldrin, endrin, DDE, DDD and DDT) is varying in sediments between the detection limit and 0.005 µg/g dry sediment, and, in water, between detection limit and 0.02 µg/L.

Annual averages in water, exceded the maximum permitted levels under Directive 105/2008 of the European Commission on environmental quality standards in the field of water policy in more than 50% of HCB, lindane and cyclodienes pesticides (aldrin, dieldrin, endrin) and more than 20% in the cases of DDT.

Analysis of the temporal evolution of the concentrations of organochlorine pesticides in marine waters in front of the mouth of the Danube in the period 2006 - 2013 outstanding a significant decline of the total content of organochlorine pesticides (Fig. 22), in recent years (2009 - 2013) and also, of the concentrations of individual compounds, that had significant concentrations in previous years: HCB, lindane, aldrin.

A significant increase was observed for the concentration of p, p 'DDD, which, correlated with relatively constant limits of the p, p' DDT concentration, indicates an increase degradation process of p, p 'DDT.

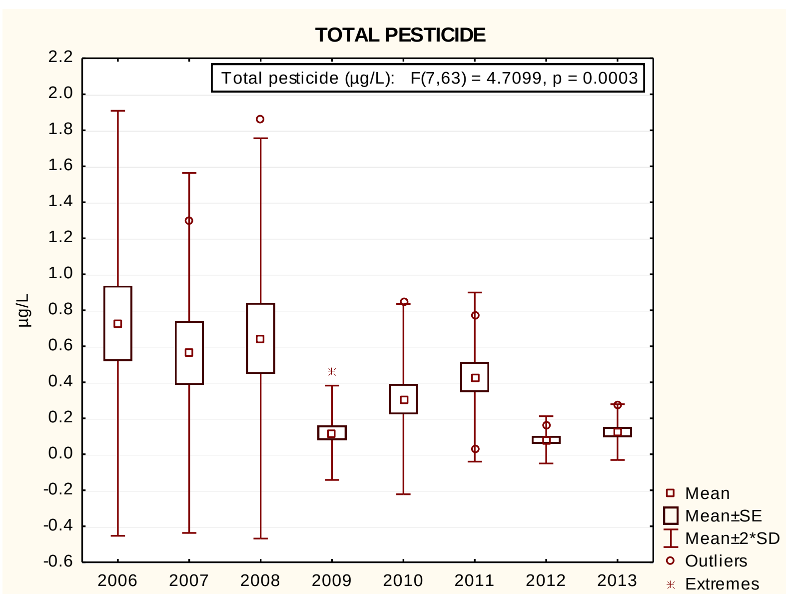


Fig. 22 Variation of total organochlorine pesticide, in water, in the Danube mouths area, 2006 -2013

Polychlorinated biphenyls (PCB 28, PCB 52, PCB 101, PCB 118, PCB 138, PCB 153, PCB 180) are monitored recently (2012) in Romanian coast. Measurements made in water during 2012 - 2013 showed low levels, ranging between the limit of detection and 0.0055 µg/L PCB 28, between the detection limit and 0,007 µg/L PCB 101 and below the detection limit for most compounds analyzed (PCB 118, PCB 138, PCB 153, PCB 180). The only compound for which the measured values were higher is PCB 52. The concentrations of this compound ranged from the limit of detection and 0.46 µg/L; most of the values ranging between the limit of detection and 0.1 µg/L.

In sediment, in 2012 and 2013, concentrations of PCB 28, PCB 52 and PCB 118 ranged between the detection limit and 0.16 µg/g dry sediment and concentrations of PCB 101, PCB 138, PCB 153 and PCB 180 ranged between the detection limit and 0.05 µg/g dry sediment (Fig.23). Most values (90%) measured for PCB 28, PCB 101 and PCB 118 were between the detection limit of 0.02 µg/g dry sediment and between the detection limit and 0.005 µg/g dry sediment for PCB 138, PCB 153 PCB 180. The dominant compound, as in the case of water, was PCB 52, for which most of the measured values were between 0.02 and 0.016 µg/g dry sediment.

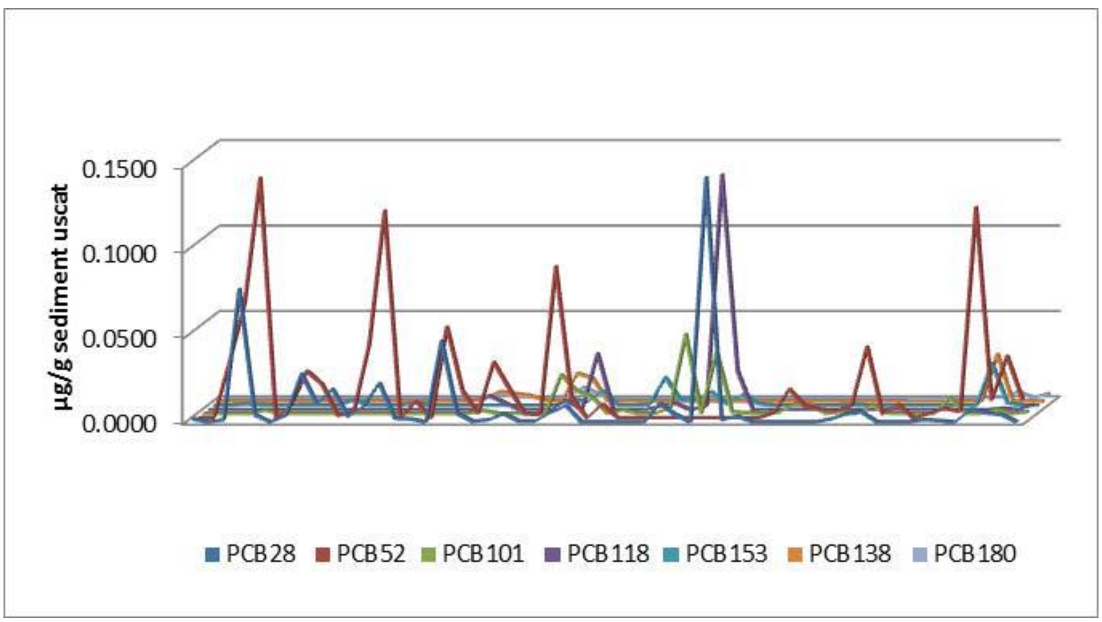


Fig. 23 Variations of polychlorinated biphenyls concentrations in sediment in Romanian coastal zone, in 2012 - 2013

There are no maximum permissible values establshed for polychlorinated biphenyls in water. In sediment, except PCB 153 and PCB 180, compounds of this class have been exceeded the values proposed to characterize good environmental status, in 5% - 10% of the samples analyzed.

Comparative analysis of data on concentrations of organochlorine pesticides and polychlorinated biphenyls in water along the 5 transects located in areas with human impact show no differences (p> 0.05) between the mean values of individual compounds or total content of organochlorine pesticides and polychlorinated biphenyls (Fig. 24).

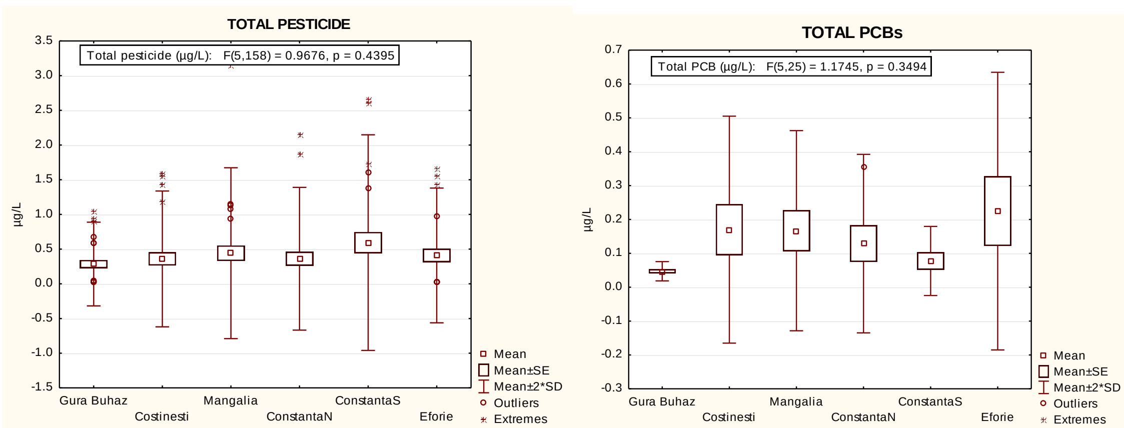


Fig. 24 Variation of organochlorine pesticides and polychlorinated biphenyls in water, in the areas of human impact (treatment plants, ports), 2006 -2013

Comparative analysis of data on concentrations of organochlorine pesticides and polychlorinated biphenyls in sediment along the 5 transects located in areas with human impact show no differences (p> 0.05) between the mean values of individual compounds or total content of organochlorine pesticides and polychlorinated biphenyls (Fig. 25). The variation range and frequency of extreme values are higher on transects Constanta South and Eforie, while at the Constanta North transect these values are the lowest (Fig. 26).

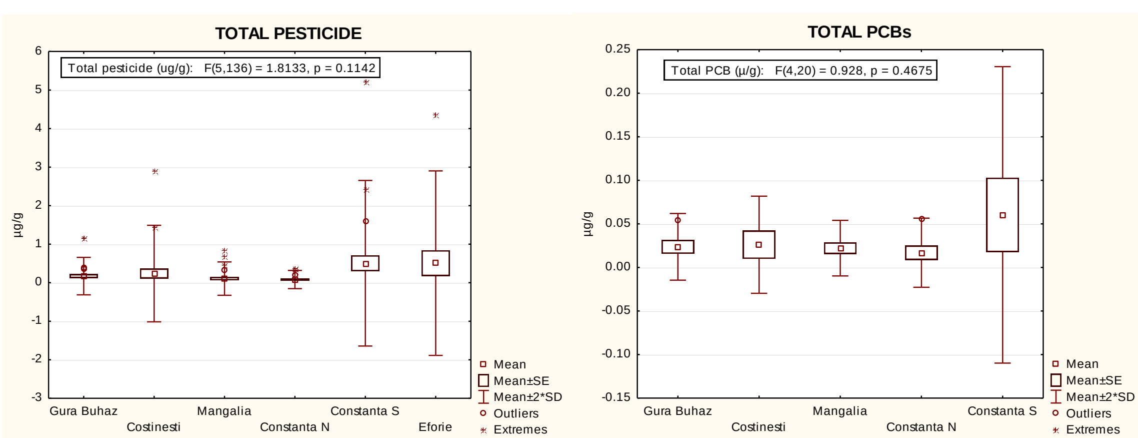


Fig. 25 Variation of organochlorine pesticides and polychlorinated biphenyls concentrations, in sediment, in areas with human impact (treatment plants, ports), 2006 -2013

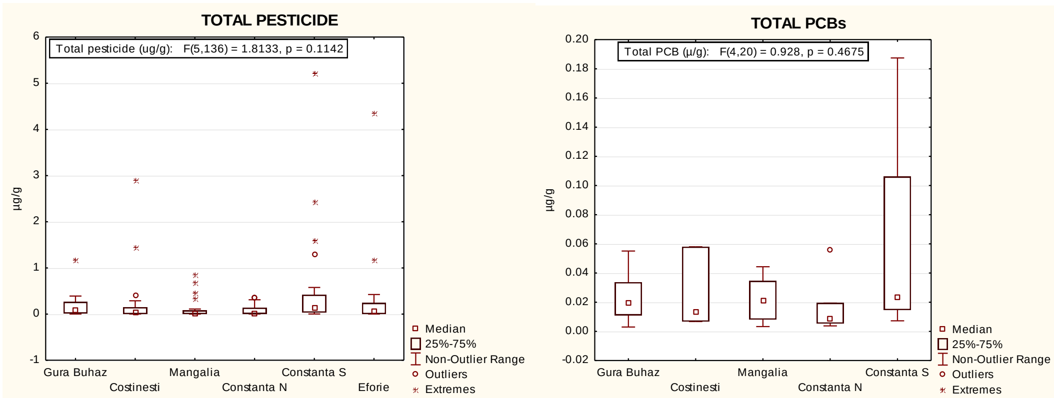


Fig. 26 The range of organochlorine pesticides and polychlorinated biphenyls concentrations, in sediment, in areas with human impact (treatment plants, ports), 2006 -2013

The distribution of concentrations suggests chronical pollution with organochlorine pollutants, especially organochlorine pesticides on the entire coastal area, the source of this pollution being predominantly diffuse, most likely from air pollution.

CONCLUSIONS

Following the analysis of the monitoring data of the abiotic components of the marine ecosystem in the receiving area of the land based sources of pollution it was observed that:

- The significant input in the western part of the Black Sea become from the Danube whish freshwater discharge influences the Black Sea chemistry along the entire Romanian littoral.
- Permanent or seasonal, in the neighbourhood of the settlements Constanta and Mangalia, were found increased concentrations of nutrients and contaminants in the marine receiving area.
- As regards nutrients, were generally observed mean concentrations higher in the central and southern part of the area, permanent in the neighbourhood of the Constanta Sud and seasonal, Mangalia.
- The impact analysis of discharges of hazardous substances (heavy metals, pesticides and polycyclic aromatic hydrocarbons) identified sediment contaminated with heavy metals in ports (Constanta Sud, Mangalia), in shallow areas affected by discharges of wastewater (Gura Buhaz, Eforie Sud) and marine area in front of the Danube mouths (Sulina, Mila 9 St. Gheorghe).

- Indices calculated to identify pollution sources show a petroleum pollution in the area near the port of Constanta South - Agigea and another of pyrolytic nature in Constanta South WWTP, concentrations of contaminants are at levels where there is an unacceptable risk of term biological effects long.
- The differences in spatial distribution of heavy metal concentrations in marine waters revealed for some elements the fluvial contribution in the north part of the coast (lead, nickel, chromium) and terrestrial sources of pollution in the southern sector (lead, chromium) (Mangalia, Constanta Sud).
- Most metals had increased accumulation in sediments from the Danube front area (Sulina - Portita) and Constanta South port aquatorium, while the central sector (Baia Mamaia, Constanta East) and southern extremity (Costinesti - Vama Veche) were generally characterized by lower values.
- During 2006-2012 period, evaluating the level of contamination with polycyclic aromatic hydrocarbons indicates a bad ecological status (BES-red) for marine sediments from immediately adjacent area of pollution sources (5m) and for those from marine areas (depth of 20 m).
- Recent data (2013) of quality of the polycyclic aromatic hydrocarbons contaminated sediments indicate a good environmental status in sediments from mouths of the Danube and Rompetrol Refinery areas and those neighboring sewage treatment plants, at the depth of 5, 20 m, with a moderate level of pollution of polycyclic aromatic hydrocarbons in which biological effects are reduced unlikely.
- Analysis of the temporal evolution of the concentrations of organochlorine pesticides in marine waters in front of the mouth of the Danube outstanding a significant decline of the total content of organochlorine pesticides and also, of the concentrations of individual compounds, that had significant concentrations in previous years: HCB, lindane, aldrin.
- A significant increase was observed for the concentration of p, p 'DDD, which, correlated with relatively constant limits of the p, p' DDT concentration, indicates an increase degradation process of p, p 'DDT.
- The distribution of concentrations suggests achronical pollution with organochlorine pollutants, especially organochlorine pesticides on the entire coastal area, the source of this pollution being predominantly diffuse, most likely from air pollution.

REFERENCES

- Boicenco L., Alexandrov L., Anton E., Coatu V., Cristea M, Diaconeasa D., Dumitrache C., Filimon A., Lazar L., Malciu V., Marin O., Mateescu R., Micu D., Mihailov M., Nicolaev S., Nita V., Oros A., Radu G., Spanu A., Stoica E., Tabarcea C., Teodor C., Tiganus D., Timofte F., Zaharia T., **2012**. *"Evaluarea initiala a apelor romanesti ale Marii Negre"*, cerinta a Directivei Strategia pentru Mediul Marin, pp. 219*(http://www.mmediu.ro/beta/wp-content/uploads/2012/07/2012-07-17_evaluare_impact_planuri_evaluareinitialamediumarin.pdf)*
- Boicenco L., Coatu V., Dumitrache C., Lazar L., Marin O., Micu D., Nicolaev S., Nita V., Oros A., Radu G., Spanu A., Tiganus D., Timofte F., Zaharia T., **2012**. *" Determinarea Starii Ecologice Bune pentru apele romanesti ale Marii Negre"*, cerinta a Directivei Strategia pentru Mediul Marin, pp. 51
- Boicenco L., Anton E., Buga L., Coatu V., Dumitrache C., Filimon A., Lazar L., Marin O., Micu D., Mihailov M. - E., Nicolaev S., Oros A., Radu G., Spanu A., Tiganus D., Timofte F., Vlas O., Zaharia T., **2013**. *"Studiu privind completarea / reevaluarea definirii starii ecologice bune si a obiectivelor de mediu conform cerintelor art. 9 si 10 din Directiva Cadru Strategia pentru Mediul Marin (2008/56/CE)"*, pp. 176.
- Farrington JW, Goldberg ED, Risegrough RW, Martin JH, Bowen VT., 1983. "*An overview of the trace-metal, DDE, PCB, hydrocarbon, and artificial radionuclide data".* Environ Sci. Techn. 1983, 17:490–6.
- Gomoiu M.-T.Sur l'état du benthos du plateau continental roumain. Rapp.Comm.int.Mer Médit., CIESM, Monaco, 29, 5, 1985, pp. 199-204.
- J.J. Gonzalez , L. Vinas, M.A. Franco, J. Fumega, J.A. Soriano, G. Grueiro, S. Muniategui, P. Lopez-Mahıa, D. Prada, J.M. Bayona, R. Alzaga, J. Albaiges, 2006. "*Spatial and temporal distribution of dissolved/dispersed aromatic hydrocarbons in seawater in the area affected by the Prestige oil spill"*. Marine Pollution Bulletin 53, 250–259
- Kennicutt, M.C., Sweet, S.T., Fraser, W.R., Stockton, W.L., Culver, M., 1991*." Grounding of the Bahia Paraiso at Arthur Harbor, Antarctica. 1. Distribution and fate of oil spill related hydrocarbons.*" Environmental Science and Technology 25, 509–518.
- Lara, R.J., Asteasuain, A., Rusansky, C., Asteasuain, R., 1995. "*Distribution of petroleum hydrocarbons in water of the Bahı´a Blanca Bay, Argentina".* Marine Pollution Bulletin 30, 281–283.
- Law, R.J., Dawes, V.J., Woodhead, R.J., Matthiessen, P., 1997. *"Polycyclic aromatic hydrocarbons (PAH) in seawater around England and Wales."* Marine Pollution Bulletin 34, 306–322.
- Neff, J.M., Stubblefield, W.A., 1995. *"Chemical and toxicological evaluation of water quality following the Exxon Valdez oil spill. In: Wells, P.G., Butler, J.N., Hughes, J.S. (Eds.), Exxon Valdez Oil Spill: Fate and Effects in Alaskan Waters*," ASTM STP 1219. American Society for Testing and Materials, Philadelphia, pp. 141–177.
- OSPAR, 1992. DGW Report nr. 92.033 - Background concentrations of natural compounds in rivers, seawater, atmosphere and mussels. RW Laane (ed). International Workshop on Background Concentrations of Natural Compounds, 6-10 April 1992, Olanda.

- Reddy, C.M., Quinn, J.G., 2001. "*The North Cape oil spill. Hydrocarbons in Rhode Island coastal waters and Point Judith Pond."* Marine Environmental Research 52, 445–461
- Riley J.P., Skirrow G., 1965 -Chemical Oceanography, Vol.II. Academic Press London and New York, pp. 647.
- UNEP, 2002: Global Mercury Assessment, UNEP Chemicals, Geneva, Switzerland, 270 (http://www.chem.unep.ch);
- UNEP, 2006. Review of scientific information on lead, UNEP Chemicals, Geneva,
- UNEP, 2006: Review of scientific information on cadmium, UNEP Chemicals, Geneva, Switzerland, 151 p. (http://www.chem.unep.ch);
- US Environmental Protection Agency, 1998. EPA's contaminated sediment management strategy. EPA-823-R-98-001. Washington, DC
- Zakaria, M.P., Takada, H., Tsutsumi, S., Ohno, K., Yamada, J., Kouno, E., Kumata, H., 2002. "*Distribution of polycyclic aromatic hydrocarbons (PAHs) in rivers and estuaries in Malaysia: a widespread input of petrogenic PAHs".* Environmental Science and Technology 36, 1907e1918.
- Zhou, J.L., Maskaoui, K., 2003. "*Distribution of polycyclic aromatic hydrocarbons in water and surface sediments from Daya Bay, China.*" Environmental Pollution 121, 269–281.