Cross border Maritime Spatial Planning for Black Sea Bulgaria and Romania - MARSPLAN-BS II

Grant Agreement:

EASME/EMFF/2018/1.2.1.5/01/S12.806725 - MARSPLAN-BS II

SYNTHESIS REPORT ON MARITIME USES

WP 1, Activity 1.1, Sub-activity 1.1.1

Acknowledgement:

The work described in this report was supported by the European Maritime and Fisheries Fund of the European Union through the Grant Agreement: ***EASME/EMFF/2018/1.2.1.5/01/S12.806725 - MARSPLAN-BS II***

Responsible Partner(acronym)	**NIMRD**
Involved Partners	**CCMS, NVNA, GeoEcoMar, OUC**
Authors	**NMRD:** Laura Alexandrov **CCMS:** Margarita Stancheva, Hristo Stanchev, Milena Manova **GeoEcoMar:** Dan Vasiliu **UOC:** Dragos Vintila

Co-Authors	**NIMRD**	**GeoEcoMar**	**UOC**
	Simion Nicolav	Jeni Bujini	Aivaz Kamer
	Victor Nita	Vlad Radulescu	Isabella Stan
	Laura Boicenco	Tatiana Begun	Ionela Ionitiu
	Alina Spinu	Mihaela Muresan	
	Valeria Abaza	Raluca Tutuianu	
	Luminita Lazar	Sorin Balan	
	Oana Marin		
	Adrian Filimon		
	Emanuela Mihailov		
	Dragos Niculescu		
	Elena Vlasceanu		
	George Tiganov		

SUMMARY

Introduction: defining the working framework

Based on the detailed studies for complete analyses of the Romanian and Bulgarian maritime areas and the five Case Studies on major challenges developed within the first MARSPLAN-BS project, the competent authorities of Bulgaria and Romania should be supported in the preparation of the official planning. For that reason, a synthesis report, based on the main findings is elaborated containing short descriptive information and thematic maps.

Capitalising the results obtained in the previous MARSPLAN-BS Project, the Sub-activity 1.1.1 has the following main objectives:

- to summarise and synthesise all information and existing knowledge available so far for the maritime space of Bulgaria and Romania, based on detailed study and case studies results from the first MARSPLAN-BS, the own results and experience of project partners research, analyses and experience, al wide specifical documentation and European new projects and practices;
- to identify critical planning issues, as well as data and knowledge gaps;
- to set the state of knowledge in order to frame and support the subsequent implementing of the MSP process in the Black Sea Basin.

MARSPLAN-BS was the first pilot project to bring together Bulgarian and Romanian national authorities and research institutions aiming to identifying cross-border issues, similarities, discrepancies, ways, posbilities, solutions, measures to collaborate towards transposition of the Maritime Spatial Planning (MSP) Directive 2014/89/EU and to contribute to the transboundary Black Sea MSP process. This exercise has been particularly successful for increasing knowledge and understanding of national and cross-border interests and approaches to MSP, taking into account a large data inventory in developing; for identification of knowledge gaps and needs for harmonization of data collection; for promoting sectoral integration by highlighting conflicts and synergies between different sectors; enhancing stakeholder involvement; encouraging the development of shared transboundary planning; and developing concrete recommendations to the pilot MSP area of Mangalia-Shabla and to other specifical areas, fields and MSP practices.

The detailed analysis on the maritime space of the two Member States Bulgaria and Romania, and report formed an integral part of the initial assessment (WP1 Cross-border MSP development, Activity 1.1 Initial Assessment) of the first MARSPLAN-BS project, which was one of the main deliverables of the project. The purpose of the study was to elaborate detailed and complete analysis of the Romanian and Bulgarian maritime areas, underlining the most important aspects based on available data. The content comprised a first comprehensive description of current existing conditions of the maritime areas of both countries: physical, biological, natural preservation features and main maritime human uses as well as coastal and marine infrastructure, in spatial representation. The study aimed at the definition of the existing conditions of Romanian and Bulgarian maritime space in terms of human uses both mainly in marine areas in strong relation with coastal ones, taking into account their economic value, of environmental conditions and natural valuable areas, of legal and jurisdictional aspects acting at the different scales, of existing identified conflicts or compatibilities and other economic and SWOT analysis.

Case Study approach of the first MARSPLAN-BS Project included five case studies on major challenges for three specific areas and for two specific domains. The case study approach was based on problem and contextual specificities, such as coastal erosion for Eforie Nord-South, Land-Sea Interactions for Burgas, elaboration of a new ship routing system for Bulgaria and

Romania, stakeholder involvement in Sfantu Gheorghe, marine fishery and aquaculture issues. The study of existing traffic separation system of the Republic of Bulgaria gave the opportunity to define and then group together all aspects of maritime safety. Attention has been paid also to the impact of the system on other activities in the marine environment and reversely - the extent to which other activities have an impact on maritime routes. The findings of the study aimed and indicated that the system can be optimised. The identified solution, necessary measures and steps have already been investigated and defined. All case studies have a positive impact on the protection of the environment and for maritime human wise uses (identifying conflicts and synergies), key issues selection and adaptation of potential MSP solutions.

1. Geographical scope of the Black Sea MARSPLAN-BS area: Bulgaria and Romania

Black Sea is a unique sea in the world, being almost completely separated from the rest of the world's oceans and embodying an abyssal basin with a depth of 2200 m, and a wide continental shelf area in its NW part. The maximum depth in the central part is 2210 m.

The Black Sea coastline length is 4,869 km and its area are 421,638 km^2 (Stanchev et al., 2011). It is the largest land-locked sea bordered by Europe at North, West and East, and with Asia at the South. The Black Sea is connected by strait of Kerch to the shallow Azov Sea and with Marmara Sea (respectively Mediterranean Sea) by the strait of Bosphorus. The Black Sea is bordered by six coastal states, including two EU Member States Bulgaria and Romania, and Turkey, Georgia, Ukraine and Russia (Figure 1).

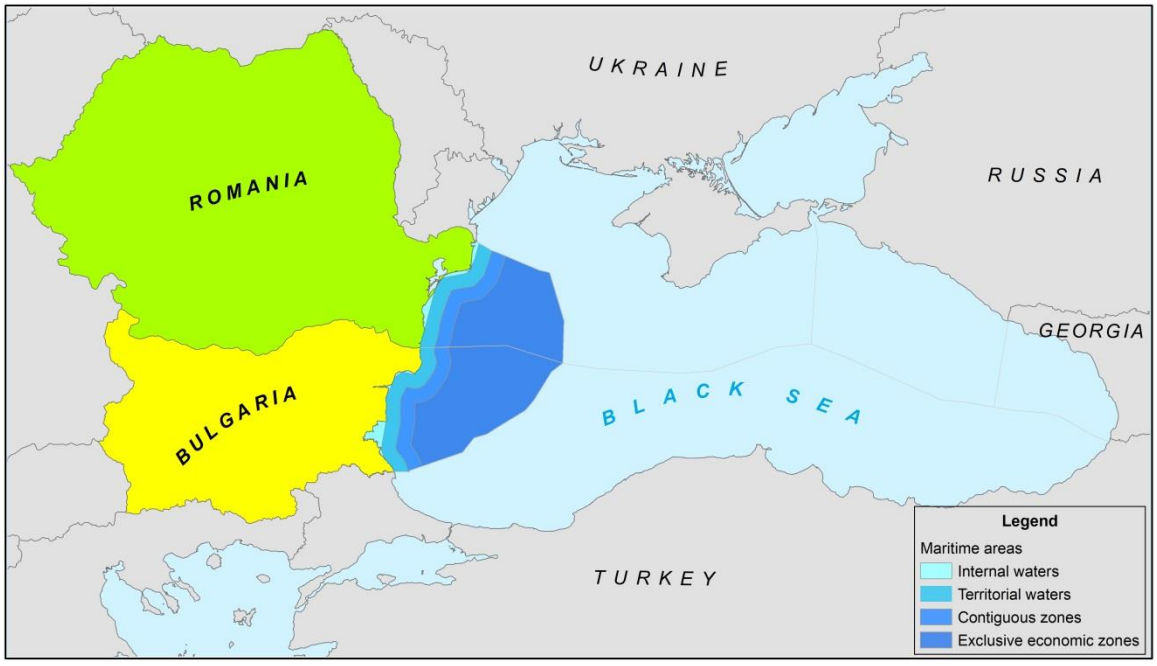


Figure 1. Location Map (*produced by CCMS, Bulgaria*)

The geographical scope of the first pilot MARSPLAN-BS project embraced the territorial sea of Bulgaria and Romania. In both countries, the legal status of the internal waters, the territorial sea, the contiguous zone and the Exclusive Economic Zone (EEZ) are in accordance with the United Nations Convention on the Law of the Sea (UNCLOS) since 1982. MSP methodology was applied to the territorial sea zone of Romania and Bulgaria (12 nm, 22.2 km), the planning

process being performed only for this area and the coastal cross-border area including the basic administrative units (NUTS 4 in Romania and municipalities in Bulgaria) neighbouring the shoreline. The draft MSP plan area was located at the border between Romania and Bulgaria, its delimitation took into consideration two types of zones: the territorial waters (the management area) and adjacent coastal area, and EEZ (the extended analysis area for the study of interactions). The coastal area included the municipalities Mangalia and Limanu (in Romania) and Shabla (in Bulgaria). The management area was 1,093,389 km^2, from which the Romanian area encompassed 417,084 km^2 and the Bulgarian area - 672,093 km^2.

In 1987 a Law on the Maritime Spaces entered into force in Bulgaria (State Gazette No 55/1987). It was entirely consistent with the essentials enshrined in the Convention on the Law of the Sea (UNCLOS, 1982). Bulgaria ratified the Convention in 1996. Later on, in 2000 this law was repealed and replaced with a new legislative act: Law on the Maritime Spaces, Inland Waterways and Ports of the Republic of Bulgaria (State Gazette No. 12/11.02.2000). According to this law, the sea spaces of the Republic of Bulgaria shall comprise the internal sea waters, the territorial sea, the contiguous zone, the continental shelf and the EEZ.

In Romania, the Law 17/1990 on the regime of internal waters, territorial sea, the contiguous zone and EEZ was republished and regulates the legal status of the internal waters, the territorial sea, the contiguous zone and EEZ in accordance with the United Nations Convention on the Law of the Sea, ratified by Law 110/1996.

The Black Sea is the largest meromictic basin on the Earth. The dense water flowing from the Bosporus sinks, while the fresh river input floats at the surface. Deep layers do not mix with the surface ones and as a result gas convection is prevented and deep layers remain anoxic. The established water column structure with strongly developed vertical stratification defines the physical characteristics.

The basin has a positive water balance; that is a net outflow of water 300 km^3 per year through the Bosphorus and the Dardanelles into the Aegean Sea. The Mediterranean water flows into the Black Sea as part of a two-way hydrological exchange. The Black Sea outflow is cooler and less saline, and floats over the warm, more saline Mediterranean inflow as a result of differences in density leading to a significant anoxic layer well below the surface waters. The Black Sea also receives freshwater from the large Eurasian fluvial systems in the north of the Sea, of which the Don, Dnieper and Danube are the most significant. The Danube catchment covers vast and polluted area. It is the second largest river basin in Europe, after Volga's watershed. It is also the basin that covers the greatest number of countries in the world. The Danube's catchment lies west of the Black Sea in Central and Southeast Europe. Main physic-geographical features for Bulgaria and Romania are summarised in the table below (Table 1).

Table 1. Geographical and physical features of the western Black Sea

Bulgaria – Romania			
	Main points	**BULGARIA**	**ROMANIA**
		Coastline length of 432 km (comprising 8.5% of the total length of the Black Sea coastline; Coastal landscapes of diverse geomorphological features: cliffed and rocky coasts,	*Coastline length of 244 km (about 5.3% of the total length of the Black Sea coast); two geomorphological units and a transitional one in between: northern unit (Musura Bay – Midia Cape): deltaic and lagoon shore with low beaches, gentle*

	Coastal area	*wetlands, dunes and sand beaches, and lagoons.* *Cliffs of varying composition are the most common shore type along Bulgarian coast covering 49.3 % or 213 km of the whole shoreline.* *Sandy beaches constitute at least 34.5 % (149 km) of the coast and the armoured/engineered coast occupies 16.2% (70 km), (Stanchev et al. 2013) In the past, large dune formations existed, however, due primarily to direct removal by coastal developments, the dune landscape is continually diminishing and today they are found only along 10% of the entire country's coastline*	*submerged slope, L: 160 km; southern unit (Cape Singol - Vama Veche): abrasive and accumulative forms: cliffs, small pocket beaches, benches and barriers, steep submerged slopes.* *Sandy beaches constitute at least 68, 5 % (167,3km) of the coast, from which 136 km of wild beaches located in the North Unit of the Romanian shore (mostly consisting of alluvial sand, from Danube discharge). The armoured / engineered coast occupies 12,7 % (31 Km). The rest of 18, 8 % of the shore represents the structures of the Romanian ports.*
Geographical and physical features	**Marine Area**	*The shelf of Bulgarian part of the Black Sea is widest (120 km) in the northern part and relatively short (30 km) southeast from Cape Kaliakrain in the northern part of the Bulgarian coast.* *A few small islands along the coast exist.* *The maximum depth is 2150 m.*	*The Romanian shelf narrows from north to south - the 100 m depth is located at 180-200 km distance from shore in the northern and 100-110 km in the southern sector.* *- uniform relief, with slopes that vary widely* *Continental slope starts at -180 / -200 m down to – 1500/ - 1800 m; Canyon Viteaz (- 100/ - 1000 m depth;* *Continental aprons start at – 1500/ - 1800 m depth: the biggest one: the Abisal Danube cone / cone Abisal EUXIN.*
	Underwater Surficial Sediments	*Most part of the shallow shelf is covered by gravels, sands, rocky platforms. Silt and aleurolities are prevailed beyond 10 -15 m depth.*	*- up to 10 m depth: sand and silty sand prevail* *- beyond 10 m depth: sandy silt with clay intercalations prevail*
	Oceanographic Characteristics	*Surface water salinity varies largely between 11-13 ‰ in summer in case of abundant precipitation and 18-19 ‰ in open waters in winter, define upper layer salinity increases to 17.5 – 18.5 ‰. Strong vertical stratification and cyclonic surface circulation in Black Sea. A stable local cyclonic gyre is located west of Cape Kaliakra and a less intensive one occurs in Burgas Bay. The coastal current caused by the river inflow in the*	*The vertical distribution of the water temperature depends on the thermal regime of the atmosphere and the sea currents and waves that generate the water mass mixing (usually reaches depths of 100 – 150m, and only seldom 200m). Intermediate and deep water masses (88% of the sea volume) undergo only slight variations of their thermohaline parameters; The surface quasi-homogeneous layer (SQL) is subject to seasonal variations, its temperature and*

		Black Sea's northwest flows southward and near Cape Kaliakra it merges with the Rim Current. The shore currents are week, influenced by winds, but generally retain a southerly direction. *Downwelling, combined with the strong cooling of the surface waters in winter, favours the vertical circulation and sliding of water masses down the continental slope. The Rim system strongly influences the vertical oxygen and nutrient transportation and biological productivity.*	*salinity evolution have a well-defined annual cycle; The high temperature and low salinity are characteristic for the sea water near the surface, the sea temperature decreases to a minimum of about 8°C in the Cold Intermediate Layer (CIL) and the salinity increases continuously from 18 PSU, as well as the sea temperature, toward the deep waters (Mihailov et al., 2016). Mean water surface temperature in winter (February) – 2 - 8^0C and 22 - 24^0C in summer, respectively.*
	Hydrography	*River network in the Bulgarian Black Sea coastal area is formed by rivers with small catchment, short length and minor amount of river runoff. Kamchia River (191 km), as longest river on the Balkan Peninsula to flow directly into the Black Sea. Catchment area of Bulgarian rivers, flows directly into the Black Sea is 16 666 km^2.* *Most coastal lakes, lagoons and marshes in Bulgaria are also important Natura 2000 protected areasand Ramsar sites: Durankulak Lake, Shabla-Ezeretc Lake, Varna-Beloslav Lake, Pomorie Lake, Atanasovsko Lake, Burgas Lake, etc.*	*Romanian Black Sea hydrography network is formed by:* *- Danube river basin covers an area of 817,000 km^2 and extendsto 2,860km in length. It flows through 10 European countries, and includes almost the whole Romanian territory. Less then 2.5% of the Romanian catchments are directly connected to the Black Sea.* *- Coastal Lagoon and related Lakes - Razim – Sinoie lagoon complex(Natura 2000 Danube Delta Biosphere Reservation) consists of four main lakes – Razim, Goloviţa, Zmeica and Sinoie and a series of smaller marginal lakes. Of the total area of the complex (1.015 km^2), the lakes cover an area of 863 km^2.* *The littoral lakes show the characteristics of "limans" (blocked estuaries) (Corbu- Natura 2000 Danube Delta Biosphere Reservation), Taşaul, Agigea, Techirghiol (protected under Ramsar Convention) Tatalgeac, Mangalia) or lagoons (Siutghiol).*
Marine delimitations and jurisdictions	**Internal waters**	*Internal waters are defined by the Law on Maritime Spaces, Inland Waterways and Ports of the Republic of Bulgaria and include also the waters of:* *• Varna Bay between the coastline and the straight line, joining Cape St. Konstantin to Cape Ilandzhik;*	*Romanian ACT concerning the Legal Regime of the Internal waters includes* ***The territorial sea of Romani****a (the zone of the sea adjacent to the coast or, where applicable, the internal waters, having a width of 12 nautical miles (22,224 m) measured from the baselines.)*

		• *Burgas Bay between the coastline and the straight line joining Cape Emine to Cape Maslen Nos;* • *The waters between the coastline and the straight baselines, joining Cape Kaliakra to Cape Tuzlata, Cape Tuzlata to Cape Ekrene and Cape Maslen Nos to Cape Rohi.* *Total area of 967 km².*	*The baselines are the lines of low tide along the coast or, where applicable, the straight lines which join the most advanced points of the coast, including the coasts of islands, mooring places, hydrotechnical works and other permanent Harbour installations.* ***The contiguous zone of Romania** is the zone of the sea adjacent to the territorial sea and extending along the sea coast to a distance of 24 nautical miles measured from the baselines.*
		It includes waters on the side of the baseline of territorial water that is facing toward the land. It includes waterways such as rivers and canals, and sometimes the water within small bays.	
	Territorial waters	*Total area of 6293 km².*	*Total area of 5257 km².*
		A belt of sea of 12 nm in breadth adjacent to the territory, including land territory and internal waters.	
	Contiguous zone	*Total area of 5097 km²*	*Total area of 4275 km².*
		An area extending up to 24 nm from the territorial sea baseline.	
	EEZ	*Total area (from 24 nm) of 25557 km².*	*Total area of 20075 km².*
		An area beyond and adjacent to the territorial sea but may not extend beyond 200 nm from the territorial sea baselines.	

References

1. Agreement between the Republic of Turkey and the Republic of Bulgaria on determination of the boundary in the mouth area of the Mutludere/Rezovska river and delimitation of the maritime areas between the two states in the Black Sea, 4 December 1997. Promulgated in the State Gazette, No 68/ 30.07.1999, under ratification by a law adopted by the 38th National Assembly on June 24, 1998 (State Gazette/79 of 1998) and entered into force on November 4, 1998 (Promulgated State Gazette No 68 of July 30, 1999).
2. Geological map of the Bulgarian sector of the Black Sea in scale 1: 500,000. 2010. Authors: E. Kozhuharov L. Dimitrov, R. Hristova, S. Keremedchiev N. Ruskova, V. Doncheva, I. Kozhuharov, T. Rankova L. Dimkova. Ministry of environment and water, contract № 1377/30.12.2008, Contractor of the project: "IO-JES CONSULT" Ltd. May 2010, Sofia.
3. General Bathymetric Chart of the Oceans (GEBCO), http://www.gebco.net/ last accessed on 22/01/2016), http://oceanservice.noaa.gov/facts/bathymetry.html (last accessed on 22/01/2016).
4. DG MARE EU Atlas, *http://ec.europa.eu/maritimeaffairs/atlas/index_en.htm.*
5. Law on Maritime Spaces, Inland Waterways and Ports of the Republic of Bulgaria Act. Promulgated, State Gazette No. 12/11.02.2000, last amended and supplemented, SG No. 28/29.03.2018.
6. Mateescu R., Spinu A, *Marine and Coastal Spatial Data Analysis and Management within Web-GIS system for data access and sustainability on Romanian Black Sea Coastal Zone*, Proceedings of CoastGIS 2011: 10th International Symposium on GIS and ComputerMapping for Coastal Zone Management Sub-title: Marine and Coastal Spatial Planning, vol 2, Corila, 2011, ISBN: 9788889405246, pag 75-82.
7. *http://coastgis.corila.it/2011/download/book/ CoastGIS_2011_Proceedings_Vol_2.pdf*

8. Mateescu R., Spinu A., Niculescu D., Alexandrov L.- *Delineation criteria for Romanian southern coastal zone, based on the variability of geomorphological processes*, Proceedings of International Conference on Marine and Coastal Ecosystems (MarCoastEcos2012): Increasing knowledge for a sustainable conservation and integrated management, 25 – 28 April 2012, Tirana, pag. 627-630
9. Mateescu R., Spinu A., Omer I., Analysis of the sea-land interface variability on the Romanian littoral, based on the Remote Sensing and GIS techniques applications, Ovidius University Annals, Series Civil Engineering, 2012, Issue 14, pag. 49-57, ISSN: 1584-5900 (Indexată Copernicus)
10. Mateescu R., Spinu A., Alexandrov L., Iordache G. - Criterii metodologice de delimitare a spatiului *public din zona costiera*, Buletinul Directiei Hidrografice Maritime, vol II/2010
11. Mateescu R., Spinu A., Niculescu D., Alexandrov L.- *Delineation criteria for Romanian southern coastal zone, based on the variability of geomorphological processes*, Proceedings of International Conference on Marine and Coastal Ecosystems (MarCoastEcos2012): Increasing knowledge for a sustainable conservation and integrated management, 25 – 28 April 2012, Tirana, pag. 627-630
12. Golumbeanu M, Nicolaev S., Abaza V., Alexandrov L., Bakan G., Boicenco L., Brasoveanu L., Coatu V., Dyakov, Lazar L., Nenciu M. I., Mateescu R., Nita V., Oros A., Spinu A. D., Stegarescu V., Stoyanova G. A., Tiganus D., Zaharia T., 2015, Study on Integrated Coastal Zone Management, 454 p, Ex Ponto Publishing House, 2015, ISBN: 978-606-598-397-7;
13. *** România c. Ucraina la CIJ: maritime space delimitation in the Black Sea, *http://www.mae.ro/node/2168*
14. 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. *Geo-Eco-Marina*, *17* (2011), 27-31.
15. Stanchev, H., Young, R., Stancheva, M. 2013. Integrating GIS and high resolution orthophoto images for the development of a geomorphic shoreline classification and risk assessment - a case study of cliff/bluff erosion along the Bulgarian coast. Journal of Coastal Conservation, Vol. 17, p. 719-728. DOI 10.1007/s11852-013-0271-2.
16. Stanchev et al., 2013. Part 1.1. Bathymetry. In: Report "An assessment of the environmental status of marine waters (WFD) in 2013". Agreement between the Ministry of Environment and Waters and the Institute of Oceanology, BAS, Varna on the implementation of obligations on the monitoring of the Black Sea, pursuant to art. 171, paragraph 2 pt. 3 of the Water Act.
17. Stanchev, H., 2015. Geoinfromation system of the Bulgarian Black Sea sector and coastal zone. PhD Thesis, Varna, 180 p.
18. UNCLOS Part Ii, Territorial Sea and Contiguous Zone, Section 2. Limits of the Territorial Sea, Article 5". United Nations: *http://www.un.org/depts/los/convention_agreements/texts/unclos/part2.htm; http://www.gc.noaa.gov/gcil_maritime.html*.

2. Legal framework, governance structure and stage of MSP process

Table 2. MSP Bulgaria-Romania

Main points	Bulgaria	Romania
Agreed EEZs	*Agreed with Turkey and not yet with Romania*	*Agreed with Ukraine and not yet with Bulgaria*
Previous experience with MSP and ICZM	*The MSP experience so far has been limited to involvement in EU funded projects with relation to MSP; the first pilot MSP project is MARSPLAN – BS to support directly the implementation of the MSP Directive.*	*The MSP experience so far has been limited to involvement in EU funded projects with relation to MSP; the first pilot MSP project is MARSPLAN – BS to support directly the implementation of the MSP Directive.*

	No ICZM equivalent policies or national strategy were in advanced stages of preparation, only fragmented tools and EU funded projects were in place to address coastal issues.	*There were fragmented tools and EU funded projects to address coastal issues, the Law 280/2003 regarding the ICZM defined and established the coastal zone and adopted measures in order to ensure its integrity.*
Stage of MSP development	*The MSP development has been started and the Directive 2014/89/EU was transposed in early 2018 in the national legislation by an Amendment of the on Maritime Spaces, Inland Waterways and Ports of the Republic of Bulgaria Act, State Gazette No 28/29.03.2018.* *In Bulgaria the final version of the MSP shall be adopted by the National Expert Council on Territorial Development and Regional Policy and thereafter - approved by the Council of Ministers. The national plan is currently in the first stage of development and drafting, and it is foreseen to be finalised and approved until 31 March 2021. It will be developed with the involvement of stakeholder consultations and will be reviewed at every 10 years or earlier in case significant changes in the socio-economic conditions occur.*	*The MSP development has been started and the Directive 2014/89/EU was transposed in the national legislation by: a) Government Ordinance No. 18/2016 on the maritime spatial planning; and b) Law No. 88/2017 related to the approval of the Government Ordinance No. 18/2016 on the maritime spatial planning.* *In Romania, MSP will be developed in accordance with the MSP Methodology which was approved by Government Decision, according to the Art. 14, par. (3), of the Government Ordinance No. 18/2016 on MSP.* *The national plan is currently in a preparation development phase and is foreseen to be finalised and approved until 31 March 2021. It will be developed with the involvement of stakeholder consultations and will be reviewed at least once at every 10 years.* *The draft national plan will be developed within the MARSPLAN – BS II Project.*
Governance structure	*Designated National Competent Authority is the Ministry of Regional Development and Public Works (MRDPW) in Bulgaria. An Advisory Council on MSP has been established as a subsidiary body to the Minister to support the cooperation and coordination between relevant stakeholders during the MSP process. The final version of the plan shall be adopted by the National Expert Council on Territorial Development and Regional Policy and thereafter - approved by the Council of Ministers.*	*Designated National Competent Authority is the Committee for Maritime spatial planning, an inter-ministerial body, without legal personality, functioning in the coordination of the prime minister, who also ensures the presidency and the Ministry of Public Works, Development and Administration (MPWDA) in Romania. More than that, the Government adopted the Decision No. 406/2017 regarding the regulation and the composition of the Maritime Spatial Planning Committee - the competent authority of Romania and the Decision No. 436/2018 regarding the Methodology for the elaboration of the Maritime Spatial Plan.*

Common strategic framework	*The strategic framework for maritime spatial planning in Romania and Bulgaria aims to develop a common development vision, common principles and common objectives for all maritime spatial area in Romania and Bulgaria (territorial sea and the coastal area - adjacent localities - LAU2). The common strategic framework developed an action plan which will ensure the coherence between the activities from maritime space, in one hand, and between activities on the sea and on the coastal area. This strategic framework will represent an important starting point for the national spatial plan of the maritime areas for both countries, to be realized afterwards within the implementation of the MSP Directive.*	
Transboundary /cross-border context and identified issues	*Bulgaria and Romania will cooperate with other Black Sea countries, including the Organization of the Black Sea Economic Cooperation and the Commission on the Protection of the Black Sea Against Pollution. Cooperation with Romania aims at consistency and coordination of the national maritime spatial plans on all issues in the cross-border context.* *Within the first pilot MSP project MARSPLAN-BS a draft MSP plan of the cross-border area of Romania and Bulgaria (Mangalia-Shabla) was elaborated (www.marsplan.ro). Draft MSP involves some activities such as setting out institutional framework for it, defining the common methodology for analysis and spatial planning for maritime cross-border area, developing the common strategic framework for maritime spatial planning in Romania and Bulgaria and elaborating the maritime spatial plan for the cross-border area (Mangalia-Shabla).*	

Bulgaria and Romania have not yet agreed and declared their Exclusive Economic Zones (EEZ). The delimitation of the continental shelf and the exclusive economic zone starts first from the direction of the state borders on the sea, up to the limit of territorial waters, situation that between the countries bordering the Black Sea has been solved only partially:

- Bulgaria – Turkey: The agreement between the Republics of Bulgaria and Turkey to determine the border in the mouth area of the Rezovo River/ Mutlu deree and delimitation of maritime spaces between the two Black Sea countries was promulgated in the State Gazette, No. 68/ 30.07.1999, under ratification by a law adopted by the 38th National Assembly on June 24, 1998 (State Gazette/79 of 1998) and entered into force on November 4, 1998 (Promulgated State Gazette No 68 of July 30, 1999).
- The line of demarcation between the zones of Romania and Ukraine was established by Decision No. 100 of the International Court of Justice from Hague, issued on 3 February 2009, which recognised the jurisdiction and sovereign rights of Romania on more than 79 % of the 12,200 km^2 of continental shelf and exclusive economic zone in dispute between Romania and Ukraine.

Both Bulgaria and Romania have limited experience in applying MSP, and prior the adoption of Directive 2014/89/EU for establishing a framework for MSP, there were only project-based efforts and results. In general, the obstacles for MSP in the Black Sea were mostly due to difficult administrative framework for MSP, still not agreed EEZs, no supportive legislation and also the weak stakeholder engagement. Another barrier has been related to diverse political context and by increasing instability in some parts of the Black Sea (for example in Ukraine). Also, the lack of some sectoral drivers for MSP, such as offshore wind energy developments, created difficulties to stimulate MSP process, compared for example to Baltic and North Sea

regions. With the Directive 2014/89/ all EU Member States, including Bulgaria and Romania, have been requested and obliged to adopt relevant legislation for MSP, on the basis of which mandatory MSP plans have to be approved until 2021. In the first stage both countries designated Competent MSP Authorities and transposed the MSP Directive in the national legislations and the national maritime spatial plans have been started to be developed. The MARSPLAN-BS project was the first pilot project to directly support the implementation of the MSP Directive and during the project a draft MSP for the cross-border area of Mangalia – Shabla was elaborated. The marine spatial plan for Mangalia-Shabla area was conceived as a pilot exercise in order to test the capacities of Romania and Bulgaria to develop a concrete instrument for the management of the marine area. This plan took into consideration the existing data describing the natural environment as well as the human activities developed in the pilot study area.

European Union legislation to MSP

1. Recommendation 2002/413 / EC of the European Parliament and the Council on 30th May 2002, concerning the implementation of Integrated Coastal Zone Management in Europe (OJ L 148, 06.06.2002).
2. Proposal for the Directive of the European Parliament and the Council to establish a framework for maritime spatial planning and integrated coastal zone management, COM (2013) 133 final 2013/0074 / COD, Brussels, 12th March 2013.
3. COM (2007) 160 final, Brussels, 11th April 2007 - Communication of the Commission to the Council and the European Parliament on the Black Sea Synergy - A new regional cooperation initiative.
4. Directive 2008/56 / EC of the European Parliament and the Council (OJ L 164/19, 25.6.2008) - establishing a community action framework in the field of marine environmental policy ("Marine Strategy" Framework Directive).
5. Directive 2000/60 / EC of the European Parliament and the Council (OJ L 327, 22.12.2000) - establishing a community action framework in the water field.
6. Communication from the Commission to the Council and the European Parliament on Integrated Coastal Zone Management: a Strategy for Europe (COM/2000/547 final).
7. Directive 2014/89 / EU of the European Parliament and the Council on 23rd July 2014 - establishing a framework for the maritime space planning.

Several technical, administrative and legal obstacles were identified in developing cross-border MSP, such as:

- Fragmentation of knowledge and differences in national data availability.
- Lack of cross-border harmonised data and common methods for synthesis as ensuring the coherence and harmonisation of the data across boundaries remains a challenge due to different data protocols and formats. Typically, this is complicated by a number of underlying issues: different languages between countries, the need for high level political agreement to share relevant data across boundaries and the need for good cooperation between local and regional interest groups.
- Institutional collaboration should be enhanced and has a long-term perspective (for example follow-up projects instead of single short-term projects).
- Existing difficulties related to delimitation of the territorial boundaries in the context of UNCLOS between Bulgaria and Romania and between Romania and Ukraine.

References

1. Maritime Spaces, Inland Waterways and Ports of the Republic of Bulgaria Act. Promulgated, State Gazette No. 12/11.02.2000, last amended and supplemented, SG No. 28/29.03.2018.
2. Law No. 88/2017 related to the approval of the Government Ordinance No. 18/2016 on the maritime spatial planning.

3. Marine environmental status

3.1. Structure and functions of marine ecosystems

3.1.1. Species

3.1.1.1. Marine mammals (species, distribution, population, trends)

- ***Populational Structure and Trends***

The taxonomic groups of marine mammals in the Black Sea are not very diverse - there are three cetacean (odontocete) species/subspecies - the Harbour porpoise (*Phocoena phocoena relicta*), the short-beaked common dolphin (*Delphinus delphis ponticus*) and the common bottlenose dolphin (*Tursiops truncatus ponticus*) (Birkun, 2007). All three cetacean species are found at the Romanian and Bulgarian coasts (Figures 2, 3, and 4).

Between 2006 and 2010, cetacean sightings of bottlenose dolphin (*Tursiops truncatus ponticus*) (Figure 5a), common dolphin (*Delphinus delphis ponticus*) and harbour porpoise (*Phocoena phocoena relicta*) were recorded in coastal Bulgarian Black Sea waters during the spring and autumn sprat and turbot trawl surveys. It has been concluded that 3 mammals were equally presented in all seasons in the Bulgarian coastal zone. The winter concentration of prey (including anchovies, horse mackerel and shad) in the south-eastern Black Sea creates appropriate conditions for cetaceans' mass assembling in this region. Summer migrations of warm-water species to the north-western shallow waters and the formation of large sprat shoals attract cetaceans to the feeding grounds located away from their wintering areas. (Table 3)

The observations carried-out at at the Romanian coast, aboard vessels, crafts or marine drilling platforms, were performed during 2001-2004, in the area between Sulina and Vama Veche, between 8 to 65 m isobaths.

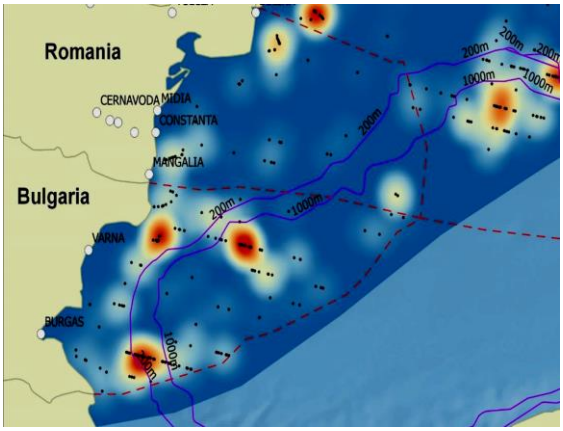


Figure 2. Distribution of Common Dolphin individuals

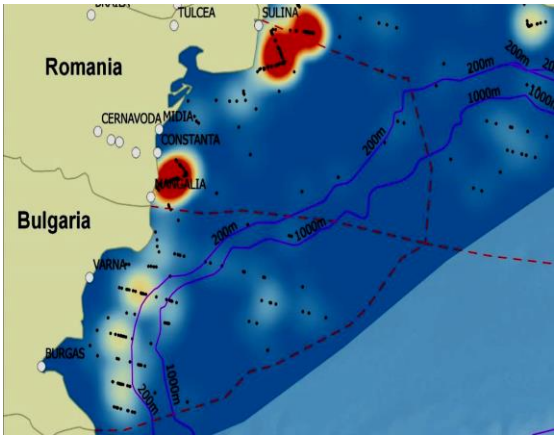


Figure 3. Distibution of Harbour porpoises individuals

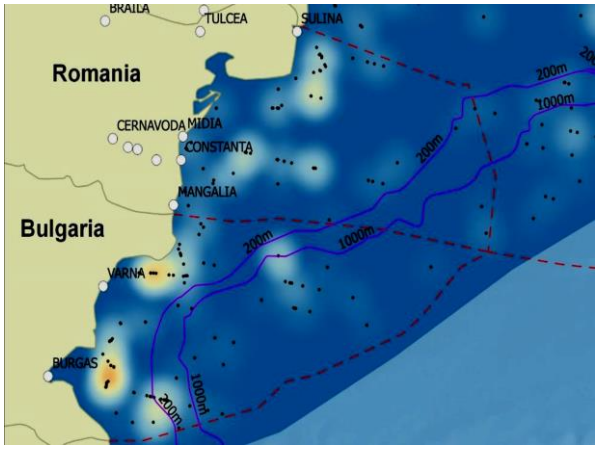
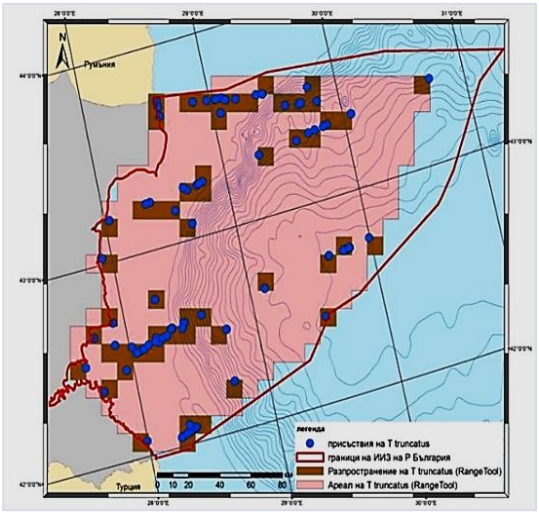


Figure 4. Distribution of individuals Bottlenose Dolphins
**- red showing the highest levels of abundance and blue the lowest. The black spots mark actual sightings. This maps are based on data from the combined vessel and aerial surveys (Birkun et al., 2014).*

The main conclusion was that they prefer clean water areas, with rich and diverse food sources. This aspect was found in the central and northern area, where dolphins are attracted by fish agglomerations for feeding and breeding.

At the Romanian coast distribution of cetaceans is non-uniform mainly determined by the seasonal evolution of environmental conditions and the presence of fish agglomerations, which are the main food for cetaceans (Radu et al., 2013).

a. 

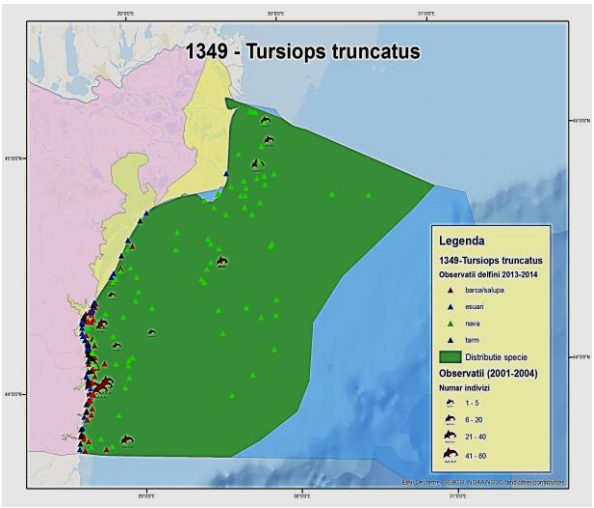
b. 

Figure 5. Distribution area of the *Tursiops truncatus* (a.Bulgaria, b.Romania)

***Bottlenose Dolphin** (*Tursiops truncatus ponticus*, Barabasch, 1940)

The subspecies of the Bottlenose dolphin (*Tursiops truncatus ponticus*), which is endemic for the Black Sea, inhabits mainly shelf waters, although occasionally it has been observed in deep offshore waters (*http://www.marsplan.ro/en).*

- ***General population status and trends.***

BULGARIA

In literature it is considered that the spread of bottlenose dolphin in the Bulgarian Black Sea includes territorial waters and exclusive economic zone.

During the surveys carried out by the Institute of Fish Resources in Varna from 2014 to 2015 it was found that spreading of bottlenose dolphin is mainly near the coast in the Bulgarian Black Sea shelf as well as in the deep zone.

The total population size is unknown. During the 20th Century, the bottlenose dolphin was considered the least abundant of the three cetacean species in the Black Sea. (Table 3).

Table 3 Habitat area for dolphins

Period	Habitats- Area	Coast distance and depth
1992- 1996 (Stanev 1996)	Area between Cape Emine and Cape Galata	5 to 10 miles and depths of 17-65 m
2010-2011 (Mihaylov, 2011)	Between Varna and Cape Cherni nos	15-25 miles from the shore at depths of 35-80 m
2006-2013 (Panayotova, Todorova, 2015)	In front of Kamchia River mouth and cape Emine.	In the shelf waters
2014-2015	Burgas Bay Cape Kaliakra Tsarevo Canyon Manganari	At the coast of the bay In front of the cape In the coastal waters Near the canyon

In coastal waters of the northern Black Sea, over the 1990s, bottlenose dolphins have become prevalent. However, it is suggested that the recovery was compromised by a mortality event in 1990 and is continuing to be compromised by anthropogenic influences.

ROMANIA

At the Romanian coast, the bottlenose dolphin is often encountered in the Gura Portiței area, at 35-45 m depths, and in the littoral area off the Techirghiol Lake, at depths ranging between 30 and 40 m. In spring, this dolphin comes very close to the shore, sometimes entering for food the enclosure of the Midia Harbour (Radu et al., 2013).

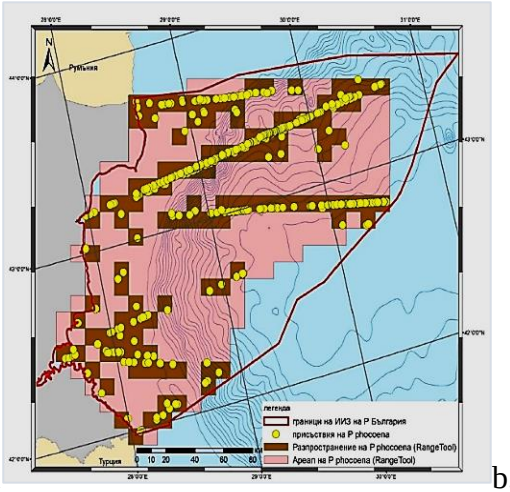
In 2013 a comprehensive study conducted in the western part of the Black Sea showed that number of the bottlenose dolphin present in the Romanian waters was approximately 6413 individuals (Birkun et al., 2014).

The presence of *Tursiops truncatus ponticus* in various shares at the Romanian Black Sea can be correlated with the food sources - fish - forming agglomerations in relation to hydro-climate and biological factors.

***Harbour Porpoise (*Phocaea phocenin relicta* Abel, 1905)** the smallest cetacean in the Black Sea and the only representative of the Phocoenidae Family encountered in the Pontic Basin (Figure 6a.b)

Phocoena phocoena relicta is encountered in the Black Sea and contiguous areas (Azov Sea, Kerchi Strait, Turkish Straits System). In November and December, they are sometimes encountered off the Danube Delta outflow *(http://www.marsplan.ro/en).*

Phocoena phocoena relicta is encountered in the Black Sea and contiguous areas (Azov Sea, Kerchi Strait, Turkish Straits System). In November and December, they are sometimes encountered off the Danube Delta outflow *(http://www.marsplan.ro/en).*

a 

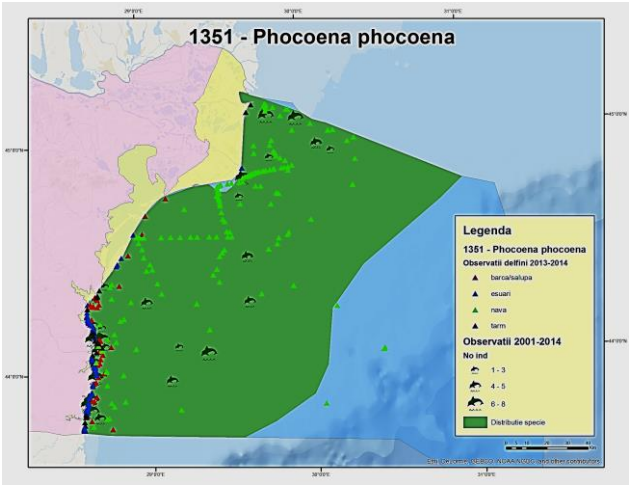
b. 

Figure 6. Area and distribution of *Phocoena phocoena* (a. Bulgaria, b. Romania)

BULGARIA

The distribution of harbour porpoise in front of Bulgarian coast, according to literature data, includes the internal waters, territorial sea and the exclusive economic zone of the Republic of Bulgaria.

Although the harbour porpoise is generally considered to be a coastal species, there is some evidence that it can be found in deeper water as well. In the largest bays in the Black Sea coast - Burgas and Varna- it registers the regular attendance of Harbour purpoise. Occasionally *Ph. phocoena* is observed in the bays around the mouth of Ropotamo River to Maslen nos and in outermost part of the Varna Lake. The research carried-out between April and November over the period 2006-2013 indicated that the higher number of individuals was observed in front of Varna and in the southern region – in front of cape Emine and cape Maslen nos near Burgas during the summer period.

Surveys carried out from 2014 to 2015 by the Institute of Fish Resources studied the seasonal migrations, distribution and abundance of Harbour Porpoise. The data, obtained in the period November -December 2014, indicated that the main part of recorded sightings of Harbour porpoise is concentrated mainly in the northern part of the Bulgarian area, but also in its southern part. During most of the 20th century, the abundance of Harbour porpoises in the Black Sea was higher than that of bottlenose dolphins, and lower than that of common dolphins.

ROMANIA

Scarce *Phocoena phocoena relicta* herds were noticed south of Constanța down to Costinești, in shallow waters, in the close vicinity of the Romanian coast. They sometimes follow their prey inside the Constanța, Mangalia and Midia Harbours.

The research carried-out by National Institute for Marine Research and Development ”Grigore Antipa” at sea, during September 2001-September 2002, for individual or group location of cetaceans, resulted in the sighting of groups comprising 1-8 *Phocoena phocoena relicta*

dolphins, 72% of them being sighted in the northern part and 28% in the southern sector (Radu et al., 2003d).

Cetaceans monitoring at sea pointed out to the fact that they prefer clean water areas, with rich and diverse food sources. This aspect was reported in the central and northern area, where porpoises are attracted by feeding and spawning fish agglomerations (Radu et al., 2004a).

In 2013 a comprehensive study conducted in the western part of the Black Sea showed that number of Harbour porpoises present in the Romanian waters was approximately 8059 individuals (Birkun et al., 2014).

- ***General population status and trend***

In the 20th Century, the number of Black Sea Harbour porpoises was dramatically reduced by significant direct killing for the cetacean-processing industry that continued until 1983. The number of animals taken was not recorded accurately. However, it can be inferred that the population size was reduced due to the direct kills (totaling some hundreds to thousands) by the time the total ban on cetacean hunting was enforced in the Black Sea region. It is strongly suspected that during the subsequent period from 1983-2006, the population declined further, due to large-scale mortality in bottom-set gillnets. In addition to this, there are other ongoing threats including habitat degradation and parasitic and bacterial infections.

***Common Dolphin (*Delphinus delphis ponticus,* Barabash-Nikiforov, 1935)**

The common dolphin is widely spread, being encountered in temperate and tropical waters around the world, tending to concentrate in open seas. *Delphinus delphis ponticus* is a species representative for the Black Sea, being widely spread in this area.

BULGARIA

The common dolphin is mainly found in offshore waters and it visits the shallow coastal waters following the seasonal assemblages and regular mass migrations of their preferred food such as the small pelagic fish, the European anchovy and the Black Sea sprat. During the period 1992-1995, in front of Bulgarian coast individuals were registered within 10-17 miles distance, at a depth of 30-83 m in the waters between Cape Emine and Cape Galata. Newer studies show presence of common dolphins off the coast up to a distance of 15-30 miles and depths of 35-80 m between Varna Bay and Cape Cherni nos.

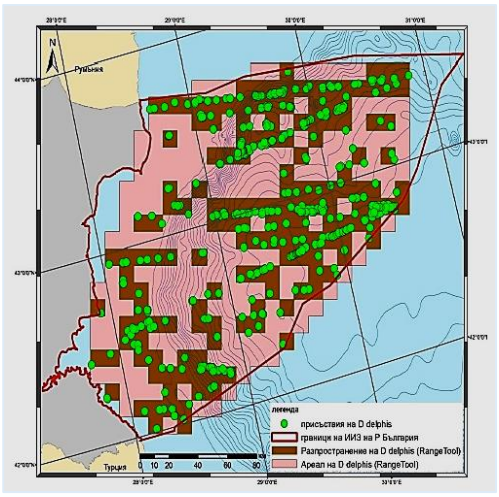
ROMANIA

In order to obtain the information on the dolphin distribution and occurrence frequency at the Romanian coast, complex and systematic research using specific methods for this type of studies has been carried-out, (Radu et al., 2003c) (Figure 7).

The cetaceans monitoring activities at sea carried-out by The National Institute for Marine Research and Development ”Grigore Antipa” during September 2001-September 2002 resulted in the sighting of groups comprising 2-12 *Delphinus delphis* ponticus individuals, reported in the northern sector in 86% of the cases. The dolphin monitoring at sea was performed in the area between Vama Veche and Sulina on the 10-55 m isobaths (Radu et al., 2013).

Monitoring at sea during April-September 2003 resulted in the sighting of herds comprising up to 20 individuals of the species *Delphinus delphis ponticus*, all located in the northern sector of the Romanian coast.

In 2013 a comprehensive study conducted in the western part of the Black Sea showed that number of common dolphin present in the Romanian waters was approximately 5447 individuals (Birkun et al., 2014).

a. 

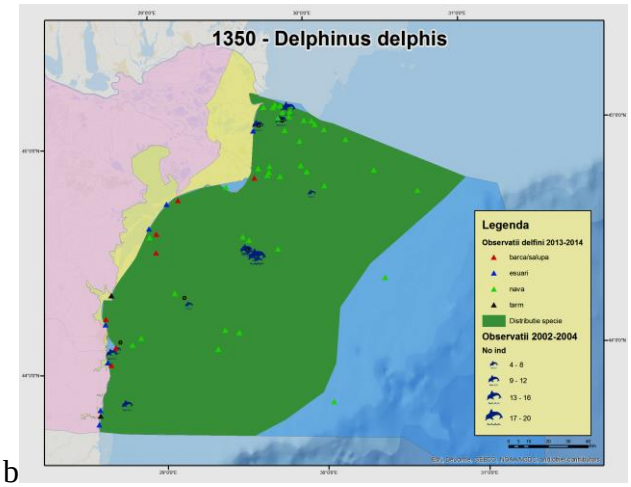
b 

Figure 7. Area and distribution of the *Delphinus delphis ponticus* (a. Bulgaria, b. Romania) ***http://www.marsplan.ro/en***

- ***General population status and trends***

By the mid of-1960s, the population was depleted due to the killing of more than 100,000s of common dolphins in the mid-20th Century. Black Sea Common Dolphin was commonly recorded nearshore. It might be assumed that after 1983 the population has increased. However, this may not be the case in view of mass mortality events in 1990 and 1994 and the pronounced depletion of these dolphins' primary prey species during the same period.

The information about the distribution and abundance of the cetacean species off the Romanian and Bulgarian Black Sea coast is scarce and most of the data werederived from stranding and opportunistic sightings during research cruises with other goals rather than cetacean sighting. It is difficult to foresee all negative consequences for the regional biodiversity, if cetaceans disappear as it has almost happened with the monk seal.

- ***Policy strategies/legislation***

The cetacean fauna in the Black Sea includes three subspecies – the Black Sea Harbour porpoise (*Phocoena phocoena relicta*), the Black Sea common dolphin (*Delphinus delphis ponticus*) and the Black Sea bottlenose dolphin (*Tursiops truncatus ponticus*). All three species are covered by various conservation designations including Annex IV of the European Habitats Directive and therefore require strict protection by EU member states (Table 4).

Table 4. Conservation designations having relevance to the protection of the Black Sea cetaceans ratified by Romania

Legislation	Description	Species Covered
Council Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Flora and Fauna (Habitats Directive)	The Habitats Directive provides protection to the habitats and European protected species listed in the Annexes through the provision of a network of protected sites (Special Areas of Conservation (SACs) and SPAs). This network is often referred to as Natura 2000. The Directive also provides special protection to European protected species where they occur outside of the boundary of a Natura 2000 site.	Black Sea bottlenose dolphin (Annex II; Annex IV – requires strict protection) Black Sea harbour porpoise (Annex II; Annex IV – requires strict protection)

	Conservation Objectives (referred to within Article 6(3) of the Habitats Directive) ensure that the European protected species identified as qualifying features of a Natura 2000 site remain or reach favourable condition (such as by maintaining the extent and distribution of habitats of qualifying features). This means that where a proposed development may affect a Conservation Objective of a Natura 2000 site, the design will need to include appropriate measures to ensure the Conservation Objectives are not adversely affected.	Black Sea common dolphin (Annex IV – requires strict protection)
Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1979)	The Bern Convention aims to ensure conservation of wild flora and fauna species and their habitats, particularly those that are endangered or vulnerable. Such species are specified in the appendices to the Convention. There should be consideration of the impact of a proposed development on the conservation of wild flora and fauna during the planning and development stages.	- Black Sea Bottlenose dolphin (Annex II; Revised Annex I of Resolution 6) - Black Sea harbour porpoise (Annex II; Revised Annex I of Resolution 6) - Black Sea common dolphin (Annex II)
Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979)	-The Bonn Convention aims to ensure the conservation of migratory species and their habitats by providing strict protection for endangered migratory species (listed in Appendix I of the Convention), concluding multilateral Agreements for the conservation and management of migratory species which require or would benefit from international cooperation (listed in Appendix II), and by undertaking cooperative research activities. -There should be consideration of the impact of a proposed development on the conservation of migratory species and their habitats during the planning and development stages.	Black Sea Bottlenose dolphin (Annex I) Black Sea harbour porpoise (Annex II) Black Sea common dolphin (Annex I; Annex II)
The Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area (ACCOBAMS).	This is an intergovernmental agreement to commit to the preservation of all species of cetacean and their habitat within the geographical Agreement area by the enforcement of stringent measures.	Black Sea bottlenose dolphin Black Sea harbour porpoise Black Sea common dolphin
Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish	The aim of the Agreement is to promote cooperation between countries in order to achieve and maintain a favourable conservation status for small cetaceans within the Agreement Area.	Black Sea bottlenose dolphin Black Sea harbour porpoise Black Sea common dolphin

and North Seas (ASCOBANS)		

Deliberate killing and taking out cetaceans from the wild is prohibited in Romania by the *Annual Prohibition Order* which also requires fishermen to release live cetaceans caught incidentally. Also, in 2004 the Action plan for conservation of cetaceans from Romanian Black Sea was adopted at the national level.

- ***Knowledge gaps***

- No existing spatial database for fishing areas and catchment;

- Data for aquaculture areas is not in spatial formats.

References

1. Birkun A. 2006. Consolidation of National Network for Cetaceans Monitoring and Conservation in Ukraine. FINS (the Newsletter of ACCOBAMS), 2 (2), 14.
2. Birkun, A. 2008. *Tursiops truncatus* ssp. *ponticus*. In: IUCN 2011. IUCN Red List of Threatened Species. 2008, Version 2011.1. www.iucnoedlist.org,
3. Birkun, A. Jr, Northridge S.P, Willsteed E.A, James F.A, Kilgour C., Lander M., Fitzgerald G.D. 2014. Studies for Carrying Out the Common Fisheries Policy: Adverse Fisheries Impacts on Cetacean Populations in the Black Sea. Final report to the European Commission, Brussels, 347p.
4. Güçlüsoy, H., Kýraç, C.O., Veryeri, N.O., Savaþ, Y. 2004. Status of the Mediterranean monk seal, *Monachus monachus* (Hermann, 1779), in the coastal waters of Turkey. E.U. Journal of Fisheries and Aquatic Sciences, 21(3-4), 201-210.
5. Kýraç, C., Savaþ, Y. 1996. Status of the monk seal (*Monachus monachus*) in the neighbourhood of Ereðli, Black Sea coast of Turkey. Zoology in the Middle East (Mammalia), 12, 5-12.
6. Öztürk, B., 1996. Past, present and future of the Mediterranean monk seal, *Monachus monachus* (Hermann, 1779) in the Black Sea. In: B. Öztürk (Ed.), Proceedings of the First International Symposium on the Marine Mammals of the Black Sea, pp. 96-101, Istanbul, Turkey, 27-30 June 1994. ACAR Matbaacilik A.Þ., Istanbul, 120pp.
7. Panayotova, M., Todorova V. 2015. Distribution of three cetacean species along the Bulgarian Black Sea coast in 2006-2013. J. Black Sea/Mediterranean Environment Vol. 21, No. 1: 45-53.
8. Radu G., Elena Radu, Maria Moldoveanu, E. Anton, 2002b - Cercetări privind starea populațiilor de delfini la litoralul românesc. *Sesiunea științifică "Un mediu pentru viitor",* București, 3-4 oct. 2002.
9. Radu G., Elena Radu, Maria Moldoveanu, E. Anton, 2003c - Cercetări privind starea populațiilor de delfini la litoralul românesc. (Research regarding the state of the dolphin populations at the Romanian littoral). *Un mediu pentru viitor*. Lucrări prezentate la Sesiunea Științifică din 3-4 oct. 2002 - București. Editura Promotal:195-198, ISBN 973-98568-2-9.
10. Radu G., S. Nicolaev, N.C. Papadopol, E. Anton, V. Maximov, I. Staicu, Elena Radu, 2004a - Results of the dolphin monitoring between 2001-2002. *Cercetări Marine - Recherches marines*, INCDM. ISSN: 0250-3069, **35**:191-204.
11. Radu G., Anton E., Nenciu M., Spînu D.A., 2013-Distribution and Abundance of Cetaceans in the Romanian Marine Area, "*Cercetări Marine*"Issue No. 43 Pages 320-341, 2013.
12. ORDER No. 374 from 3 September 2004 to approve of National Action Plan for conservation of cetaceans from Romanian Black Sea.
13. Raykov, V., 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.
14. Black Sea Commission, 2006/2007, State of Environment Report 2001 - 2006/7; State of Cetacean Populations 2007, *http://www.blacksea-commission.org/_publ-SOE2009-CH10.asp*.
15. Black Sea Transboundary Diagnostics Report 1996, *http://www.blacksea-commission.org/_tda2008.asp*.
16. Red Data Book of the Republic of Bulgaria, 2011, *http://e-ecodb.bas.bg/rdb/en/*.

17. Black Sea Red Data Book, *http://www.grid.unep.ch/bsein/redbook/index.htm.*
18. Boris Culik, 2010. Odontocetes. The toothed whales: "*Phocoena phocoena*". UNEP/CMS Secretariat, Bonn, Germany, *www.cms.int/reports/small_cetaceans/index.htm.*
19. IUCN 2015. IUCN Red List of Threatened Species, *www.iucnoedlist.org*.
20. Operational Program Environment 2007-2014, Project: "Field studies of the distribution of species / assessment of the status of species and habitats throughout the country- phase I ". Activity: Field studies of the distribution of marine mammals *Tursiops truncatus*, *Phocoena phocoena* and *Delphinus delphis* in EEZ in the Black Sea, *http://eea.government.bg/bg/bio/opos.*

3.1.1.2. Birds

The geographical location of Bulgaria on the western part of the Black Sea is an important precondition for its fauna features. Four biogeographical regions are included on its territory. Over the country passes Via Pontica - the second largest autumn migratory route in Europe, part of the Mediterranean/Black Sea Flyway, for raptors, storks, pelicans and a wide range of seabirds. Priority species include Yelkouan Shearwater (VU), the Mediterranean subspecies of the European Shag, the Common Tern (LC), Little Tern (LC) and Mew Gull (LC). Many birds not considered to be seabirds, as passerines, also fly over the Black Sea during migration.

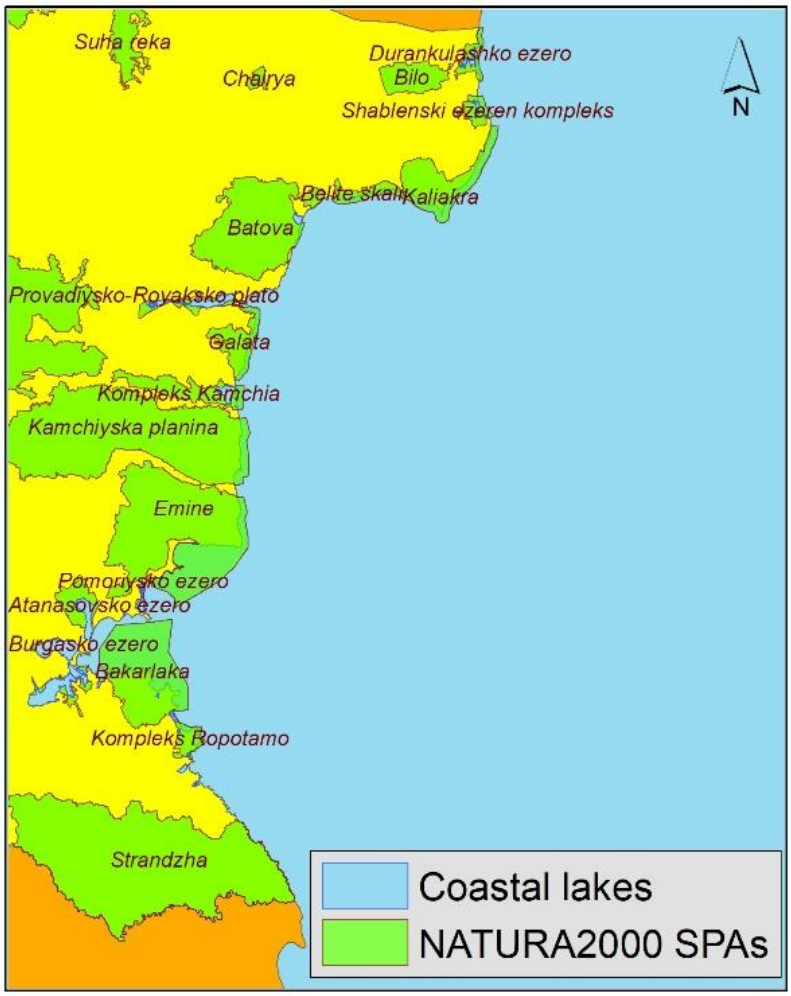


Figure 8. Important bird areas along the Bulgarian Black Sea coast (*Map produced by CCMS)*

The only currently known feeding area of the Yelkouan Shearwater in the Black Sea is in Emine Important Bird Areas (IBA), however breeding has not been found yet. The only known breeding colony in the Black Sea of the Mediterranean shag is found in the Kaliakra IBA. The biggest IBA in Bulgaria is Strandza encompassing 100,000 ha (Figure 8). The Ramsar sites along the Black Sea coast are ranked first in view of their importance on bird biodiversity, including Atanasovo Lake (145 species) and Shabla Lake (141 species), Vaya Lake of Burgas (115) as well as the lake complex of Varna and Beloslav (104).

All Important Bird Areas (IBA) were proclaimed as Natura 2000 Special Protection Areas in accordance with the Biological Diversity Act (SG No. 77/2002). The habitats diversity and climate along the Bulgarian Black Sea coast create conditions suitable for the nesting, migration and wintering for thousands of seabirds.

Unique places at continental level are the wetlands situated within the region of Burgas and its surroundings. Almost the whole European population of *Ciconia ciconia* pass through or spend nights within these regions. The same is valid for the representatives of *Pelecanus onocrotalus*, *Aquila pomarina* and *Falco vespertinus*. A site of great ornithological importance for the country is Srebarna Managed reserve for its populations of *Pelecanus crispus*. World importance have Shabla and Durankulak Lakes, also located along the North Bulgarian Black Sea coast (Table 5).

Table 5. Bulgarian Coastal Habitats for birds

Habitat	Species	Protected Species (SPEC)				Suitable Habitats for Bird Species	
		SPEC 1	SPEC 2	SPEC 3	Red Data Book for Bulgaria (2015)	Included in Annex 2 of the Birds Act	Listed in Annex 1 of the Birds Directive (2009/147/EC)
Atanasovsko Lake	288	19	28	80	84	105	103
Balchik	136	7	18	40	42	51	51
Bakarlaka	172	3	24	46	43	53	53
Belite Skali	91	4	16	28	27	40	39
Burgas Lake	245	9	26	69	71	89	80
Beloslav Complex	202	7	21	63	59	70	64
Chengene Skele	180	6	51	53	52	65	58
Durankulak Lake	260	14	27	69	72	95	91
Emine	218	8	29	59	73	79	73
Galata	178	1	22	50	34	61	59
Kamchiyska mountain	189	9	22	50	47	63	56
Kamchia Complex	237	7	25	69	53	82	76
Kaliakra	310	17	21	68	71	100	95
Mandra-Poda Complex	254	12	24	73	74	86	83
Pomorie lake	204	7	21	63	59	72	64
Ropotamo Complex	236	10	27	67	69	87	83
Shabla Lake	260	13	26	72	70	90	86
Strandzha	260	12	29	71	75	96	96

Bulgaria is among the six European countries with one of the highest number of bird species of European conservation importance. Hence, it reports 210 species out of 287 found on the whole continent.

Currently, anthropogenic pressure on sea bird populations over the Bulgarian part of the Black Sea coast is exerted through - forestry destroy and habitat loss/degradation/; coastal construction and development; agricultural intensification/pesticide use/drainage; erection of power lines and associated infrastructure; overfishing and accidental bycatch; invasive alien species; tourism; urbanization; oil and chemical pollution; solid waste dumping; water contamination; entrapment in sewage; wind turbines climate change.

The impact of climate change on biodiversity can be illustrated by the change in the number of wintering waterbirds in Bulgaria. In the past five years the number of wintering in Bulgaria bird species varied widely. Compared to the initial year of counting there is a decrease of more than 60% in the number of wintering birds In the short term, the number of birds recorded in 2012 is 46.87% less than in 2011. The variation in number mainly depends on the weather conditions in the country and to the north of it. In warmer winters with relatively high temperatures many waterfowl remain in the north. While in the winter period, there is a delay of the arrival of some wintering species due to the late cold snap. In recent years, there are changes in the number of some waterfowl mostly geese, ducks and grebes.

In Romania there is a total of 322 of bird species (most of them in the Danube Delta) (Figure 9). Migratory are 279 and waterbirds 120 *(http://datazone.birdlife.org/country/romania*).

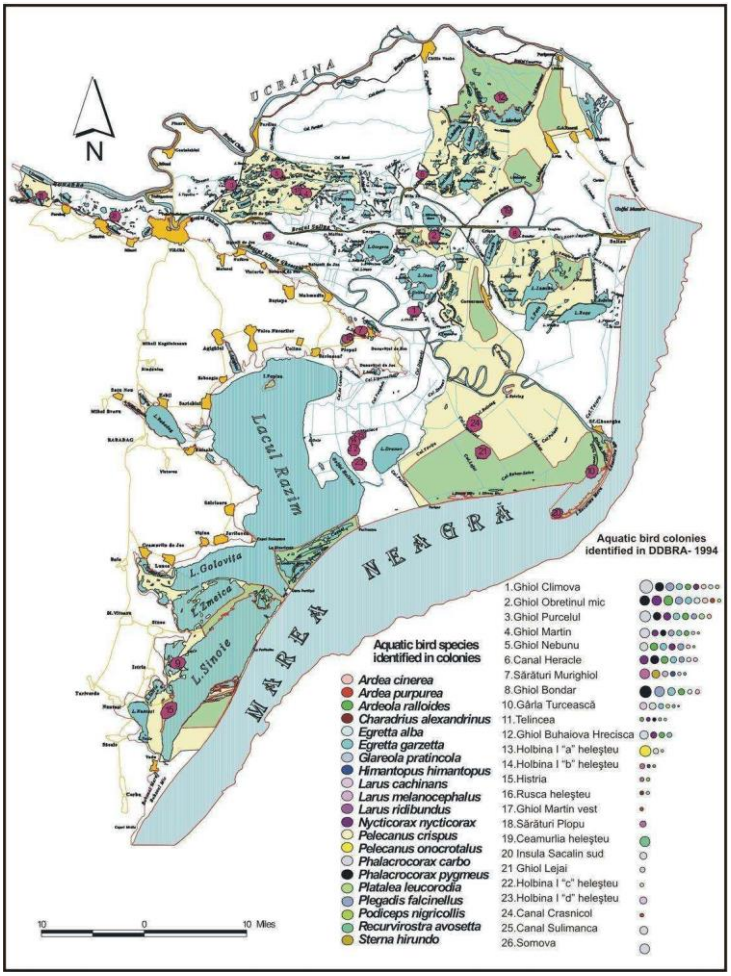


Figure 9. Danube Delta in Romania, area of 322 bird species, native and in passage (*produced by DDNIRD)*

The inventory of the bird species (marine and migrating) in Romania, realized on bibliographical studies, shown that there are 130 species inhabiting/using the research area listed in the annexes of Bern Convention (129), Bonn Convention (66), Bird Directive (53), Washington Convention (6), Black Sea Red Book (9) and un-official Romanian Red List (13). Regarding the status, according with IUCN criteria, 72 species are vulnerable and 1 species (*Pelecanus crispus*) is extinct. The area is used for nesting, wintering, and migration by the bird species with European importance. The area is part of the bird route migration "via-pontica". The Danube Delta, coastal lakes and RAMSAR zones, in both countries, are a real heaven for birds which have here a true point of their migration.

Numerous studies focused on the Danube Delta Biosphere Reserve have been conducted to approach waterbird particularities such as: habitat use, status, breeding success and disease outbreaks. However, the degree of knowledge is limited and highly fragmented, mainly due to the type of approach, hence a new kind of approach is required. A candidate solution could be landscape genetics, a multidisciplinary approach that combines spatial analyses, ecology and population genetics.

The measures proposed for the improvement the assessment and protection of coastal birds in Romania:

- Increasing the efficiency of the waterbirds / waterfowls monitoring system in the relevant sites for waterbirds species;
- Evaluate the breeding populations of the target species regularly regarding to get up-to-date knowledge about their trends;
- Considering the National Strategy for biodiversity the highest priority component of the national development strategies;
- Identify sites and habitats for migratory waterfowls occurring within their territory and encourage the protection, management, rehabilitation and restoration of these sites;
- Limiting the negative impact of the navigation on the waterbirds habitats;
- Exchange information and results from research, monitoring, conservation and education programmes.

References

1. Fisheries and Aquacultures Act, Prom. SG. 41 of 24 April 2001, Last amended SG. Issue 98 of November 27, 2018.
2. Shliakhov, V., Daskalov, G. 2008. BSC, 2008. State of the Environment of the Black Sea (2001-2006/7). Chapter 9 - State of Marine Living Resources. Black Sea Commission Publications 2008-3, Istanbul, Turkey, 419 pp.
3. Biological Diversity Act, 2002. Promulgated State Gazette No. 77/09.08.2002, last amended by State Gazette No. 61/11.08.2015.
4. Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds. OJ of the European Union, 26.01.2010:7-25.
5. Donchev, S. 1980. Bird migrations along Black Sea coast. – Ecology Sofia, 7: 68-84.
6. Doroșencu A., Onără D. F., Taflan E., Tošić K. , Marinov M., Ciorpac M., Suciu R., Alexe V., 2016, *An experimental design for assessing the genetic diversity of colonial waterbirds from the Danube Delta Biosphere Reserve (Romania)* Scientific Annals of the Danube Delta Institute Tulcea, România, Vol. 22, 2016.
7. Georgiev, G. 2010. Nature under protection, Publishing house Geya Libris, Sofia, pp.48-49.
8. Grimmett, R.F.A., Jones R.T.A. 1989. Important Bird Areas in Europe, ICBP Technical publication N9, Cambridge, ICBP, p. 888.

9. Gramatikov, M. 2005. The bottleneck sites in Bulgaria. – Inf. Bull. BSPB, 14: 7-8 (in Bulgarian). IBER – http://www.ecolab.bas.bg/main/field/atanasovsko_lake/ migration.
10. Iankov, P., D. Georgiev. 2007. "Galata". - In: Kostadinova, I., M. Gramatikov (eds.) 007. Important Bird Areas in Bulgaria and Natura 2000.Bulgarian Society for the Protection of Birds, Conservation Series, Book 11. Sofia, BSPB, p. 331-333.
11. Kostadinova, I. (Ed.) 1997. Important Bird Areas in Bulgaria. BSPB Conservation Series, Book No 1. Sofia (Bulgarian Society for the Protection of Birds). 176 p. (In Bulgarian).
12. Kostadinova, I. 1999. BirdLife International programme for important bird areas and the place of Srebarna biosphrere reserve in the European network of IBAs. At "Srebarna biosphere reserve – a key site of the European ecological network, 25-26 09.1999, Vetren, Seminar proceedings.
13. Kostadinova, I., Gramatikov M. (Eds.). 2007. Important Bird Areas in Bulgaria and Natura 2000. Bulgarian Society for the Protection of Birds, Conservation Series, Book 11, Sofia, BSPB, 639 p.
14. MOEW 2014. Ministry of Environment and Waters – Natura 2000. Available at: http://www.moew.government. bg/?show=top&cid=182.
15. Michev, T., Profirov, L., Karaivanov, N., Michev, B. 2011. Migration of soaring birds over Bulgaria. – In: International conference "The Birds of Prey and Owls of Caucasus, 26-29 October 2011, Tbilisi, Abastumani, Georgia, (abstract).
16. Michev, T., Simeonov, P. 1981. A contribution to studying of autumn migration of some waterbirds and raptors at Burgas (13-23. IX. 1978). – Ecology Sofia, 8: 43-48 (In Bulgarian, English summary).
17. Michev, T., Iankov, P.1994. Ornithofauna. At National strategy for biodiversity protection. Main collection of papers, Volume I, Ministry of the Environment and Water, Sofia, pp.585 – 614.
18. Michev, T., Iankov, P.1995. The Bulgarian Ornithofauna. – In: Meini K. (Ed.): Bulgaria's Biological Diversity: Conservation Status and Needs Assessment v. I and II, Washington, D. C.: Biodiversity Support Program, 503 p.
19. Povvik, A. D. 2011. Appropriate Assessment of National Action Plan for Wind Energy. http://www.mi.government.bg/bids.
20. Roberts, J. 1978. Observations on migrant and winter wildfowl populations on the Bulgaria Black Sea coast. – IWRB Bull. 45: 19-27.
21. Roberts, J. 1979. Observations of the migration of raptors and other large soaring birds in Bulgaria, 1975-1978. – Ibis, 121: 301-312.
22. Shurulinkov, P., Tsonev, R., Nikolov, B., Stoyanov, G., Assenov, L. 2005. The Birds of Middle part of Danube plain. Federation Green Balkan, Sofia, 120 pp. (In Bulgarian).
23. Simeonov, S., Michev, T., Nankinov, D.1990. The Fauna of Bulgaria, vol. 20, Aves. Part I. Publ. House of BAS, C., 350 pp. (In Bulgarian, English summary).
24. Zalles, J. I. Bildstein K. L. (eds.): 2000. Raptor-watch: A global directory of raptor migration sites. Cambridge, UK and Kempton, PA, USA. (BirdLife Conservation Series No. 9).
25. Information system for protected areas of Ecological Network NATURA 2000 *http://natura2000.moew.government.bg/.*
26. Red Data Book of the Republic of Bulgaria (Digital edition), *http://www.e-ecodb.bas.bg/rdb/en/.*
27. Black Sea Red Data Book *http://www.grid.unep.ch/bsein/redbook/index.htm.*
28. Birds in Europe: Their Conservation Status" (BirdLife International, 2004), *http://www.birdlife.org/community/2011/01/birds-in-europe-their-conservation-status.*
29. Red Data Book of the Republic of Bulgaria Digital edition, *http://www.e-ecodb.bas.bg/rdb/en/.*
30. , Biological diversity act, http://old.europe.bg/upload/docs/CONF_BG_02_03_ad12.pdf

3.1.1.3. Fish (species, distribution, population, trends)

- ***Socio-economic trends***

The composition of the Black Sea ichthyofauna has changed in response to the alterations of the living conditions in the sea. Some of the changes had an impact on coastal and shelf waters; others, on the pelagic zone, affecting common and rare species, juveniles and adults, commercial and non-commercial species.

Two types of water bodies are included in the Bulgarian part of the Black Sea: coastal lakes and tributaries. In Romania is a similar situation, including the Danube Delta with wetlands, lakes and lagoons.

The ichthyofauna is represented by 87 species, divided into 2 categories: 48 are fresh waters permanent residents and 39 species are immigrants from the sea, which reside temporarily in the lakes and rivers. In the rivers of the Black Sea Basin a total of 75 species are found. Of these, 47 are permanent residents, and other 28 reside temporarily in the rivers after entering from the sea. About 18 lakes are situated along the Bulgarian Black Sea coast. A total number of 79 fish species are found in these lakes - 50 of them are permanent *http://msp-platform.rmri.ro/downloads/2018%20Eforie%20Case%20Study.pdf,* http://msp-platform.rmri.ro/downloads/2018%20Eforie%20Case%20Study.pdf while others are regularly or occasionally migrants from the sea for feeding.

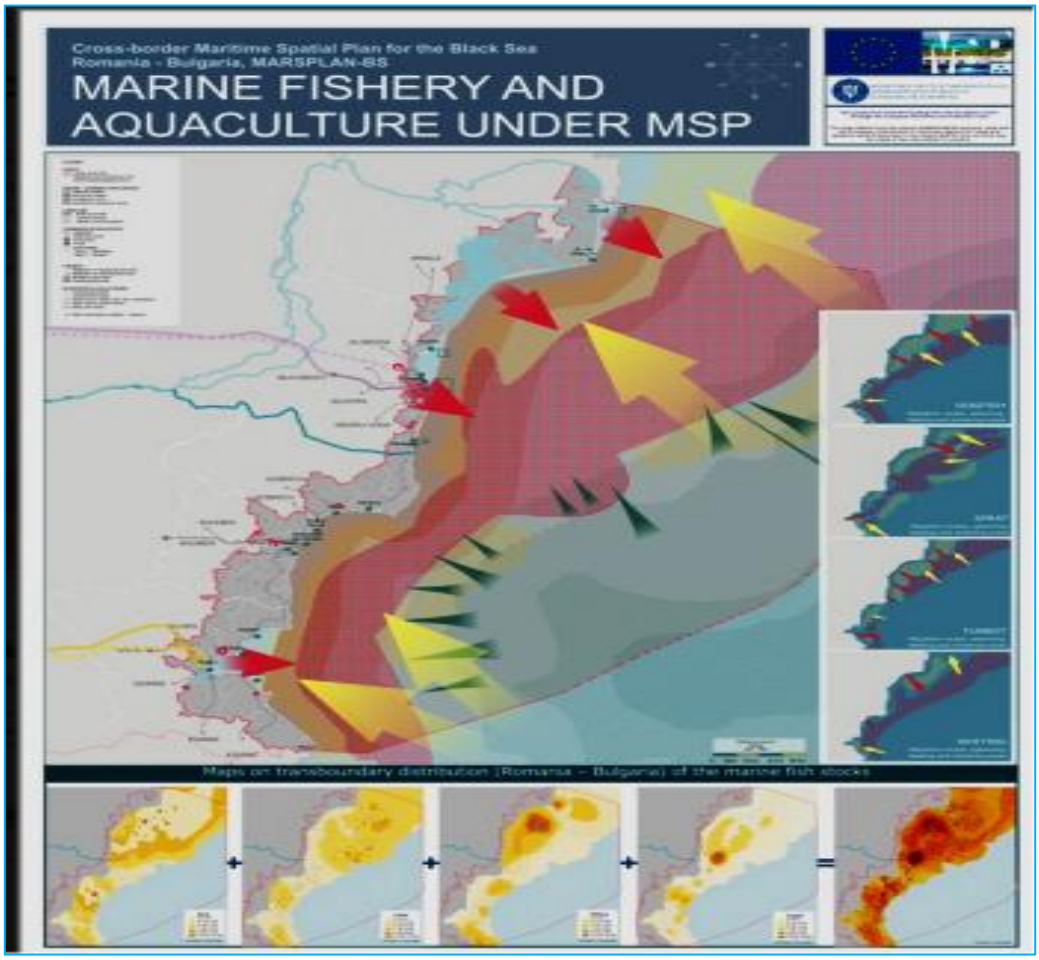


Figure 10. Sampling network for fish stocks distribution: *http://www.marsplan.ro/en*

In Romania in the coastal-marine waters are around 133 species, out of which 58 are marine, 31 are brackish and 44 are freshwater (Table 6,7 and 8).

In terms of commercial value, the most important pelagic species are: European anchovy (*Engraulis encrasicolus*), Mediterranean horse mackerel (*Trachurus mediterraneus*), European sprat (*Sprattus sprattus*), Atlantic bonito (*Sarda sarda*) and bluefish (*Pomatomus saltatrix*) (Figure 10).

Table.6. Key pelagic fishes

Fish species	Distribution	Stock Assessment	Environmental impact and effect
Black Sea anchovy *Engraulis encrasicolus*	Over the entire Black Sea is subject to intensive commercial fishery. Wintering grounds (October-November), forms dense wintering concentrations until March. The food availability dictates the adults' distribution during the summer in the Romanian and Bulgarian waters.	The assessment of anchovy stock in the Black Sea has been done by Scientific, Technical and Economic Committee for Fisheries (STECF-EWG-15-16). In Bulgaria anchovy catches represent less than 1% of the total anchovy catch in the Black Sea.	With a key role for the throphic web in Black Sea as one of main zooplankton consumers. Has role of important prey species for piscivorous predators. By the end of the 1980s, the food competition with and predation by the invasive ctenophore *M. leidyi*, combined with the excessive fishing led to a catastrophic reduction of the Black Sea anchovy stock.
Sprat *Sprattus sprattus*	Distributed over the whole Bulgarian and Romania Black Sea area. Maximum abundance in the northwestern Bulgarian region, Romanian all coast and shelf waters of the Black Sea.	Commercially important and abundant pelagic fish species in the both countries also an important food source for the larger fish. The assessment of sprat stock in the Black Sea has been done by STECF-EWG-15-12 (STECF, 2015). The sprat is also an important food source for larger fishes.	During the *M. leidyi* outbreak the heavy overfishing aggravated the stock depletion. Also, the jellyfish *A. aurita* presence in deeper waters has a strong trophic interference with sprat. Intensification of the fishery in the last years has impacted the sprat stocks as well.

Horse mackerel *Trachurus mediterraneus*	A migratory species distributed all around the Black Sea. In the spring, it migrates to the north for reproduction and feeding. In the summer, it is distributed preferably in the shelf waters above the seasonal thermocline. In the western part of Bulgarian Black Sea is tipical larger forms aggregation (Cape Shabla, Cape Kaliakra and Balchik). In Romanian waters could be found at the end of summer, August and September	The assessment of stock in the Black Sea was accomplished by the STECF-EWG-15-12 on base of available official data of riverine countries.	The influence of the commercial fishery is a factor which directly devastated significant part of the species populations. The Black Sea pollution led to an ecological disequilibrium. The pressure of predator *M. leidyi* led to sharp decline in *Oithona* species and that it affected the survival of horse mackerel.

Table 7. Key demersal fishes

Fish species	Distribution	Stock Assessment	Environmental impact and effect
Whiting Merlangius merlangus	Rarely a target species in Bulgaria and Romania It is one of the most abundant species among the demersal fishes in the Black Sea. Do not realize long migrations, in the cold season spawns within the whole sea. Produces pelagic juveniles, which inhabits the upper 10-meter water layer for a year. The adult whiting is cold-living species at temperatures 6-10^{0}C	The stock status in the Black Sea in according to research bellow (STECF-15-16) The main transboundary threats are: Illegal fishing and the use of the destructive harvest techniques. Illegal fishing impact - in the context of the use of destructive harvest techniques by trawls due to high by-catch capture rate of the year 0+ small-sized populations is a real threat.	The alterations of trophic flow structure due to eutrophication induced effects in the ecosystem may be critical for whiting populations because zooplankton, small pelagic fishes and benthos organisms are among their important diet. In turn, whiting is an important prey species for large predators, dolphins and fish-consuming birds. Juveniles of Whiting and bottom-dwelling whiting at age less than 2 years old distributed mainly in shallow depths are the most

			vulnerable for eutrophication effects.
Picked dogfish *Squalus acanthias*	Inhabits the whole Black Sea shelf at water temperatures 6^0C-15^0C. Abundant wintering concentrations of picked dogfish are observed at depths from 70-80m to 100-120m in Romanian and Ukrainian grounds of whiting and sprat concentrations. Reproductive migrations of picked dogfish take place in spring and autumn at coastal shallows 10-30m depths Two peaks of birth of juveniles can be distinguished - in spring (April-May) and during the summer - autumn (August-September).	Picked dogfish stock status in the Black Sea according to the research bellow (STECF-15-16) The catches of the long-lived and relatively unproductive species, for the mentioned period, are very low compared to the past and the stock appears to be severely depleted (STECF, 2015). Not a target species of fisheries. During their wintering period are mostly caught as by-catch in trawl and purse seine operations	The causes of reduction of picked dogfish stock is related to the changes in the Black Sea ecosystem due to pollution from land based sources (rivers) and direct discharges (inshore area) and subsequent progressive deterioration of reproductive ability of females. As a long - living predator as compared with other fishes in the Black Sea, picked dogfish has the ability to accumulate toxic pollutants such as the heavy metals (mercury, arsenic, lead, copper, cadmium and zinc) and chlorine organic compounds (including its metabolites, polychloride biphenyls, etc.
Turbot *Psetta maxima*	Occurs all over the shelf of the Black Sea. Large-sized fish with long life cycle. Larvae and fries in the first two months inhabit in the pelagic zone, mainly at Romanian coast, feeding on zooplankton. Adults feed on fish mainly, both on demersal (whiting, red mullet and gobies), and with pelagic species (anchovy, sprat, horse mackerel, shad). Not undertake transboundary distant migrations Local migrations (spawning, feeding and wintering) have a general direction from the open	The stock status of the turbot in the Black Sea in according to the research below (STECF-15-16) Along the Bulgarian Black Sea coast- an abundant species, representing a substantial share of the Bulgarian commercial sea catches, less in Romania where ships of other countries use to come and illegaly fish. Because of this it needs management measures	Turbot is one of the most valuable fish species in Black Sea. Like for many demersal fish species, the serious problem for estimating the status of turbot population and justifying efficient measures for its fisheries regulation is considerable difference between the recorded statistics and the real catches. The expert assessments are not complete, as they included only the unregistered turbot by-catch during sprat fisheries and poaching (illegal) catches. The main threats on turbot resources in the

	sea towards the coast or from the coasts towards offshore. Inhabits the waters of Bulgaria and Romania during the maturation period of 3- 5 years. Spawns in spring- late March, late-June, at water temperature range 8^0-12^0C. The peak of spawning occurs in May at depths from 20 m to 60 m.		Black Sea are Illegal fishing and use of destructive harvest techniques. In the broad sense it is not only poaching but deliberate avoidance of adopted measures of regulation by fishermen. This threat is of social and economic character, and not easy to reduce it. An almost equivalent, in expert's opinion, threat is the lack of regional cooperative management of fisheries.
Red mullet *Mullus barbatus*	Distributed in the entire Black Sea shelf - it is customarily distinguished in two particular forms - settled and migratory ones. Migratory form has the greater commercial value. Along the coasts of Romania and Bulgaria in September-November Red mullet migrates to the Turkish waters of the Black Sea and Sea of Marmara for wintering.	The stock status of the Red mullet in the Black Sea is according to the research (STECF-15-16) Catches of red mullet in EU waters are taken primarily by Bulgaria (314 t during 2014, 28.3% of the Black Sea total).	There is also thought to be overfishing in the Black Sea. The fish has been listed by the International Union for Conservation of Nature as being of "*least concern*" - it has a wide range, occurs at high depths and is expanding its range northwards as a result of rising sea temperatures.

Table 8. Key anadromous fishes

Fish name	Distribution	Stock Assessment	Environmental impact and effect
Pontic shad *Alosa immaculata*	There are two populations of Pontic shad- Don and Danube ones - inhabit in the Azov and Black Seas. The Danube populations wintering in the western part of the sea. The Danube population migrates into the Danube, Dnieper and Dnestr Rivers for spawning during spring	Stocks of anadromous fishes are formed mainly by the Danube populations. The overfishing is mainly in the area of the Danube Delta area affects the success of the Danube shad reproduction.	The three main threats for anadromous fishes are as follows: -loss of valuable spawning and nursery habitats in rivers and lagoons; -modification in river flow regimes; -illegal fishing and use of destructive techniques for harvesting.

Russian Sturgeon *Acipenser gueldenstaedtii* **Starred Sturgeon** *Acipenser stellatus* **Beluga** *Huso huso*	All of anadromous sturgeons make extended migrations during their life from the sea into the rivers; larvae drift after hatching and juveniles in rivers; and back into the sea after completion of spawning. Major part of the adult sturgeon populations (*A. gueldenstaedtii A.s stellatus, Huso huso*), in the sea come from the Danube and Dnieper population.	In the past, the species was found frequently in the Danube River and along the Bulgarian Black Sea coast. In recent years, its abundance has declined considerably. In the period 2002-2005 alone, its annual catch in the Danube and the Black Sea has decreased. In Bulgarian Black sea part, all sturgeon species have drastically decreased in number.	All the species from the families *Acipenseridae* since 1998 are on the list of species under the Convention of International trade with endangered species of the wild flora and fauna (CITES Appendix II /Notification to the Parties No. 1998/13 Conservation of Sturgeons). In the International Red Book from 2010 (The IUCN Red List of Threatened Species. Version 2019-2) in category "critically endangered" are included all species of sturgeons inhabiting Bulgarian sea waters.

The three main threats anadromous fishes are as follows: loss of valuable spawning and nursery habitats in rivers and lagoons; modification in river flow regimes; illegal fishing and use of destructive harvest techniques.

- ***Policy strategies/legislation***

In the Danube River and Black Sea, the commercial fishing was prohibited from April 2007 to April 2016. Sturgeons, for reproduction, are fished in the areas recommended by CITES, for a period of 45 days between 1 March and 15 April every year.

In 1986, Romania declared as Exclusive Economic Zone (EEZ) an area of the Black Sea of 25,000 km^2. However, for fishing in the Black Sea region, as stipulated in the UN Convention on the Law of the Sea, defined in particular by the International Court's decision in 2009 on the disputes with Ukraine on the marine platform, the EEZ is extend to 29,000 km^2.

References

1. Alexandrov B. 2004. Problem of aquatic organisms' transportation by ships and some approaches for risk assessment of the new invasions. Marine Ecological Journal 3 (1): 5-17. (in Russian).
2. Berg, L. S. 1948. Freshwater fishes of the USSR and adjacent countries. Vol 1, 1-466 (In Russian).
3. Bloesch, J., Jones, T., Reinartz, R. et al. Österr. Wasser- und Abfallwirtschaft (2006). 58: 81. https://doi.org/10.1007/BF03165708 DOI https://doi.org/10.1007/BF03165708. Springer-Verlag. ISSN 0945-358X. Online ISSN 1613-7566.
4. Grishin A. et al. (2007). Influence of gelatinous zooplankton on fish stocs in the Black Sea: analysis of biological time-series. Marine Ecological Journal, 6(2), Sevastopol, 5-24.
5. Daskalov, G. 1998. Pêcheries et changement environmental à long-term en mer Noire. PhD thesis. Centre d'océanologie de Marseille, Univ. Aix-Marseille II (in French).
6. Daskalov G. M. 2002. Overfishing drives a trophic cascade in the Black Sea. Marine Ecology Progress Series 225: 53- 63.
7. Daskalov G, et al., 2007. The Black Seas fisheries and ecosystem change: discriminating between natural variability and human-related effects. In: Proceedings of the Fourth World Fisheries

Congress: Reconciling Fisheries with Conservation (Ed J. Nielsen, J. Dodson, K. Friedland, T. Hamon, N. Hughes, J. Musick and E. Verspoor). American Fisheries Society Symposium 49, 587–602.

8. Kopralev I, Yordanova M, Mladenov Ch (Eds.) (2002). Geografiya na Balgariya. Fizicheskageografiya. Sotsialno-ikonomicheska geografiya [Geography of Bulgaria. Physical Geography.Socio-Economic Geography]. ForCom, Sofia (in Bulgarian).
9. Serobaba I.I., et al., 1988. Commercial Fishery Description of the Black Sea (section Characteristics of the commercial species - Description of fishing grounds). AzcherNIRO, Publishing House of the Chief Department of Navigation and Oceanography of the Ministry of Defense for the Ministry of Fisheries of the USSR, 48-96 (in Russian).
10. Prodanov K, Mikhailov K, Daskalov G, Maxim K, Chashchin A, Arkhipov A, Shlyakhov V, Ozdamar E (1997). Environmental management of fish resources in the Black Sea and theirrational exploitation. Studies and Reviews. GFCM. 68, FAO, Rome, 178pp.
11. Radu G, Nicolaev S, Radu E, Anton E (2006). Evolution of main indicators of marine living resources from the Romanian Black Sea sector in 2004 and 2005. 1 st Bilateral Scientific Conference. “Black Sea Ecosystem 2005 and Beyond” 8-10 May 2006, Istanbul, Turkey.\
12. Radu, G., Anton E., Golumbeanu M., Raykov V., Yankova M., Panayotova M., Shlyakhod 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.
13. Shliakhov V, Daskalov G (2008). BSC, 2008. State of the Environment of the Black Sea (2001-2006/7). Chapter 9 the state of marine living resources. Black Sea Commission Publications 2008-3, Istanbul, Turkey, 419 pp.
14. Shushkina EA, Musaeva EI (1990). Structure of the plankton communities in the epipelagic zone of the Black Sea. Oceanology, 30(2), 306-310 (in Russian).
15. Vinogradov ME, Shushkina EA, Nikolaeva GG (1993). State of zoocenoses in the open areas of the Black Sea in late summer 1992. Oceanology, 33(3), 382-387 (in Russian).
16. Black Sea Commision- State of Environment Report 2001- 2006/7, Chief Editor, Prof. Dr. Temel Oguz, Institute of Marine Sciences, Middle East Technical University, Erdemli, Turkey, *http://www.blacksea-commission.org/_publ-SOE2009-CH9.asp*.
17. NatureServe (2013). *"Mullus barbatus"*. *IUCN Red List of Threatened Species. Version 2014.3. International Union for Conservation of Nature*. Retrieved 15 December 2014.
18. Report of the scientific, technical and economic committee for fisheries STECF advice for sprat and turbot in the Black Sea, *https://stecf.jrc.ec.europa.eu/documents/43805/55543/0710_Black+Sea+advice+for+sprat+and+turbot.pdf.*
19. Red data book of Bulgaria Turbot, *http://e-ecodb.bas.bg/rdb/en/vol2/Psmaxima.html.*
20. Russian Sturgeon, Red data book of Bulgaria, *http://e-ecodb.bas.bg/rdb/en/vol2/Acguelde.html.*
21. Beluga Red data book of Bulgaria, *http://e-ecodb.bas.bg/rdb/en/vol2/Acguelde.html*.
22. Huso huso. The IUCN Red List of Threatened Species. Version 2019-2. *https://www.iucnoedlist.org/species/IUCN* (International Union for Conservation of Nature) 2010

3.1.1.4. Fish Spawning Ground and Nursery

The commercial fish stocks depend upon availability of wintering, forage resources and undisturbed spawning and nursery grounds. A crucial role in the reproduction of fish stocks has the quality of nursery and spawning grounds.

Dams and hydraulic structures construction kept the anadromous species, like sturgeons, away from their natural spawning grounds in the estuaries of the Danube and Dnipro Rivers.

Currently, these anadromous fish species depend on industrial breeding. Main spawning grounds and spawning seasons of some Black Sea fishes are presented in the Table 9.

Distribution areas for the fish species present in commercial catches were defined on the basis of available information for Romanian littoral, i.e. data from scientific surveys (in the last 15 years have been undertaken more than 45 scientific surveys for determination of the abundance and distribution of eggs, larvae, juveniles and fishing agglomerations), information on catches and landings, as well as other types including indirect and bibliographic information and expert estimates.

Table 9. Main fish species and their spawning grounds and spawning seasons (*www.marsplan-bs.ro)*

Family	Fish (scientific name)	Fish (EN name)	Spawning grounds /Spawning seasons
Acipenseridae	*Acipenser gueldenstaedtii* Brandt & Ratzeburg, 1833	Russian sturgeon	Depending on the period of the year it could be found in different habitats. During the reproduction period, it migrates upstream the large rivers, otherwise it inhabits the open sea, coastal areas and estuaries. Spawning occurs in April–May at water temperature of 12–15°C.
Acipenseridae	*Acipenser stellatus* Pallas, 1771	Starry sturgeon	During the reproduction period, it is found in permanent large rivers, and during the rest of the period – in open sea, coastal areas and estuaries. Spawning lasts from April through September, in deep water with strong current and sandy and gravel bottom.
Acipenseridae	*Huso huso* (Linnaeus, 1758)	Beluga	During the reproduction period, it is found in permanent large rivers, and during the rest of the period – in open sea, coastal areas and estuaries.
Atherinidae	*Atherina pontica* (Eichwald,1831)	Black Sea Silverside	Coastal area up to a depth of 20 m and lakes (May-August).
Belonidae	*Belone belone* (Linnaeus, 1761)	Black Sea garpike	Coastal area (April-September).
Carangidae	*Trachurus mediterraneus ponticus* Aleev,1956	Black Sea horse Mackerel	(June-August).
Clupeidae	*Sprattus sprattus* (Linnaeus,1758)	European sprat	Spawns throw in few portions, almost year-round, from late July to May.
Clupeidae	*Alosa immaculata* Bennett, 1835	Black Sea shad	An anadromous fish. It winters in the sea, and enters the big rivers for spawning (April-July).
Clupeidae	*Alosa fallax* Lacepede, 1803	Twaite shad	An anadromous fish. It winters in the sea, and enters the big rivers for spawning (April-June).
Clupeidae	*Alosa caspia* Eichwald, 1838	Caspian shad	An anadromous fish. It winters in the sea, and enters the big rivers (Dnieper, Dniester, and Danube) for spawning (April-June).
Clupeidae	*Alosa maeotica* Grimm, 1901	Black sea shad	Spawning occurs from April to the middle of June, most likely in the brackish waters in the western parts of the Black Sea and the Sea of Azov.

Engraulidae	*E. encrasicolus ponticus* Aleksandrov,1927	Black Sea anchovy	(May –August).
Gadidae	*Merlangius merlangus* Linnaeus,1758	Whiting	Breed almost throughout the year, as during the summer months at a depth of about 40 m, and in winter in nearby coastal area.
Gobiidae	*Mesogobius batrachocephalus* Pallas,1814	Knout goby	Coastal area (February-May).
Gobiidae	*Neogobius melanostomus* Pallas,1814	Round goby	Coastal area (April-September).
Gobiidae	*Neogobius ratan* Nordmann, 1840	Ratan goby	Coastal area, breeds from the end of March to the end of May, and usually spawns two times in this period. The eggs are deposited in between and under stones near shore.
Gobiidae	*Knipowitschia caucasica* Berg, 1916	Caucasian goby	Spawning takes place in shallow coastal areas over sandy or muddy-sandy bottom with some vegetation. In the Black Sea region the species spawns from March to the end of July.
Gobiidae	*Neogobius gymnotrachelus* Kessler, 1857	Racer goby	Coastal, brackish waters (coastal lakes, river-mouths) with salinity less than 2‰ and freshwaters. It prefers sandy, rocky and muddy bottoms. (April-June).
Gobiidae	*Zosterisessor ophiocephalus* Pallas, 1814	Grass Goby	Coastal area (April-July).
Gobiidae	*Gobius cobitis* Pallas, 1814	Giant goby	Marine species, which does not enter in fresh or brackish waters. It stays close to the shore, down to 10m depths, in between and under the rocks. The breeding period extends from March to the beginning of July.
Gobiidae	*Gobius paganellus* Linnaeus,1758	Rock goby	Coastal sub-littoral area, under stones or among algae on rocky substrates. Spawning is portioned from March to mid-May.
Gobiidae	*Gobius niger* Linnaeus, 1758	Black goby	Estuaries, lagoons and coastal sea waters, in depths from 0.5 down to 50-75 m, over muddy or sandy bottoms, among shells and algae. *Gobius niger* breeds in portions from April to September**,** depositing small eggs under stones and shells.
Mugilidae	*Liza ramada* Risso,1810	Thinlip mullet	Open sea (October-November).
Mugilidae	*Liza aurata* Risso, 1810	Golden grey mullet	Coastal area and open sea (August-October).
Mugilidae	*Liza saliens* Risso, 1810	Leaping mullet	Open sea (August-September).
Mugilidae	*Mugil cephalus* Linnaeus, 1758	Thicklip grey mullet	Open sea (June-September).
Pomatomidae	*Pomatomus saltatrix* Linnaeus,1766	Bluefish	Main breeding areas of bluefish are located in the northwest Black Sea and in front of the Crimean coast. Small groups of the population of the species breed in the waters in the Bulgarian Black Sea. Coastal area and open sea (July-September).

Scombridae	*Sarda sarda* Bloch, 1793	Atlantic bonito	Shallow waters (June).
Squalidae	*Squalus acanthias* Linnaeus, 1758	Piked dogfish	For spawning the pike dogfish approaches the coast to depths of 25–40 m (April- May).
Scombridae	*Sarda sarda* Bloch, 1793	Atlantic bonito	Shallow waters (June).
Soleidae	*Solea nasuta* Pallas,1814	Sand sole	Coastal area (May-September).
Gobiidae	*Mesogobius batrachocephalus* Pallas,1814	Knout goby	Coastal area (February-May).
Squalidae	*Squalus acanthias* Linnaeus, 1758	Piked dogfish	For spawning the pike dogfish approaches the coast to depths of 25–40 m (April-May).
Mullidae	*Mullus barbatus* Linnaeus, 1758	Red mullet	Coastal area (June-September).
Scophthalmidae	*Psetta maxima* Linnaeus 1758	Turbot	Spawning occurs at water temperature of 8-16 °C, from the middle of April to the middle of June, for spawning the turbot approaches the coast to depths of 10–30 m.

In the north-western and western continental shelf of the Black Sea, along the coast of Bulgaria, Romania and Ukraine the main spawning grounds of the The European anchovy (*E. encrasicolus)* are distributed. Spawning is between May and August. Spawning activity is also thought to take place in coastal waters in the southern Black Sea. Near the surface, at depths of 10 to 20 m, spawns the European sprat (*Sprattus sprattus*) after its seasonal migrations between inshore feeding grounds and offshore spawn grounds. Whiting (*Merlangius merlangus*) occurs along the shelf at depths 60-120 m and sometimes up to 150 m. It not undertakes long migrations, instead spawning during the winter season within its habitat area. The turbot (*Psetta maxima*) according to the annual surveys carried out in both Bulgaria and Romania is distributed all along the continental shelf with the largest abundance in water depths between 50 and 75 m. Adults migrate to shallow waters and aggregate during the spawning period in spring after which they move into deeper waters (100 m to 140 m). In the north-western and western continental shelf regions of the Black Sea, are situated the main spawning and feeding grounds of horse mackerel. During the autumn (September to November) they migrate along the coastal waters to wintering grounds - in the coastal waters of Turkey, Georgia, Russia and the Crimea Peninsula. They migrate back to feeding and spawning grounds in the spring (Mid-April). Peak spawning in the Bulgarian Black Sea Coast falls between June-August.

References

1. Karapetkova, M., Zhivkov, M. 2006. The Fishes of Bulgaria. Sofia, Gea Libris Publ. House, 2006, 216 (in Bulgarian).
2. Radu, G., Anton E., Golumbeanu M., Raykov V., Yankova M., Panayotova M., Shlyakhod 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.
3. STECF 2012, Daskalov G., C. Osio A., Charef (eds.) Aysun Gümüş, Zengin M., Panayotova M., Duzgunes E., Shlyakhov, V., Genç, Y., Radu G., Yankova M., Maximov V, Mikhaylyuk A, Raykov V. 2012. Assessment of Black Sea Stocks (STECF-12-15). Scientific, Technical and Economic Committee for Fisheries (STECF), European Commission, Joint Research Centre, Institute for the Protection and Security of the Citizen. ISBN 978-92-79-27208-0, doi: 10.2788/63715. http://stecf.jrc.ec.europa.eu.

4. Yankova, M., Raykov V. 2009. Resent investigation on population structure of Horse mackerel (*Trachurus mediterraneus ponticus* Aleev., 1956) in the Bulgarian Black Sea coast. Proceedings of the Institute of Fishing Resources Varna, Volume 27, 39-46.
5. Yankova, M. 2011. General Reproductive Biology of Horse Mackerel *Trachurus mediterraneus* in the Bulgarian Black Sea Coast. Animal Diversity, Natural History and Conservation, Daya Publishing House, New Delhi, (Edited by V. K.Gupta), Vol. 1., 241 - 247. ISBN: 978-81-7035 – 752 - 0.
6. The State of the Environment of the Black Sea: Pressures and Trends 1996-2000 Report, BSC, *http://www.blacksea-commission.org/_publ-SOE2002-eng.asp#_Toc39914649.*
7. Appendix 15.1: Fisheries Study. South Stream, *https://www.southstreamtransport.com/media/documents/pdf/en/2014/07/ssttbv_bg_esia_151_web_en_303_en_20140728.pdf.*
8. Appendix 15.1: Fisheries Study. South Stream report, URS-EIA-REP-202375. *https://www.southstreamtransport.com/media/documents/pdf/en/2014/07/ssttbv_bg_esia_151_web_en_303_en_20140728.pdf.*

3.1.1.5. Shellfish (species, distribution, abundance, trends)

Overfishing in the World Ocean including the Black Sea, as well as the global pollution led to a reduction in the quantity of industrial fish species. Due to the occurring changes the focus of fishing organizations and companies has shifted to harvesting some non-fish resources of economic importance. The catches help meet both the domestic market needs and increase the export list of some other marine resources. The main shellfish in the Bulgarian and Romanian Balck Sea and the mussels' stocks evolution at the Romanian coast are shown in the Table 10 and Figure 11.

Table 10. Main shellfishes in the Bulgarian and Romanian Black Sea areas

Country	Species	Assessment area	Distribution	Status /abundance	Trends
BG	Mediterranean/ Black mussel *Mytilus galloprovincialis*		Most widespread along the Bulgarian Black Sea coast at depth up to 65 m.	It is the most abundant in the NW part of the basin. From the mid-70s, its biomass varied between 8 and 12 million tonnes.	The oxygen deficiency in the near-bottom water layer led to the massive death of bottom organisms. This led to a rejuvenation of the mussel population as compared with the period before 2010.
RO	*Mytilus galloprovincialis* - mussel	BLK_RO_RG_MT01 –shelf area	Shelf area, mainly on the soft sediments (mud) forming biogenic reefs between 30 and 60 m depths. Mussels occur on the hard rock substrate, too.	Abundances ranging between 30 ind/m^2 (2015) and 1200 ind/m^2 in 2011. Biomass values ranged between 10 g/m^2 (2018) and 1000 g/m^2 (2011). Not assessed on infralittoral rock	Population trend was clearly increasing in the period 2009-2011, sharply declining after 2011, on circalittoral sediments. Not assessed on infralittoral rock

RO	*Lentidium mediterraneum*	BLK_RO_RG_TT03 BLK_RO_RG_CT	Small bivalve is distributed on the fine sands especially in the northern Romanian area on infralittoral fine sediments (sand)	Abundances ranging between 10 ind/m^2 and 17000 ind/m^2 in the period 2009 - 2018 and biomass between 0.1 g/m^2 and 500 g/m^2	Population registered an increasing trend from 2009 to 2011, and a slight decline after 2012. Presently, the trend is stable
BG	Striped venus *(Chamelea gallina)*		Inhabits sandy grounds down to 35 m depth.	In 1996-2005, an increase in landings was observed, with mean annual catches making up 9459 tonnes. According to the obtained results, the density is 153 ind/m2 and biomass is 223.4 g/m2 respectively.	Based on dynamics of its harvesting one may conclude that a rapid growth is available, for the first three years after the beginning of harvesting and a subsequent five-year period of decline.
RO	*Chamelea gallina* – striped venus	BLK_RO_RG_TT03 BLK_RO_RG_CT	Distributed on infralittoral and shallow circalittoral fine sediments especially in the central and southern Romanian area	Abundances ranging between 10 ind/m^2 and 400 ind/m^2 in the analysed period; biomass between 1 g/m^2 and 100 g/m^2 in the routine monitoring	Population registered an increasing trend between 2009 and 2018.
	Sea snail *(Rapana venosa, Rapana. thomasiana)*		In the Black Sea, *Rapana venosa* occurs on sandy and hard-bottom substrates to 45 m depth	The commercial stock biomass (individuals with fresh weight above 60 g) and total allowable catch of about 7482.6 and 3217.5t respectively.	In 1994 started the Rapana fisheries in Bulgaria- by scuba diving. Illegal use of beam trawls has been commonly occured. The official landings are misreported to some extent (Scientific, Technical and Economic Committee for Fisheries - STECF, 2012). The impact assessment on benthic communities reveals disruption of mussel bed and

					transformation of the bottom community from epifauna (mussels and crustaceans) dominated to infauna (clams and polychaetes), which is generally less diverse.
BG	Sand mussel (*Mya arenaria*)		Distributed everywhere - the largest aggregations are observed in the south coastal area in front of estuaries and bay aquatories.	Quantitative parameters: average density – 100 ind/m^2 and biomass 31 – 49 gr/m^2 in one mile zone along the Bulgarian Black Sea coast.	*Mya arenaria* is tolerant to low salinity and quite large changes in salinity and temperature.

a

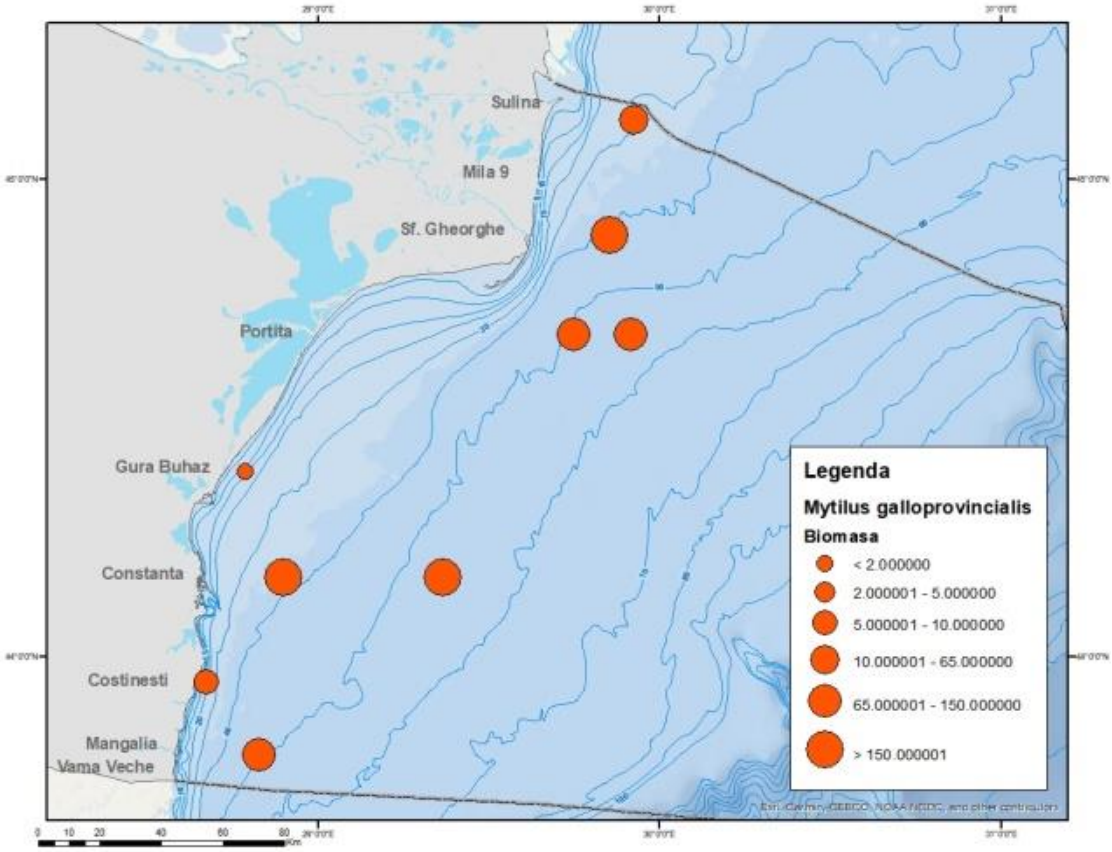
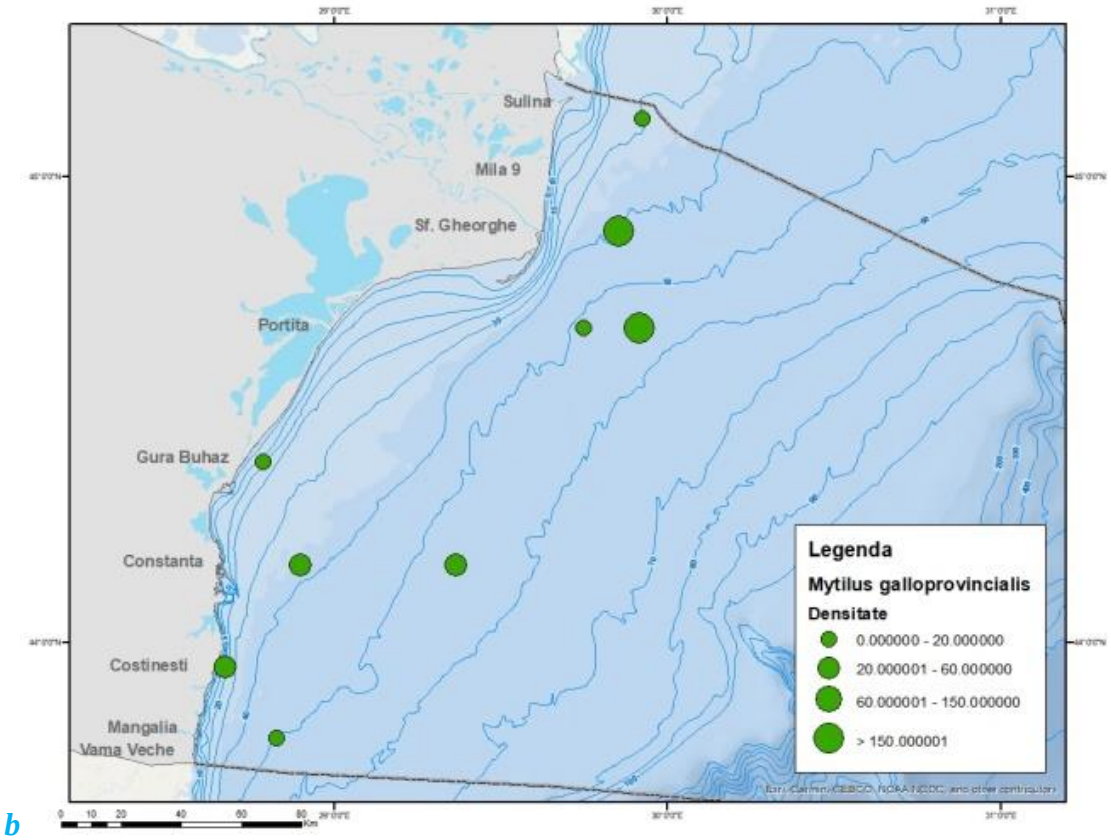


Figure11. Mussell (*Mytilus galloprovinciales)* stocks: Biomass (a) (*produced by NIMRD*)

The importance of the molluscs in the Black Sea ecosystem is well-known, some species widely covering the continental shelf, determining one of its main characteristics: natural bio-filter. Being rather large organisms as compared to the other benthic groups inhabiting marine sediments, the marine molluscs, especially bivalves, dominate the benthos biomass, frequently

accounting over 70-80% of the total biomass (Figure 12). Therefore, molluscs represent an important food source for both demersal and nektonic fish species. Additionally, their fossilised shells tell us the ancient history of this semi-enclosed sea basin. The molluscs were very well studied in the last 50 years and, starting from the 1990ies, monitored on the regular bases.

Routine monitoring carried out on the Romanian Black Sea shelf in the period 2009 – 2018 evinced the occurrence of 28 mollusc species, among them 18 bivalves and 10 gastropods, establishing different communities distributed differently according to depth and sediment grain.



b

Figure12. Mussell (*Mytilus galloprovinciales)* stocks: Density (b) (*produced by NIMRD*)

References

1. Abaza V., Dumitrache C., Dumitrescu E., 2010. Structure and distribution of the main molluscs from the Romanian marine areas designated for their growth and exploitation, Cercetari Marine – Recherches Marines, INCDM Constanta, 39: 137-152.
2. Bacescu M., Muller G.I., Gomoiu M-T, 1971. Cercetari de ecologie bentala in Marea Neagra – analiza cantitativa, calitativa si comparata a faunei bentale pontice. Ecologie marina, Edit. Acad. RSR, 4: 1-357.
3. Dencheva, K. 1994. Macrophytes- bioindicators of the water state in Varna bay. Marine sciences, 3, 235-239.
4. Konsulova T., et al., (2003). Benthic macrofauna status - a relevant tool for environmental impact assessment in port areas, PDCE'2000 Proceedings, Black Sea Coastal Association, Varna, pp. 109-119.
5. Petrova-Pavlova E (2014). Non-fish marine resources and their exploitation along the Bulgarian Black Sea coast. Agricultural Science and Technology, vol. 6, No 2, pp 215 – 218.

6. Popescu I (2010). Fisheries in the Black sea, http:/www.europarl.europa.eu/studies.
7. Prodanov K, Konsulova T (1993). *Rapana thomasiana* stock assessment and catch projection along Bulgarian Black Sea coast. Rapp.Comm.int. Mer Medit., 34, p.40.
8. Prodanov K., et al., 1995. Growth rate of *Rapana thomasiana* (Gastropoda) along the Bulgarian Black Sea coast. Rapp. Et Proces-Verbaux des Reunions, 34.
9. Rosioru D.M., Abaza V., Dumitrache C., Filimon A., Timofte F., 2014. Ecological and biochemical aspects of *Mytilus galloprovincialis* from the Romanian Black Sea coast, 14th International Scientific Multidisciplinary Geoconference on Water Resources, Forest, Marine and Ocean Ecosystems SGEM 2014, Conference proceedings, vol.2: 569-576.
10. STECF 2012, Daskalov G, C. Osio A, Charef (eds.) Aysun Gümüş, Zengin M, Panayotova M, Duzgunes E, Shlyakhov, V., Genç, Y., Radu G, Yankova M, Maximov V, Mikhaylyuk A, Raykov V (2012). Assessment of Black Sea Stocks (STECF-12-15). Scientific, Technical and Economic Committee for Fisheries (STECF), European Commission, Joint Research Centre, Institute for the Protection and Security of the Citizen. ISBN 978-92-79-27208-0, doi: 10.2788/63715. http://stecf.jrc.ec.europa.eu.

3.1.1.6. Algae and marine plants

- ***Structure and trends***

There were 331 macrophytes inventoried for the whole Black Sea, namely 80 green (*Chlorophyta*), 76 brown (*Phaeophyta*), 169 red algae (*Rhodophyta*) and six seagrasses (*Phanerogama/Magnoliophyta*), more recently a total number of 332 species has been reported. Some of them were disappeared completely or impoverished, the other part flourished in the last decades due to the anthropogenic impact on the marine environment. As a result of increased level of eutrofication some of biologic valuable species reduced their stocks and biomass.

BULGARIA

The long-term observations in Varna Bay area reported a trend of decreasing on macrophyte species in general and of oligo saprobic species in particular in response to increased level of eutrophication. More than half of macrophyte species (particularly *Rhododphyta* and *Phaeophyta* species) were lost in comparison with the first half of the last century. At the same time *Chlororphyta* species increased with 50% (Table 11).

Table 11. Changes in species structure of different types of macrophytes in Bay Varna (*http://www.blacksea-commission.org/_publ-SOE2009-CH7.asp*)

Type	1904-1939	1962-1972	1994	1999	2001	2002
Chlorophyta	10	9	13	13	13	15
Phaeophyta	11	6	4	3	4	4
Rhodophyta	37	23	14	8	11	8
Total	58	38	31	24	28	27

The average biomass of the Phaeophyta species *Cystoseira barbata* was estimated at 7 $kg \cdot m^{-2}$ in 1966-1969, and at 1.1 $kg.m^{-2}$ in 1997 up to 2 m depth. It was mostly substituted by *Enteromorpha intestinalis*, *Cladophora vagabunda* and *Ceramium rubrum*.

The saprobic structure of macrophytes in Varna Bay also have undergone structural changes. Major loss have occurred in oligosaprobic species, which almost have dissapeared since the 90's. During the last two decades oligosaprobic species as *Ralfsia verrucosa*, *Stilophora tuberculosa*, *Nereia filliformis*, *Dictiota dichotoma*, *Cladostephus verticillatus* were not detected in this region. The polysaprobic and mesosaprobic species such as *Ceramium rubrum*, *Callithamnion corrymbosum*, *Enteromorpha intestinalis*, Ulva rigida, *Bryopsis plumosa* are the dominant species in terms of their biomass.

In 1994, it was found that the macrophytobenthos along the Bulgarian Black Sea coast contains 157 species, which constituted 53% of the total Black Sea macroflora. They belonged to 82 genera, 43 families and 25 classes of Rhodophyta, Phaeophyta and Chlorophyta. The first group contains about 55% of all species, followed by the rest with approximately even number of species.

The eutrophication level was indicated by the specific surface value of the macrophyte biomass. The most eutrophicated zone is the canal between Varna Bay and Varna Lake in which 92% of biomass belong to species with specific surface value over 30 $m^2 \bullet kg^{-1}$, followed by cape Galata with 83%. The average value of macrophyte biomass, for the period 1999-2002, along the coast decreases from Trakata (911.8 $g \bullet m^{-2}$) to Veteran (613.83 $g \bullet m^{-2}$), Cape Galata (512.7 $g \bullet m^{-2}$) and the canal (484.6 $g \bullet m^{-2}$).

During the last decade the major change was seen in the biomass decreases of *Cystoseira* (indicator of high quality waters) in Varna Bay. In more eutrophic areas this olygosaprobic macrophyte is replaced by other polysaprobic species *Cladophora*, *Enteromorpha*, and *Ceramium*. The macroalgal production is highest in Trakata and the canal regions.

The high values in the canal are due to presence of species with high specific surface and intensity of functioning and short life cycle and biomass (Dencheva, 2008). The high production in Trakata is because of the presence of Cystoseira (high biomass, low specific surface) (Dencheva, 1994). The opaque seawater color caused by eutrophication is the major threat for the habitat. The reduction of light penetration causes the restriction of distribution of the edificators from the genus Cystoseira.
The industrial, chemical and household pollution of the coastal waters, pollution with petrol and solid wastes also have negative impacts on the habitat and may result in biodiversity loss.
Eelgrasses are represented in the Black Sea by two species - *Zostera marina Linnaeus*, 1758 (common eelgrass) and *Zostera noltii Hornemann*, 1832 (dwarf eelgrass).

The *Zostera marina* inhabits slimy, sandy floors of shallow littoral zones of the Black Sea, forming submarine meadows. As a result of the pollution of the sea water in the coastal zone, the distribution of *Z. marina* is very limited.

Zostera marina (VU) and *Z. noltii* (VU) are included in the Red Data Book of the Black Sea (1999) at regional level, while *Zostera marina* and *Z. noltii*, are also in the list of species important for the Black Sea according to the Convention for the protection of the Black Sea against pollution. *Zostera marina* is also included in the Bern Convention. The deterioration of the quality of the habitats is due to water pollution, destruction of the plants as a result of fishing, anchoring of boats and construction activities in the ports.

ROMANIA

Phytobenthic communities play a particularly important role in the marine ecosystem. Over decades, along the Romanian Black Sea shore, algal communities have suffered a serious decline as a result of the cumulative action of some unfavourable natural and anthropogenic

factors, so the deterioration of sensitive perennial habitat forming species *Phyllophora*, *Cystoseira* and *Zostera* has been noticed. These species have a slow development cycle and due to their slow growth rate, the recovery of damaged areas is a difficult long-term process.

Macroalgae and marine plants are good indicators of the state of the marine benthic habitats, based on the Marine Strategy Framework Directive principles. In high eutrophication conditions macrophytobenthic communities obtain a very simplified patchy structure, with monospecific character and dominance of tolerant opportunistic species (Berov D., et al, 2015).

During the summer and cold seasons, at depths between 0 to 5 m, the photophilic association *Cladophora – Ceramium*, and *Ulva - Porphyra - Scytosiphon* enoiched with various seasonal elements, respectively, are dominant. *Cystoseira* and *Zostera* communities are currently dominated by the key species *Cystoseira barbata* and *Zostera noltei*, being a substrate for other plants, refuge, feeding and breeding area for zoobenthic elements. These species are nowadays in a regeneration process along the Romanian Black Sea coast, but remain highly sensitive to anthropogenic factors. The phytobenthic associations develop up to 7 meters depth, rarely 10 metres, where there is enough light for the photosynthesis process.

In the past years, the clear quantitative dominance of the green algae followed by the red ones can be noticed (Figure 13). This fact is due to proliferation of a small number of species characterized by a high reproductive capacity and opportunistic degree.

Over the past years, *Ulva rigida* among the green algae (common for the summer season) has become a dominant and constant species present along the Romanian Black Sea coast. Also, *Cladophora* and *Ceramium* were present in most areas along the Romanian Black Sea coast, but with lower biomass values compared to *Ulva* species. These species form the dominant photophilic association *Ulva – Cladophora – Ceramium*, component of the broad habitat Infralittoral rock and biogenic reef. The broad habitat Infralittoral mud is dominated by marine higher plants - *Zostera noltei*, *Potamogeton pectinatus*, *Ruppia cirrhosa*, and *Zannichellia palustris*.

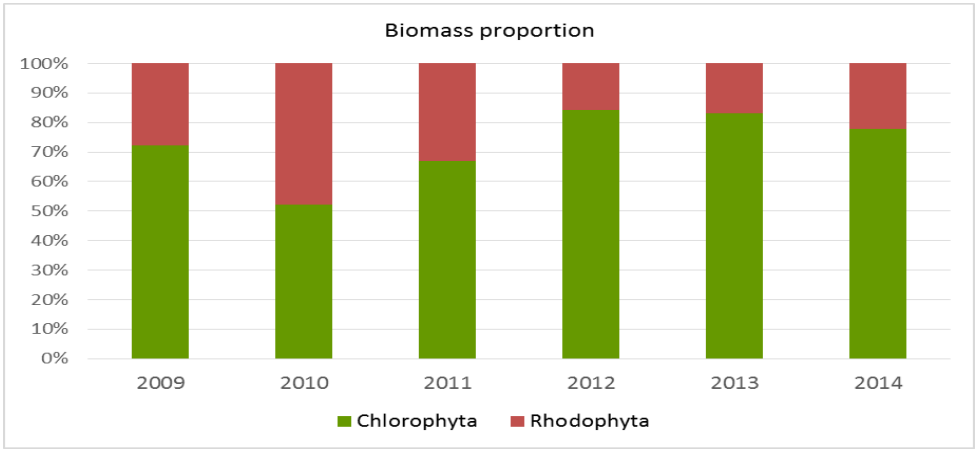


Figure 13. The proportion of opportunistic species fresh biomass along the Romanian Black Sea coast

Photophilic perennial species are an important submerged vegetation component, represented at the Romanian Black Sea coast by a small number of species belonging to the genera *Cystoseira, Phyllophora and Zostera*. All of these are habitat forming species, shelter for an important associated fauna, also preventing the coastal erosion. *Cystoseira barbata* beds of various sizes were identified in the past years at Mangalia, Jupiter-Saturn, 2 Mai and Vama Veche, whilst *Zostera noltei* meadow and *Phyllophora brodiaei* (one of the two *Phyllophora*

species identified nowadays along the Romanian Black Sea shelf; the other one is *Phyllophora crispa*) have a fragmented, punctiform distribution at Navodari and Mangalia (for *Zostera noltei*) and at Constanta North (for *Phyllophora brodiaei*). All these slow-growing important species are distributed along the Romanian coast in shallow waters, at depths between 0 to 6m, where the anthropogenic influence is at its maximum level (Marin O., et al, 2015).

- ***Policy strategies/legislation***

Maritime spatial planning provides useful informations regarding the coastal activities that may have an impact on this important marine environmental component, namely the phytobenthic association. Certain anthropogenic activities (tourist activities, consolidation of cliffs, etc.) can endanger the submerged vegetation, a component with a great ecological importance for the marine environment.

Due to the fact that the phytobenthic communities are located in the coastal area, the anthropogenic activities have a strong impact and the algal vegetation will respond accordingly - by reducing the area of perennial sensitive species and through an abundant development of opportunistic species, as a result of the increased amount of nutrients.

References

1. Berov D., Todorov E., Marin O., 2015 - BLACK SEA GIG –COASTAL/TRANSITIONAL WATERS- BQE. Technical report, 24 pp.
2. Dencheva, K. 1996. Macrophytes-bioindicators of the water state in Varna bay- Compt. Rend. Acad.Bulg.Sci. 49 (9-10): 123-126.
3. Dencheva, K. 2008. Chapter 7 the state of macrophytobenthos (Bulgarian shelf area) BSC, 2008. State of the Environment of the Black Sea (2001-2006/7). Black Sea Commission Publications 2008-3, Istanbul, Turkey, 419 pp.
4. Dimitrova D., Ebert I., Greilhuber J., Kozhuharov S. 1999. Karyotype constancy and genome size variation in Bulgarian *Crepis foetida* (Asteraceae). Plant Syst. Evol. 217, 245-257.
5. Marin O., Berov D., Todorov E., 2015 – Macrophytobenthic communities from the Romanian Black Sea coast - indicators of the ecological status of coastal water bodies. Cercetări marine – Recherches marines, Constanţa, 45: 195-205. ISSN :0250-3069.
6. Milchakova, N. A. 2003a. Systematic composition and distribution of green macrophyte algae (Chlorophyceae Wille S.L.) of the Black Sea. Algologiya, 13(1), 70–82.
7. Milchakova, N. A. 2003b. The macrophytobenthos. In: Modern condition of a biodiversity of coastal waters of Crimea (the Black Sea sector). Sevastopol, 152-208.
8. Milchakova, N. A. 2007. The regional aspects of the phytodiversity of Black Sea macrophyte flora. Morskoy ecologicheskiy zhurnal, 1(1), 44-54 (in Russian).
9. Milchakova, N. A. 2011. Marine Plants of the Black Sea. An Illustrated Field Guide. Sevastopol, DigitPrint, 144 pp.
10. Uzunova, S. 2010. The zoobenthos of eelgrass populations from Sozopol bay (Black Sea) Bulgarian Journal of Agricultural Science, 16 (No 3) 2010, 358-363.
11. State of Environment Report 2000 – 2006/7, http://www.blacksea-commission.org/_publ-SOE2009-CH7.asp.

3.1.1.7. Non- indigenous species

The first alien invasive species in the Bulgarian Black Sea has been reported since the beginning of the past century - *Balanus improvisus*, the sessile crustacean, arrived in the area before 1900. In the period 1910-1990, the acclimatization rate of alien species increased, due

to the growing commercial changes and the high anthropogenic impact - coastal development, pollution, eutrophication and overfishing. This trend is expected to continue in the next decades. From 1990 to present, the number of alien species in the Bulgarian Black Sea coast increased (Figure 14).

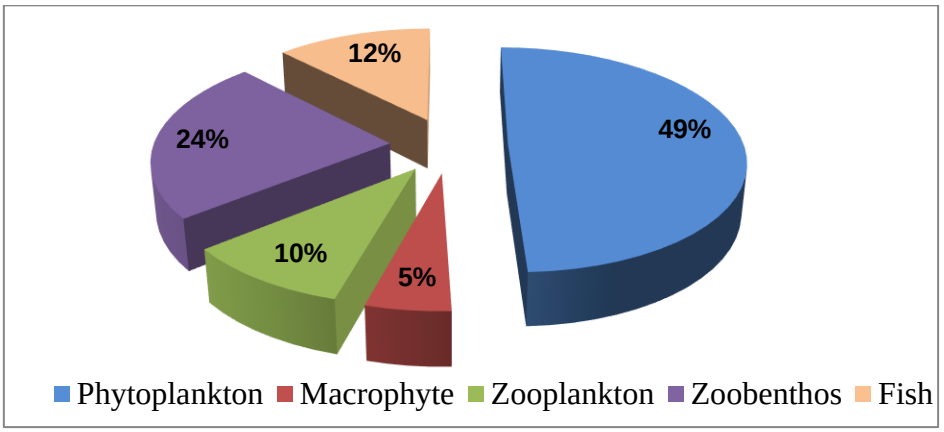


Figure 14. The number of alien species (%) along the Bulgarian coast (*www.marsplan.ro/en*)

Most of the species were introduced accidentally as fouling communities on ships' hulls and in ballast water, while others for aquaculture purpose. For the Bulgarian marine ecosystems, about 43% of the alien invasive species were accidentally introduced with ballast water and about 2% were introduced for aquaculture. Only about 1% was intentionally introduced for aquarium breeding (Tables 12, 13 and Figure 15).

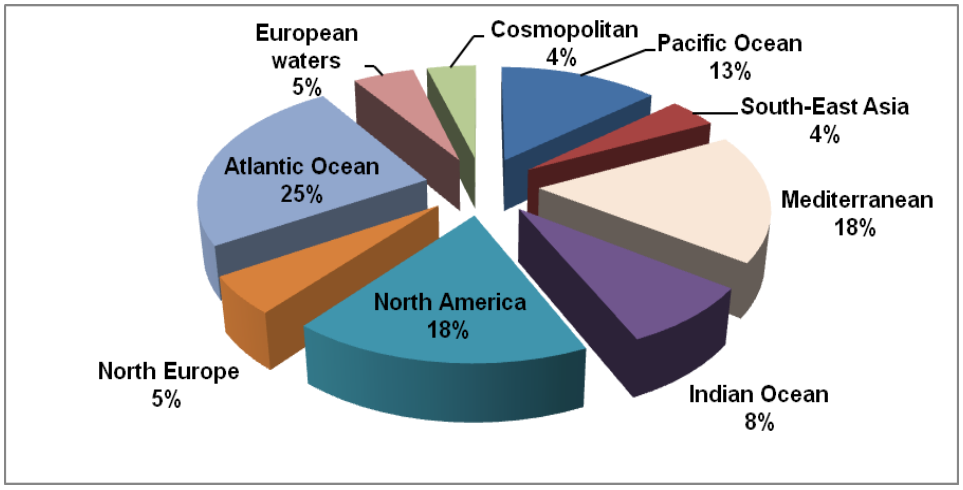


Figure 15. Origin of marine alien invasive species at the Bulgarian Black Sea coast (*www.marsplan.ro/en)*

Table 12. Periods of invasion of the alien species at the Bulgarian Black Sea coast

Period	Invasive Species	Impact
1900- 1950	*Bacteriastrum hyalinum* (Chaetocerotaceae), *Octactis octonaria* (Dictyochaceae), *Cladophora hutchinsiae* (Cladophoraceae), *Polysiphonia fucoides* (Rhodomelaceae),	Major impacts on native communities- not reported.

	Monstrilla grandis (Monstrillidae), *Blackfordia virginica* (Blackfordiidae), *Ficopomatus enigmaticus* (Serpulidae) *Perigonimus megas* (Bougainvilliidae) and crab *Rhithropanopeus harrisii ridentata*	
1950 – 1980	Phytoplankton species *Distephanus speculum f. octonarius, Gymnodinium fuscum,* Gastropoda: *Rapana venosa (Rapana thomasiana),* Bivalve: *Mya arenaria* Benthic water communities zoo benthos: *Alpheus dentipes, Callinectes sapidus, Diadumene lineate, Hesionides arenaria, Polydora cornuta, Streblospio shrubsolii and Streptosyllis varians*	The number of alien invasive species reports increased both in marine and freshwater ecosystems. *Rapana venosa (Rapana thomasiana)* - large populations on the Bulgarian coast - contributed at the disappearance of oyster banks. *Mya arenaria* - dominant in shallow sandy bottoms with low salinity waters
1980s-1990s	From phytoplankton association the *Apedinella spinifera- 1987* Ctenophore *Mnemiopsis leidyi* *Phaeocystis pouchettii* Bulgarian coastal waters-1989 Bivalve species *Anadara inaequivalvis* observed Varna Bay and Gulf of Burgas-1982	Max. developement of *Mnemiopsis leidy i- 1*989 and 1990, it is the dominant species and its mass development has affected the whole pelagic zone. The effects were -drastic reduction of pelagic fish populations; affected by overfishing, as well as the modification of the structure of the native gelatinous zooplankton
1990 -2000	Phytoplankton species: *Alexandrium monilatum, Gymnodinium pulchrum, Peridinium quinquecorne, Petalodinium porcelio, Scaphodinium mirabile* and *Spatulodinium pseudonoctiluca,* Zooplankton species: *Beroe ovata* Copepod species: *Acartia tonsa, Euryte longicauda, Oncaea minuta* Ichthyofauna: *Sphyraena sphyraena* and *Chelon labrosus*	As a result of the penetration of ctenophore *Beroe ovata*, from 1995 *Mnemiopsis leidyi*'s density and biomass began to decline *Alexandrium monilatum*- reach bloom-forming densities with ecological and socioeconomic implications
After 2000	*Alexandrium acatenella, Alexandrium affine, Alexandrium minutum, Alexandrium tamarense, Gymnodinium aureolum, Gymnodinium nolleri, Cochlodinium polykrikoides, Gyrodinium impudicum, Pentapharsodinium dalei, Pentapharsodinium tyrrhenicum, Scrippsiella lachrymosa, Scrippsiella operosa, Scrippsiella ramonii, Scrippsiella spinifera, Scrippsiella trifida, Gymnodinium nanum, Gyrodinium cochlea, Gyrodinium flagellare, Gyrodinium varians, Lessardia elongata, Lioloma pacificum, Peridiniopsis polonicum*	The number of phytoplankton species reported at the Bulgarian coastal waters increased An increase in phytoplankton blooms frequency, species involved, duration, timing and area are well documented, provoking substantial perturbations of the entire food web structure and functioning (Bodeanu, 1995; Moncheva & Krastev, 1997).

	Zooplankton- ctenophore *Bolinopsis vitrea,* cyclopoid copepod *Oithona davisae* macrophyte *Vaucheria dichotoma f. marina* Fish communities *Umbra krameri,* gobies *Pomatoshistus marmoratus* and *Pomatoschistus bathi* Oriental shrimp *Palaemon macrodactylus*- Varna lake	

Table 13. Main characteristics of the most substantial alien species along the Bulgarian Black Sea part (*www.marsplan.ro*)

Alien species	Main Characteristics
Comb jelly *Mnemiopsis leidyi*	In present it is balanced by *Beroe ovata;* it had the highest impact on the associations of zooplanktonic and neritic species in the Black Sea (Malyshev, Arkhipov, 1992); affected the whole pelagic zone, being concurrent to the fish living food
nude ctenophores *Beroe ovata*	The same area of impact, including *M. leidyi* decreasing
Rapana venosa	Rapa whelk, with impact on native bivalve communities contributed at the disappearance of oyster banks, preying on mussel beds; it is presently intensively exploited for commercial purposes
Mya arenaria and *Anadara (Scapharca) kagoshimensis*	Became the dominant species on the shallow sandy bottoms characterized by waters with low salinity; inhabits the soft muddy bottoms and has progressively developed near the estuaries
Balanus improvisusis	Highest ecological success among the crustaceans; developed large populations on all types of hard substrate; excluded other species of barnacles to install on the rocky littoral of the Black Sea
Rhithropanopeus harrisii	Crab with the greatest impact, large ecological plasticity, for both freshwater and marine habitats (water lagoons, estuaries and bays); scavenger or phytophagous, very efficient in exploiting certain ecological niches; valuable trophic resource for native fishes
Palaemon macrodactylus	New installed, with trophic values
Corambe obscura	Predatory species that feeds exclusively on bryozoans and occupied an ecological niche;
Alexandrium monilatum	Produces the lipophilic ichtyotoxic goniodomin A causing numerous fish kills and widespread discoloration in warmer waters; affects shellfish behaviour and increases larval mortality, reach bloom-forming densities, affects the habitat negatively
Liza haematocheila, so-iny mullet	Candidate species for aquaculture and fishery enhancement; its expansion corresponds to a sharp decline of native species of Mugilidae, with which it could compete for food

Introductions of alien marine species have been accelerated in recent decades by the rapid globalisation and increasing trends of trade, travel and transportation. Alien marine species may become invasive with severe impact on biodiversity and ecosystem services. They may cause ecological, economic and public health impacts globally. The ecological impact includes changes in habitats, communities and food-web functioning. The economic impact ranges from financial losses in fisheries to expenses for industries. The public health impact may arise from the introduction of microbes or toxic algae. Enclosed or semi-enclosed ecosystems, as the

Black Sea, seem particularly sensitive to biological invasions. With the increased shipping traffic, aquaculture and trade the Black Sea has become a major recipient of alien species.

In ***ROMANIA*** the non-indigenous species are registered as well (Figure 16). At international level, the problem of non-indigenous species, especially of invasive species became of paramount importance in the context of sustainable development and biodiversity conservation. Intensification of sea transport or through inner watercourses, and climate changes represent major factors favouring the penetration of non-indigenous species in both marine and freshwater bodies (Gomoiu et al., 2005).

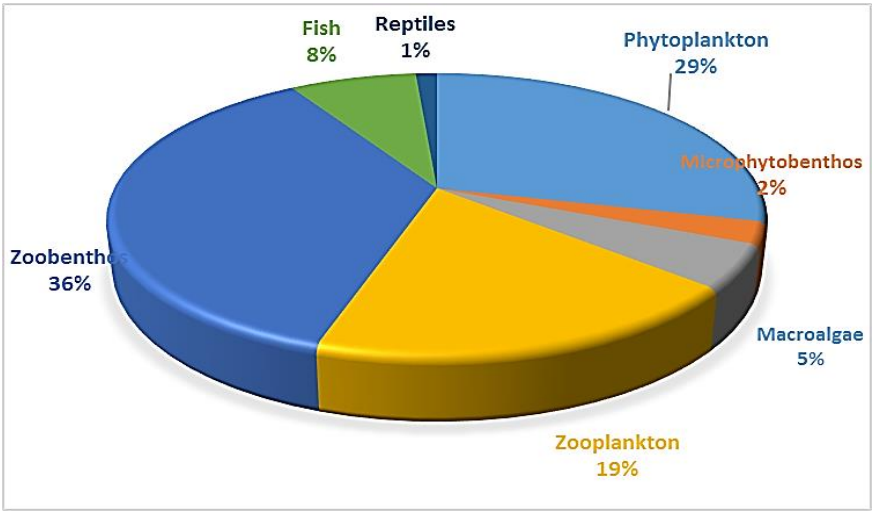


Figure 16. Major non-indigenous species in the Romanian Black Sea waters species groups (*www.marsplan.ro/en*)

Because these species cannot be observed immediately, and special protection measures are needed to keep the phenomenon under control, the threat posed by non-indigenous species, especially by the invasive ones, is much more complex. The necessity of monitoring the non-indigenous species aims to prevent the ecosystem changes caused by penetration and acclimatization of these opportunistic species, capable of surviving in various environments, in detriment of indigenous species, less able to withstand such competition.

There have been identified 80 species, benthic invertebrates being the most numerous (36%); they were followed by phytoplankton (29%), zooplankton (19%), fish (8%), macrophytes (5%) microphytobenthos (2%) and reptiles (1%) (Figure 16).
In the MSFD context, non-indigenous species represent a distinct pressure descriptor (D2) among the 11 descriptors characterising the marine environment status. The last assessment relating to the non-indigenous species inventory was undertaken within the MISIS (MSFD Guiding Improvements in the Black Sea Integrated Monitoring System – 2012-2014) (Table 14).

Table 14. Invasive species pressure level and information gaps

Country	Assessment area	Pressure level	Gaps
RO	BLK_RO_RG_TT03 BLK_RO_RG_CT BLK_RO_RG_MT01 BLK_RO_RG_MT02	A total of 80 non-indigenous species belonging to benthic invertebrates, phytoplankton, zooplankton, fish, macrophytes and microphytobenthos have been identified. Their impact on	Low availability of abundance data and of impact estimates, and very poor information on main

		the native species of the Black Sea is often less known. Nevertheless, an increasing trend has been observed in non-indigenous species introduction along 20th and 21st centuries. Obvious effects are only those produced by the species with very strong impact on the indigenous communities, such as gastropod *Rapana venosa*, bivalve *Mya arenaria* and ctenophore *Mnemiopsis leydi*. Currently, *Mya arenaria* registers a decreasing trend, *Rapana venosa* became a commercial resource, while *Mnemiopsis leydi* shows high population development during the warm season, both in coastal and open waters. Other non-indigenous species are not monitored in terms of population dynamics and trends.	introduction vectors. These gaps may be filled through surveillance actions in areas with high probability of introduction such as harbours and control actions on ballast water and fouling.

References

1. Alexandrov B. 2004. Problem of aquatic organisms' transportation by ships and some approaches for risk assessment of the new invasions. Marine Ecological Journal 3 (1): 5-17. (in Russian).
2. Katsanevakis S., Wallentinus I., Zenetos A., Leppäkoski E., Çinar, M. E., Ozturk B., Grabowski M., Golani D.& Cardoso A.-C. 2014. Impacts of marine invasive alien species on ecosystem services and biodiversity: a pan-European review. Aquatic Invasions 9: 391-423.
3. Molnar J. L., Gamboa R. L., Revenga C. & Spalding M. D. 2008. Assessing the global threat of invasive species to marine biodiversity. Frontiers in Ecology and the Environment 6: 458-492.
4. Senichkina, LG., 1983. Phytoplankton of the north-western part of the Black Sea in winter.
5. Skolka, M., Preda C. 2010. Alien invasive species at the Romanian Black Sea coast – Present and perspectives. Travaux du Muséum National d'Histoire Naturelle «Grigore Antipa» pp. 443–467DOI: 10.2478/v10191-010-0031-6.
6. TDA, 2007. Black Sea Transboundary Diagnostic Analysis. Programme coordinating unit, Global Environmental Facility Black Sea Environmental Programme publication, Istanbul.
7. xxx Study: Elaboration of detailed studies for a complete analysis of the Romanian and Bulgarian maritime areas, Component 1.1.1, *www.marsplan.ro/en*

3.1.2. Marine Habitats and biodiversity

(Natura 2000 marine habitat types from the Bulgarian and Romanian Black Sea)

BULGARIA

Geographical location of Bulgaria in the southeast part of Europe and in the central part of the Balkan Peninsula, although the small area of 110 910 sq. km, the territory of the country comprises parts of 3 biogeographic regions - Alpine, Black Sea and continental. The various reliefs, specific microclimatic conditions and the millennial human activity on the territory of the country determine the rich diversity of species, populations and natural habitats, most of which have high conservation value. Considering the richness of the biodiversity, the country ranks among the first places in Europe. The criteria for selection of Marine Protected Areas (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.

The marine Natura 2000 network of Sites of Community Importance (SCIs) encompasses 14 coastal sites with marine area included within their boundaries (*http://www.mesma.org/FILE_DIR/05-10-2013_18-32-56_53_1a_MESMA-FW-Case-Study-Black%20Sea.pdf*). By reason of fact that the sites were evaluated as insufficient by DG Environment of EC, the marine Natura 2000 in Bulgaria is currently under revision and will be extended towards open sea to cover larger portions of reefs (1170), sandbanks (1110), and the habitats of Alosa spp. and small cetaceans.

The marine habitats enlisted in Bulgarian Red Data Book (2015) and Habitat Directive 92/43 and they are included in the Tables 15 and 16.

- **Benthic habitats**

Several large groups of habitats are determined based on their lithological characteristics and distribution depths, namely mediolittoral sands, mediolittoral rocks and reefs, shallow sublittoral sands, shallow sublittoral mud, shallow sublittoral rocks and reefs and shelf sublittoral rocks and reefs (Table 15).

Table 15. Benthic habitats

Psammophilous infaunal assemblages	**The deeper seabed areas with sandy silt and silt**	**Rocky seabed in the mediolittoral and the shallow sublittoral zone**	**Rocky substrates within the euphotic zone**	**Littoral sands and muddy sands, and Sublittoral sandvv**
Mesodesmatidae (*Donacilla cornea*)	Mactridae (*Spisula subtruncata*)	Mytilidae mussels (*Mytilus galloprovincialis,Mytilaster lineatus*)	*Cystoseira* genus algae	*Zostera marina; Zostera noltii*
Donacidae (*Donax trunculus*)	Semelidae (*Abra alba*),	Barnacles (*B. improvisus, B. eburneus, Chthamalus stellatus)*		
Corbulidae (*Lenthidium mediterraneum*)	Cardiidae (*Parvicardium exiguum*)			
Veneridae (*Chamelea gallina*)	Burrowing thalassinidean shrimps (e.g. *Upogebia pusilla*)			

There is a number of identified benthic habitats of transboundary importance. These include: *Mytilus galloprovincialis* habitats; *Cystoseira* habitats; *Zostera* beds; and sublittoral sands. About 157 species of macro algae, known as seaweeds, are found along the Bulgarian coast attached to shells, stones or rocks in the shallow coastal waters. In the last forty years the diversity of macro algae has changed considerably and certain populations have decreased in number and even disappeared from some areas.

Recognizing the importance of *Cystoseira* dominated habitats, they are under the protection of national legislation and international laws and conventions (Habitats Directive (92/43/EEC). Until the late 1970s, *Cystoseira* communities were present along the whole Bulgarian Black Sea coast. Recent studies showed a significant decrease in their presence and complete disappearance from the two large coastal bays – Burgas Bay and Varna Bay – eutrophicated coastal areas under high anthropogenic stress.

Zostera species are key elements of three marine habitats in Bulgarian Red Data Book 2015, namely: Underwater "meadows" of sea grasses, Littoral sands and muddy sands, and Sublittoral sands. *Zostera marina* is defined as endangered species in the Bulgarian Red Data Book (IUCN category) and is also present in the Bern Convention list.

The high eutrophication and increasing human pressures on the coastal zone have led to losses of seagrass beds in many parts of the Bulgarian Black Sea waters. The decline in eelgrass (*Zostera spp.)* beds has resulted in the loss of a habitat and food source for a number of associated species within the habitat and in surrounding benthic communities. A consequence of this has been an increase in coastal erosion by wave energy due to the loss of sediment stabilization by seagrass beds. *Zostera* beds are vulnerable to the effects of many of the human activities in the coastal zone- coastal development, water pollution and physical habitat disturbance. Other forms of coastal development (eg. construction of harbours or marinas, pipeline laying, channel dredging) can also affect seagrass beds by altering the local hydrographic regime and sediment balance.

Ecosystem stability reduction, nutrient enoichment and phytoplankton growth have had a dramatic effect on the bivalve community (e.g. mussel *Mytilus galloprovincialis).* When the degraded bivalve community is unable to cope with food supplies from phytoplankton blooms and detritus, the excessive supply creates a huge oxygen demand leading to bottom hypoxia. Degradation of mussel beds which support diverse epifauna, infauna and interstitial community leads to decline/loss of species and genetic diversity.

- **Pelagic habitats**

Four major pelagic habitats are identified in the Bulgarian Black Sea waters:

a. Coastal water habitats in the 1-mile zone (13 water bodies identified by the criteria of the WFD 2000/60/EC);
b. Nearshore habitats (outside the 1-mile zone to a depth of 25-30 m);
c. Shelf habitats (up to 200 m depth) and
d. Open sea habitats (> 200 m).

Phytoplankton is the most important primary producers in the ocean, base of the oceanic food chain, and important component of the global carbon cycle. Phytoplankton, also known as microalgae, contains chlorophyll and requires sunlight in order to support their basic life functions. Most phytoplankton is buoyant and floats in the upper surface layers of the sea, where the sunlight, necessary for the photosynthesis process, penetrates the water. Phytoplankton also requires inorganic nutrients such as nitrates, phosphates, and sulfur which they convert into proteins, fats, and carbohydrates. Due to this feature their distribution is closely associated with the mechanism of sea water eutrophication.

Great amounts of nutrients in the marine coastal zone are discharged by the rivers or directly from the coast. Increased nutrients load in the coastal zone over the recent decades have resulted in a shift in the ratio of species with a relative increase in the number of dinoflagellates and the appearance of several new phytoplankton species. Investigations on phytoplankton in Bulgarian waters show a variety of 229 species among which diatoms and dinoflagellates dominate.

Zooplankton is typically formed of tiny animals found in sea and freshwater, drifted along with the currents. Their communities are composed of two main groups, permanent members of the plankton, called holoplankton (such as radiolarians, krill, copepods, salps, etc.), and temporary members (such as most larval forms of sea urchins, sea stars, crustaceans, marine worms, and some marine snails, etc.), which are called meroplankton. Along with phytoplankton, zooplankton is a key component of marine ecosystems forming the base of most marine food webs.

There are over 70 zooplankton species in the Bulgarian coastal waters. The introduction to the Black Sea of an exotic species, the jellyfish *Mnemiopsis leidyi*, which has no natural predators in this part of the world, resulted in the decreasing of large amounts of zooplankton, including fish eggs and larvae.

The ichthyofauna in the Bulgarian Black Sea part includes nearly 170 species. In this group are included important commercial pelagic (e.g. horse mackerel, sprat, anchovy bluefish), demersal fish (e.g. turbot, red mullet, gobies) and bentho-pelagic (e.g. piked dogfish, whiting).

The marine mammals in the Bulgarian Black Sea are represented by common dolphin, the bottlenose dolphin and the Harbour porpoise. They live in a variety of habitats, from coastal waters to the open sea following seasonal aggregations and regular mass migrations of their preferred prey, small pelagic fishes such as anchovy and sprat.

The major antropogenic impacts on pelagic habitats include algal blooms, water quality impairment (reduced transparency, jelly and mucous accumulation, hypoxic events), modification of community structure and food webs (elimination of large top predators via fishing activities, predominance of small pelagic species exerting top-down control over the food web, dead ends in the food web as a result of jellyfish), alien species establishment and ecosystem instability.

The relevant socio-economic consequences of the above comprise reduced income and employment opportunities in commercial fisheries, loss of recreational values and potential losses in tourism, increased risk for human health, mitigation, restoration and treatment costs, reduced capacity to meet basic human needs (food), reduced educational, scientific, cultural and aesthetic value and potential human conflicts at international level related to the shared exploitation of marine living resources. Physical damage to the bottom substrates and associated biological communities in the Bulgarian part of the Black Sea shelf is mainly caused by commercial fishing with active pelagic or demersal fishing gears. Fishing with bottom gear (beam trawling permitted since 2013) leads to abrasion of the seabed and in particular the vulnerable biogenic substrates, e.g. causes a decrease in the number of the Mediterranean mussel (*Mytilus galloprovincialis*).

In order to ensure further sustainable development of marine ecosystems in the Black Sea it is crucial to stop further deterioration of the marine environment, as well as it has to planning and managing of all human activities.

- ***Structure and trends***

The present classification aims to unitary describe Natura 2000 marine habitat types from Romania and Bulgaria (Tables 16, 17). Interpretation was made in accordance with the Habitat Directive (92/43/EEC) (Annex 1) and its modifications with the amendments proposed by Romania and Bulgaria, Interpretation Manual of European Union Habitats (EUR 27, 2007) and the French manual Cahiers d'Habitats Natura 2000.Their protection must be ensured in conformity with this Directive.

Table 16. Marine Habitat of Bulgaria and Romania

Habitat description	Indicator species, flora and fauna	Conservation value	Presence in RO	Presence in BG
1110 Sandbanks which are slightly covered by sea water all the time:				
1130 Estuaries				
1140 Mudflats and sandflats not covered by seawater at low tide				
1150 Coastal lagoons				
1160 Large shallow inlets and bays				
1170 Reefs				
1180 Submarine structures made by leaking gases				
1310 *Salicornia* and other annuals colonising mud and sand; Bondev (1991)				
8330 Submerged or partially submerged sea caves				

Table 17. Conservation status of Romanian marine habitats

Habitat (Descriptors 1 and 6) NATURA 2000	Habitat (Descriptors 1 and 6) EUNIS	Assessment area	Extent (D6C4)	Status/Trends (D6C5)	Gaps
1110: Sandbanks	A5. Sublittoral sediment	RO	S = 3264 km^2	Unfavourable -inadequate with an unknown tendency	- lack of updated information on habitat distribution, extend and cartography. It is necessary to plan specific monitoring surveys (Side Scan Sonar, Multi-Beam and R.O.V.) and structural, functional and ecological investigations.
1130: Estuaries	X01. Estuaries	RO	S = 1000 km^2	Favorable with an unknown tendency	- lack of updated information on habitat distribution, extend and cartography.
1140: Mudflats	A2. Littoral sediment	RO	S = 2,44 km^2	Unfavourable -inadequate with an unknown tendency	- insufficient data both in terms of extent/distribution and habitat condition.
1150: Coastal Lagoons	X03. Brackish coastal lagoons	RO	S = 184 km^2	Unfavourable -inadequate with an unknown tendency	- insufficient data both in terms of extent/distribution and habitat condition.
1160: Large shallow inlets and bays	A2.5 Coastal saltmarshes and saline reedbeds	RO	S = 2 km^2	Favorable with an unknown tendency	
1170: Reefs	A2.6 Littoral biogenic reefs	RO	S = 5200 km^2	Unfavourable -inadequate with an	- there is limited data regarding the extent and condition of this habitat; therefore, further mapping is required to

	A5.6 Sublittoral biogenic reefs			unknown tendency	determine the full extent of this highly variable habitat.
1180: Submarine structures made by leaking gases	A5.71 Seeps and vents in sublittoral sediments	RO	S = 1000 km^2	Favorable with an unknown tendency	- insufficient data both in terms of distribution and habitat conditions.
1310 *Salicornia* and other annuals colonising mud and sand; Bondev (1991)					
8330 Submerged or partially submerged sea caves					

References

1. Begun T., Muresan M., Zaharia T., Dencheva K., Sezgin M., Bat L., Velikova V., 2012. Conservation and Protection of the Black Sea Biodiversity. 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. EC DG Env. MISIS Project Deliverables. *www.misisproject.eu*.
2. Berov D. 2012. Structure of Cystoseira spp. macroalgal communities and the influence of anthropogenic factors on their distribution. Macroalgae as an indicator of the ecological state of coastal marine ecosystems in the Black Sea. Abstract of a dissertation for the academic degree Doctor (PhD).
3. Black Sea Transboundary Diagnostic Analysis. 2007. Available at Black Sea Commission. *http://www.blacksea-commission.org/.*
4. Devillers, Devillers-Terschuren et Van der Linde, 1996. Palearctic Habitats Classification Database (Access 2000 file format).
5. Doniţă N., Popescu A., Paucă-Comănescu M., Mihăilescu S., Biriş I-A., 2005. Habitatele din România. Editura Tehnică Silvică, Bucureşti, 493 pp.
6. Fisheries and Aquacultures Act, Prom. SG. 41 of 24 April 2001, Last amended SG. Issue 98 of November 27, 2018.
7. Gussev Ch., Tzonev R. 2015. In: V. Biserkov & Ch. Gussev (Eds), Red Data Book of the Republic of Bulgaria, Vol. 3 Natural Habitats, *http://e-ecodb.bas.bg.*
8. Kotsev I., 2015. Landscape-based approach to identification of shallow seabed habitats. Case study: central sector of the Bulgarian Black Sea coastal zone J. Bio Sci. Biotechnol. 2015, SE/ONLINE: 241-253.
9. Kozhuharov D. 2013. The environmental problems in the Black Sea – present and future, Bulgarian Biodiversity Foundation. 6. Moncheva, S., Todorova, V. et al., 2013. Initial assessment report on marine environment according to art. 8 from MSFD. Contract No 203 / 09.08 2012, Ministry of Environment and Water (MOEW), 498 p. retrieved in pdf: *http://bsbd.org/UserFiles/File/Initial%20Assessment.pdf*.
10. Micu D., Zaharia T., Todorova V., Nita V. 2007. Habitate marine romanesti de interes European, ed. Punct Ochit Constanta, 30 p., ISBN 978-973-88566-1-5.
11. Paul G. Falkowski and John A. Raven- Aquatic Photosynthesis, , Second Edition, 2007, Princeton University Press, ISBN 9781400849727.
12. Petrova-Karadjova, V., 1975. On the quantitative distribution and resources of the brown algae Cystoseira barbata (Good et. Wood) Ag. on the Bulgarian Black sea coast. Proceedings of the Institute of Fisheries-Varna XIV, 83–101 (In Bulgarian)).

13. Petrova-Karadjova, V., 1982. Distribution and stock of the eelgrasses (*Zostera marina* and *Zostera nana*) along the Bulgarian Black Sea coast. Proceedings of the Institute of Fisheries, 19: 97-106 (in Bulgarian).
14. Todorova V., Micu D., Klisurov L., 2009. Unique oyster reefs discovered in the Bulgarian Black Sea. Comptes rendus de l'Acad´emie bulgare des Sciences 62 (7) 871-874.
15. Todorova V, Panayotova, V. 2011. Infralittoral rocks and other hard substrates. - In: V. Biserkov & Ch. Gussev (eds), Red Data Book of the Republic of Bulgaria, Vol. 3 Natural Habitats. *http://e-ecodb.bas.bg.*
16. Todorova, V. 2011. Black mussels and/or barnacle communities on mediolittoral rocks. - In: V. Biserkov & Ch. Gussev (eds), Red Data Book of the Republic of Bulgaria, Vol. 3 Natural Habitats. *http://e-ecodb.bas.bg.*
17. Yankova M, Pavlov D, Ivanova P, Karpova E, Boltachev A, Öztürk B, Bat L, Oral M, Mgeladze M 2014. Marine fishes in the Black Sea: recent conservation status Mediterranean Marine Science, 366-379, DOI: http://dx.doi.org/ 10.12681/mms.742.
18. Yankova M, Raykov V, Ivanova P, Mgeladze M, Diasamidze R, Radu Gh, Nicolaev S, Agapov St, Grinchenko M, Ozturk B, Oral M, Bat L, Shlyakhov Vl, Boltachev Al, Karpova E. 2011. Black Sea Fishes List. Black Sea Commission Publication, *http://www.blacksea-commission.org/_publications.asp.*
19. European Commission, 2007. Interpretation Manual of European Union Habitats - EUR 27. Council of Europe Publications, Strasbourg, 142 pp
20. Schipper C.A. Todorova V. Doncheva V. Application of the MESMA Framework. Case Study: Bulgarian part of the Black Sea, *http://www.mesma.org/FILE_DIR/05-10-2013_18-32-56_53_1a_MESMA-FW-Case-Study-Black%20Sea.pdf.*
21. Fifth National Report 2009 – 2013), Convention on biological diversity. *https://www.cbd.int/doc/world/bg/bg-no-05-en.pdf.*
22. Water management process in relation with EU regulations within Black Sea Basin selected regions: Bulgaria. Clean rivers-clean sea. Project financed by the Black Sea Basin Operational Programme 2007-2013, *http://www.cceg.ro/clean-rivers-clean-sea.*
23. General Description of the Characteristics of the Black Sea Basin Management Area, *http://www.bsbd.org/UserFiles/File/art.9,10_II_SUMMARY_EN(1).pdf*
24. Zooplankton ~ MarineBio Conservation Society *https://marinebio.org/creatures/zooplankton/*
25. Zostera Biotopes. An overview of dynamics and sensitivity characteristics for conservation management of marine SACs. *http://www.ukmpas.org/pdf/Detailed_Marine_Communities_Reports/zostera.pdf.*

3.1.3 Environmental protection

(Nationally designated marine protected areas – MPA and NATURA 2000)

- ***Definition and Structure***

Marine protected areas are a key element of strategies to protect coastal and shelf marine ecosystems in many parts of the world. They have been set up to maintain biodiversity, restore damaged ecosystems, and ensure sustainable development and to protect a representative range of species and habitats (OSPAR Commission, 2013). The creation of MPAs was spurred by the 1992 Convention on Biological Diversity (CBD) and the current CBD target is to conserve by well-managed, ecologically representative and well-connected protected areas by 2020 about 10% of coastal and marine areas. As well as protecting biodiversity, MPAs can help to ensure the long-term sustainability of fisheries (Weigel et al., 2014) and preserve coastal and marine sites of socio-cultural value (Börger et al., 2014).

Maritime spatial planning plays an important role for spatial protection measures. MPA networks must contribute to Good Environmental Status (GES) taking account the ecosystem-based approach, and the spatial protection measures shall give due consideration to sustainable development including social and economic impacts. These requirements for the network necessitate the integration of measures which go beyond Natura 2000 in several respects. The number, the coverage area of protected areas in Romania and Bulgaria and their distribution are shown in the Tables 18, 19 and Figure 17.

Table 18. Natura 2000 Sites (*www.marsplan.ro/en*)

Country	Natura 2000 Sites - coastal and marine (number)			Coastal protected areas (CPAs) (%)	Marine protected areas (MPAs) (%)
Bulgaria	34			80	7.8
Romania	13			90	22.0

In Bulgaria, from 2002 to 2006, through the implementation of a number of projects, a national list of potential sites for inclusion in Natura 2000 network was drawn up. Initially, the proposed list contains 114 wild bird conservation areas (Natura 2000 sites under the Birds Directive), covering approximately 23.6% of the country's territory, and 225 protected areas for the conservation of natural habitats and of wild fauna and flora (Natura 2000 Habitats Directive sites), covering approximately 30% of the country's territory. In 2007, after decisions No 122 / 02.03.2007, No. 661 / 16.10.2007 and No. 802 / 04.12.2007 of the Council of Ministers of the Republic of Bulgaria, Bulgaria presented to the European Commission a national list of potential Natura 2000 sites, which contains:

- 114 wild bird conservation areas covering 20.4% of the territory of Bulgaria;
- 228 protected areas for the protection of natural habitats, covering 29.5% of the territory of Bulgaria.

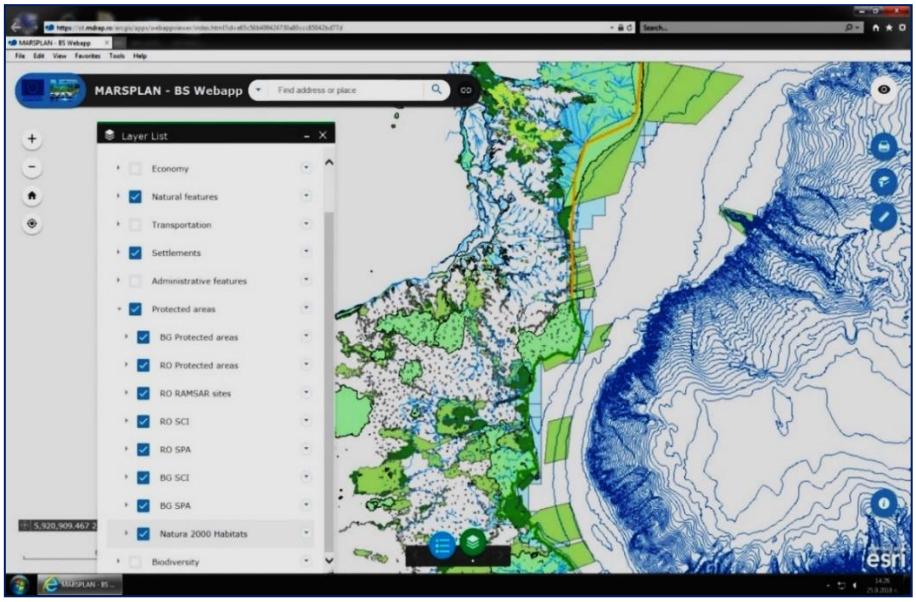


Figure 17. Coastal and marine protected areas along Bulgarian-Romanian coast (*www.marsplan.ro/en*)

At the end of 2018 there are no approved Natura 2000 management plans for the Black Sea coastal area in Bulgaria.

The Romanian MPA network consists of 10 (9 SCI and 1 SPA) and has a total area of 7,457.66 km^2 on the Romanian shelf zone, while the marine part of the Danube Delta Biosphere Reserve (ROSCI0066 - Danube Delta - marine part) represents 45% of the whole network‘s area. Unfortunately, only 37% (5 SCI with old limits and 1 SPA) from the Romanian Black Sea N2000 network have management plans and the conservation measures are largely not adapted to the requirements. In Romania, the conservation objectives were not agreed by public consensus, and the strategies that should involve the stakeholders as the first step towards understanding the ecological, cultural and social benefits, were also not elaborated, which led to hard-to-resolve conflicts.

The marine Natura 2000 network still has major gaps: by far not enough effective management (conservation measures, species protection, preventing deterioration, restoration, monitoring and financing) and therefore many marine Natura 2000 sites remain paper protected areas.

At the end of 2018 there are no approved Natura 2000 management plans for the Black Sea coastal area in Bulgaria.

The Romanian MPA network consists of 10 (9 SCI and 1 SPA) and has a total area of 7,457.66 km^2 on the Romanian shelf zone, while the marine part of the Danube Delta Biosphere Reserve (ROSCI0066 - Danube Delta - marine part) represents 45% of the whole network‘s area. Unfortunately, only 37% (5 SCI with old limits and 1 SPA) from the Romanian Black Sea N2000 network have management plans and the conservation measures are largely not adapted to the requirements. In Romania, the conservation objectives were not agreed by public consensus, and the strategies that should involve the stakeholders as the first step towards understanding the ecological, cultural and social benefits, were also not elaborated, which led to hard-to-resolve conflicts.

The marine Natura 2000 network still has major gaps: by far not enough effective management (conservation measures, species protection, preventing deterioration, restoration, monitoring and financing) and therefore many marine Natura 2000 sites remain paper protected areas.

Table 19. Natura 2000 spatial details

NATURA 2000		
	Romania	**Bulgaria**
Number of SCI/SPA	9 / 1	15/11
Surface area SCI/SPA km^2	6,056.23 / 1,401.43	2,479.88/548.62
Existence of management plans	5 (in old limits) /1	Not approved and not in force
Implementation of management plans	in developing	-

References

1. Government Emergency Ordinance No. 57/2007 on the regime of protected natural habitats, conservation of natural habitats of flora and fauna, Official Gazzette No. 442 of 29 June 2007, approved with amendments by Law No. 49/2011, Official Gazette No. 262 of 13 April 2011;
2. Minister’s of Environment and Forests Order No. 2387/2011 amending Minister’s of Environment and Sustainable Development Order No. 1964/2007, Official Gazzette No. 846 of 29 November 2011;

3. Minister's of Environment, Waters and Forests Order No. 46 of 12 January 2016 on the establishment of the protected natural area regime and the declaration of Sites of Community Importance as an integral part of the European Natura 2000 Ecological Network in Romania, Official Gazzette No. 114/15 Feb. 2016;
4. Romanian Government. 2016. Decision No. 663 of 14 September 2016 on the establishment of the protected natural area regime and the declaration of Special protection Areas for Birds as an integral part of the European Natura 2000 Ecological Network in Romania, Official Gazzette No. 743/23.09.2016;
5. OSPAR Commission 2012 Status Report on the OSPAR Network of Marine Protected Areas (No. 618/2013) OSPAR Commission, London (2013)
6. T. Börger, C. Hattam, D. Burdon, J.P. Atkins, M.C. Austen. Valuing conservation benefits of an offshore marine protected area. Ecol. Econ., 108 (2014), pp. 229-241, 10.1016/j.ecolecon.2014.10.006
7. Buhl-Mortensen, L., Galparsoso, I., Fernàndez, T. V., Johnson, K., D'Anna, G.,Badalamenti, F., et al. (2017). Maritime ecosystem-based management inpractice: lessons learned from the application of a generic spatial planningframework in Europe.Mar. Pol.75, 174–186. doi: 10.1016/j.marpol.2016.01.024
8. J.-Y. Weigel, K.O. Mannle, N.J. Bennett, E. Carter, L. Westlund, V. Burgener, Z. Hoffman, A. Simão Da Silva, E.A. Kane, J. Sanders, C. Piante, S. Wagiman, A. Hellman. Marine protected areas and fisheries: bridging the divide. Aquat. Conserv. Mar. Freshw. Ecosyst., 24 (2014), pp. 199-215, 10.1002/aqc.2514
9. Ioja, C.I., Patroescu,M.,Rozylowicz,L., Popescu,V.D.,Verghelet,M., Zotta,M.I.and Felciuc, M.2010. The efficasy of Romania's protected areas network in conserving biodiversity. Biological Conservation: 143:2468–2476.
10. Papp, D.and Tóth, C.2007. Natura 2000 Site Designation Process with a Special Focus on the Biogeographic Seminars, second ed. Budapest, Hungary: CEEWEB Office
11. General information about the ecological network NATURA 2000, *https://www.moew.government.bg/bg/priroda/natura-2000/natura-2000-v-bulgariya/obsta-informaciya-za-ekologichnata-mreja-natura-2000/*

3.1.4. GES of the marine environment

The Marine Strategy Framework Directive (MSFD) (2008/56/EC) (amended by Commission Directive (EU) 2017/845) foresees that each Member State develops a strategy for achieving or maintaining the Good Environmental Status (GES) of the Marine Environment by 2020. The Directive sets out, in the Annex I, eleven qualitative descriptors which describe what the environment will look like when GES has been achieved:

- **Descriptor 1** Biodiversity is maintained
- **Descriptor 2** Non-indigenous species do not adversely alter the ecosystem
- **Descriptor 3** The population of commercial fish species is healthy
- **Descriptor 4** Elements of food webs ensure long-term abundance and reproduction
- **Descriptor 5** Eutrophication is minimised
- **Descriptor 6** The sea floor integrity ensures functioning of the ecosystem
- **Descriptor 7** Permanent alteration of hydrographical conditions does not adversely affect the ecosystem
- **Descriptor 8** Concentrations of contaminants give no effects
- **Descriptor 9** Contaminants in seafood are below safe levels
- **Descriptor 10** Marine litter does not cause harm

- **Descriptor 11** Introduction of energy (including underwater noise) does not adversely affect the ecosystem.

GES is considered as a critical indicator in the MSP process to indicate that marine waters are clean, healthy and productive and on sustainable use of the marine environment and thus GES respectively will ensure the potential for marine uses and activities. The Ecological Status of the coastal water bodies in Bulgaria in 2017 is presented in Figure 18.

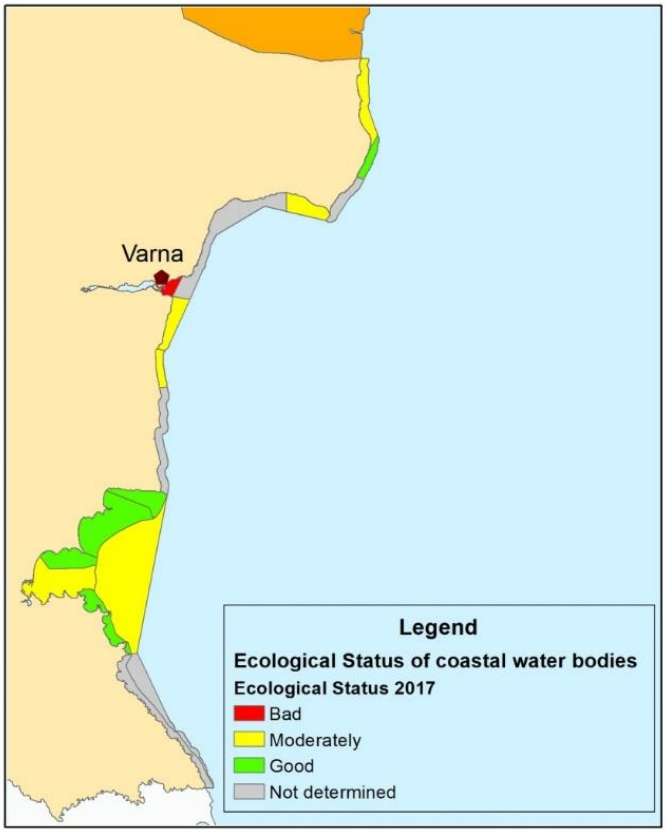


Figure 18. Map of Ecological Status of Coastal Water Bodies in Bulgaria in 2017
(Map produced by CCMS; Data source: BSBD)

In Bulgaria, the Black Sea water region includes:

a. Rivers flowing into the Black Sea, including adjacent lakes.
b. Coastal waters and territorial sea.
c. Groundwaters.

In support to Water Framework Directive (2000/60/EC) the water monitoring system aims at providing the necessary data for the assessment of the status of water bodies, including discharges of wastewater, timely identification of negative processes, forecasting their development, prevention and limitation of harmful effects and determination of the degree of efficiency of the existing measures to achieve the environmental objectives for the water bodies, in accordance with the current Black Sea Basin Management Plan for Water Management. Based on the annual report since 2017 by the Black Sea Basin Directorate (BSBD) in Varna, the trends of the changing ecological status are shown in the table below (Table 20). According to this report, in 2017 from all 17 CWB in Bulgaria, 5 WB have a Good Status, 6 WB Moderate, 1 WB have a Bad Ecological Status, and for 5 WB Ecological Status

are not determined. The Bad Ecological Status is determined for the coastal waters in Varna Bay.

The water body of Varna Bay is characterized as the most problematic along the Bulgarian coast, where it has the most tangible local anthropogenic impact and maintains a stable category. The area is subject to an extended human-induced pressure: large Harbours and seaports, pollutions from Varna (respectively Beloslav lakes), pollutions from small rivers, etc. The report recommended that it is necessary to identify the sources of pressure and to take adequate management measures to reduce the pressure, in the northern waters, whose poor condition puts the Varna Bay at the highest risk of not achieving good status in the recent years.

Table 20. Trends in the changing ecological status of coastal water bodies (CWB) in Bulgaria (*Source: BSBD, 2017*)

Trends in the changing ecological status of coastal water bodies (CWB) in Bulgaria									
CWB (2010-2015)	**2010-2015**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
BG2BS000C001	Moderately	Bad	Very bad	Bad	Moderately	Moderately	Moderately /Bad	Moderately	Moderately
BG2BS000C002	Moderately	Bad	Moderately	Bad	Moderately	Bad	Moderately /Bad	Moderately	Good
BG2BS000C003	Good	Very bad	Moderately	Moderately	Moderately	Moderately	Moderately	Moderately	Not determined
BG2BS000C004	Bad	Bad	Moderately	Moderately	Moderately	Not determined	Not determined	Moderately	Moderately
BG2BS000C013	Good	Very bad	Bad	Bad	Moderately	Moderately	Moderately	Moderately	Not determined
BG2BS000C005	Bad	Bad	Very bad	Bad	Moderately	Bad	Bad	Bad	Bad
								Moderately	Moderately
BG2BS000C006	Bad	Bad	Very bad	Very bad	Very bad	Bad	Bad	Moderately	Moderately
BG2BS000C007	Good	Moderately	Very bad	Good	Moderately	Moderately	Bad	Moderately	Not determined
BG2BS000C008	Bad	Bad	Moderately	Bad	Bad	Moderately	Moderately /Bad		
CWB (2016-2021)	-	-	-	-	-	-	-	**2016**	**2017**
BG2BS000C1008								Moderately	Good
BG2BS000C1108								Moderately	Good
BG2BS000C1208								Moderately	Good
BG2BS000C1308								Bad	Moderately
CWB (2010-2015)	**2010-2015**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
BG2BS000C009	Good	Moderately	Moderately	Bad	Moderately	Not determined	Not determined		
BG2BS000C010	Bad	Moderately	Bad	Bad	Moderately	Moderately	Moderately	Moderately	Moderately
BG2BS000C011	Moderately	Bad	Moderately	Moderately	Bad	Not determined	Not determined	Moderately	Good
BG2BS000C012	Good	Good	Moderately	Bad	Good	Moderately	Moderately	Good	Not determined
CWB (2016-2021)								**2016**	**2017**
BG2BS000C1112								Moderately	Not determined

References

1. https://www.bsbd.org/UserFiles/File/annual%20reports/Doklad_2017.pdf
2. https://www.bsbd.org/UserFiles/File/annual%20reports/Prilojenie_1-1-1-8_2017.pdf
3. http://www.rowater.ro/dadobrogea/Planul%20de%20Management%20Bazinal/Plan%20de%20Management%20actualizat%20al%20Fluviului%20Dunarea,%20Deltei%20Dunarii,%20SH%20Do

brogea%20si%20Apelor%20Costiere%202016-2021/ABADL_Planul%20de%20Management%20actualizat%20TEXT.pdf

4. Main maritime activities: trends and planning issues,
including gaps of knowledge and information (*synthesis and thematic maps*)

The main maritime activities and sectors identified during the first MARSPLAN-BS project for Bulgaria and Romania (Table 21), are summarized and analyzed in the sections below.

Table 21. The main activities and sectors at the western Black Sea

Main maritime activities/sectors		
Activities/Sectors	**Bulgaria**	**Romania**
4.1. Fishing and Aquaculture	Development of fishing and aquaculture.	Development of fishing and limited aquaculture development.
4.2. Extraction of non-living resources (oil and gas, incl. infrastructure, salt, water, etc.)	Oil and gas exploitation, salt and water extraction: all these human activities require MSP to achieve environmental protection and sustainable development of the sector.	Oil and gas exploitation, activity requires MSP to achieve environmental protection and sustainable development of the sector.
4.3. Maritime transport (shipyard, infrastructure, shipping, ship building, etc.)	This sector has high socio-economic importance as its development affects other sectors as fishing and tourism.	This sector has high socio-economic importance as its development affects other sectors as fishing and tourism.
4.4. Submarine cables and pipelines	Bulgaria benefits from the advantages of geographical location on important gas transport corridors and there are studies and explorations on gas fields.	Romania benefits from the advantages of geographical location on important gas transport corridors and access to major gas resources recently discovered in the Black Sea.
4.5. Tourism (coastal and marine)	Coastal tourism, mostly mass beach tourism, is prevailing branch; marine tourism, including yachting and recreational boating, is still limited, but expected to grow.	Beach tourism is more developed (including Danube Delta area) than coastal tourism, which is represented only by yachting and recreational boating (they are still limited).
4.6. Physical restructuring of coastline or seabed **4.6.1. Coastal defense/flood protection**	High number of coastal defense and flood protection structures (mainly groins, dikes and seawalls), few cases of beach nourishment.	High number of coastal defense and flood protection structures (mainly groins, breakwaters and seawalls), including beach nourishment.

4.6.2. Dredging and dumping	Dredging and dumping are practiced to maintain port areas and navigational canals.	Dredging and dumping are practiced to maintain port areas and navigational canals functional.
4.7. Underwater Cultural Heritage	Numerous UCH remains/ shipwrecks and their protection should be part of national MSP.	Numerous UCH remains/ shipwrecks and their protection should be part of national MSP.
4.8. Military trainings	Zones of military trainings and warnings are publicly announced before the trainings. However data/information on military trainings in maritime areas are not fully publicly available.	Zones of military training activities comprise the whole maritime space, but specifically zones and warnings are publicly announced before. Data/information on military trainings in maritime areas are not fully publicly available.

4.1 Fishing and Aquaculture

- ***Socio-economic trends***

In 2014, the total catch of fish and other aquatic organisms from commercial fishing in Bulgaria amounted to 8 546.7 tons in the Black Sea. The contribution of the fishery sector to the Bulgarian economy is around 14 million Euros. Although the fishery sector contribution to the national employment is relatively small (0.38% of national workforce), it is important at regional level, especially in the coastal areas and settlements, Varna (e.g. Byala) and Burgas (e.g. Nesebar) regions.

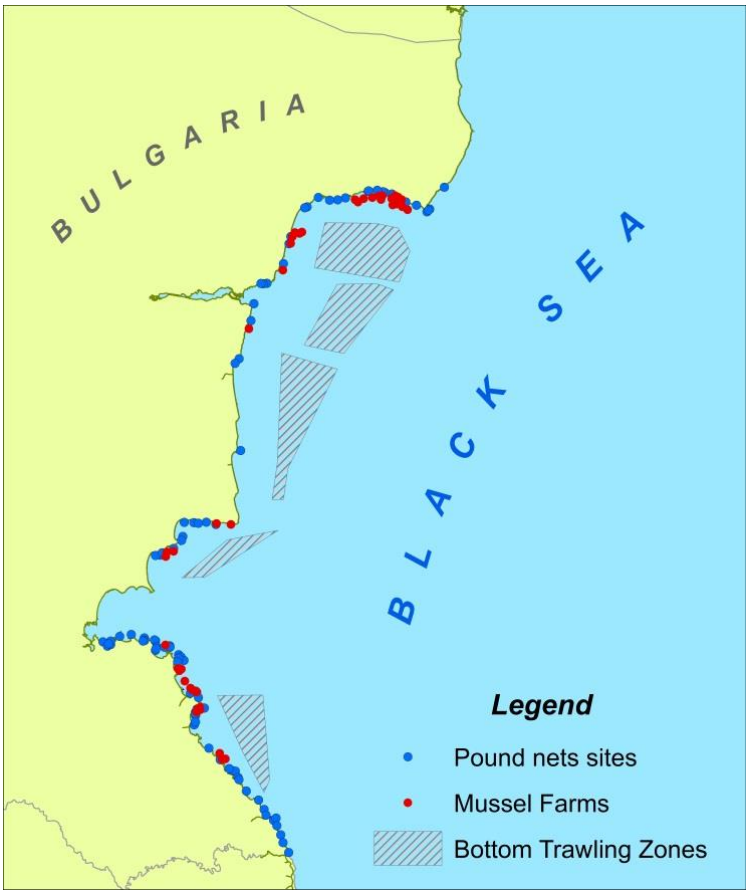


Figure19. Fishing and aquaculture in Bulgaria (*Map produced by CCMS*)

Recently, Bulgaria has evolved rapidly marine aquaculture, specifically in cultivating black mussels. The development of marine aquaculture in the Black Sea is promising due to the lack of industrial pollution, lack of dangerous toxins produced by algae (e.g. as is in the Mediterranean Sea) and the relatively small tides (8-9 cm). In the Black Sea there are no swimming predators such as starfish, etc., to inflict damage on aquaculture.

The only species reared in the Bulgarian marine aquaculture is the black mussel (*Mytilus galloprovincialis*). According to the Executive Agency for Fisheries and Aquaculture, the mussel farms with collectors are numbering 29. One of the major problems for cultivating black mussels is the limited use of specialized vessels designed to service the farms (high cost, lack of mass production) (Figures 19 and 20).

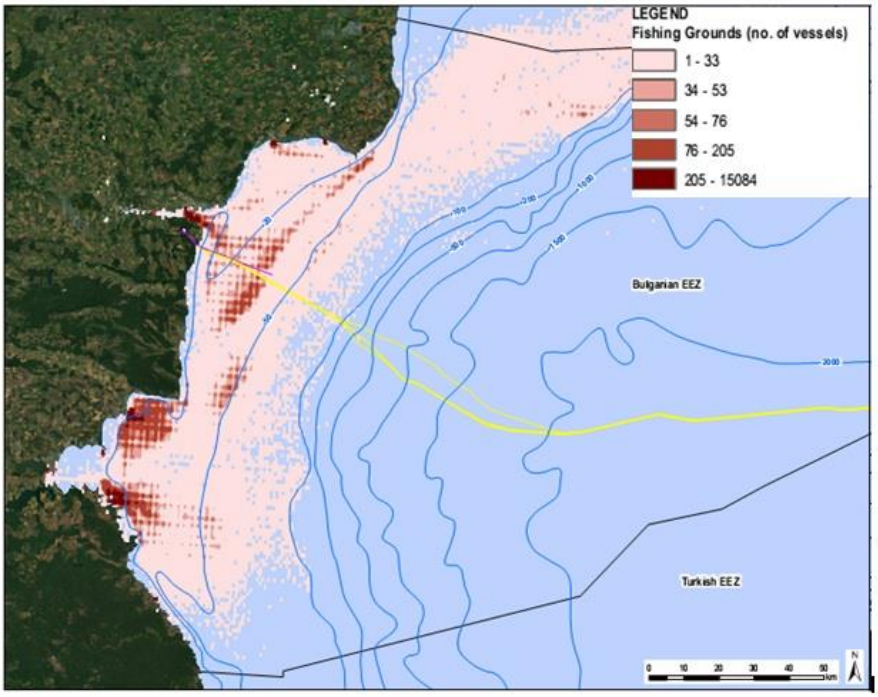


Fig. 20. Fishing grounds in Bulgaria

In Romania, fishing is practiced along the Romanian coast supported by the existence of four fishing ports (Sulina, Cape Midia, Constanta and Mangalia) and other 18 small fishing stations, located between Sulina - Vama Veche (Figures 21 and 22). Generally, the fishing depth ranges within 2 –20 m; only when specialized turbot, shad or dogfish fishing is practiced, the fishing depth goes down to 60 m. Currently, the fishing vessels used in the Romanian waters are characterized by lack of hydraulics, lifting equipment, refrigeration compartments for storage production, etc., thus negatively influencing the fishing.

The main issues are related to conflicts between representatives of the fishing community and aquaculture operators, pollution of any type that can halt mining production and significant increase in the population of *Rapana*. The invasion of this predator which has no natural enemy reflects directly on colonies of mussels which they eat.

In the Romanian marine waters, the fishing activity is 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 fishing in the Romanian Black Sea area was 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. The fishing effort in 2012 continues the decreasing trend that has been reported since 2000. Thus, in 2012, only one vessel practiced active fishing (using the mid-water trawl), while passive fishing was practiced using 157 crafts (34 boats with length less than 6 m, 121 boats with length within 6-12 m, one vessel with length within 12-18 m, and one vessel with length within 18-24 m. The fishing with fixed gear was practiced along the Romanian coast using: 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.

In the Romanian marine waters, the fishing activity is 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 fishing in the Romanian Black Sea area was 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. The fishing effort in 2012 continues the decreasing trend that has been reported since 2000. Thus, in 2012, only one vessel practiced active fishing (using the mid-water trawl), while passive fishing was practiced using 157 crafts (34 boats with length less than 6 m, 121 boats with length within 6-12 m, one vessel with length within 12-18 m, and one vessel with length within 18-24 m. The fishing with fixed gear was practiced along the Romanian coast using: 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.

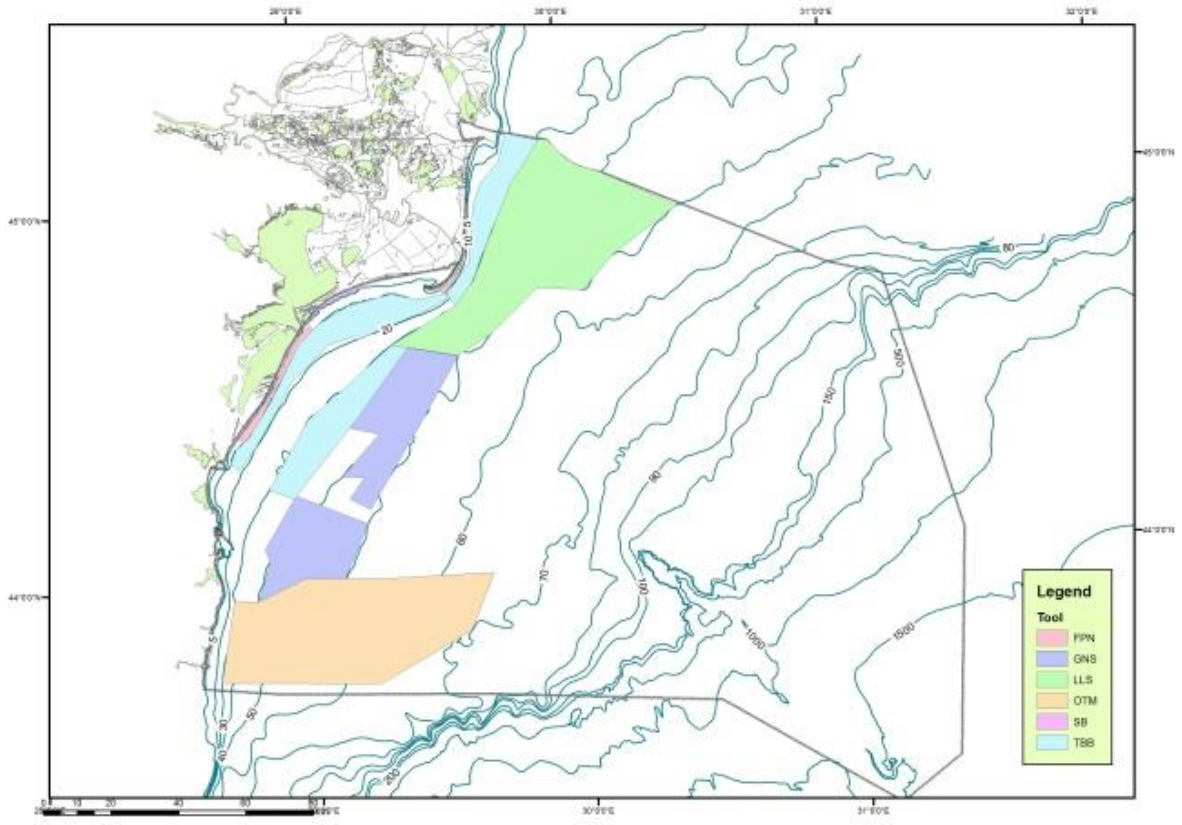


Figure. 21. Suitable areas for fisheries in Romania (*Map produced by NIMRD*)

After a decreasing trend reported for the period 2002-2010, when the total catch dropped from more than 2,000 t to a minimum value in 2010/258 t, in the past years a slight increase was observed (568 t, in 2011, and 835 t, in 2012).

Table 22. Spawning areas, eggs distribution and fishing gears in Romania

Species	Spawning		Eggs distribution	Fishing gears
	Season/Environment conditions	Areas		
Sprat Sprattus sprattus	Whole year, maximum in November-March, optimum temperature 7-12ºC	Whole continental shelf	Pelagic, on the horizon 0-100m most often between 25-50m	pound nets, trawls
Horse mackerel *Trachurus mediterraneus ponticus*	May - August, especially in July, water temperature 15-25ºC, salinity 13-19‰	continental shelf at depth >50 m	Pelagic	pound nets, trawl, purseiners
Anchovy *Engraulis encrasicolus*	May - August, optimum temperature 13-6ºC, salinity10-19‰	Whole continental shelf	Pelagic	pound nets, purseseines
Blue fish *Pomatomus saltatrix*	June - August, temperature 20 - 25º C	Whole continental shelf	Pelagic	pound nets, trawl
Atlantic bonito Sarda sarda	May - June		Pelagic; larvae at 5m depth	pound nets
Atlantic mackerel *Scomber scombrus*	End of the winter and early in the spring	Marmara Sea and Aegean Sea	Pelagic	hand lines
Turbot, *Psetta maxima maeotica*	April - June, 8 - 12ºC optimum temperature, salinity 16-19‰	At small distance from shore, depth of maximum 50m	Pelagic, from surface up to 50m depth	gill nets, lines, pound nets, trawl
Spiny dogfish *Squalus acanthias*	Reproduction takes place in April-May, October – in November is juveniles expulsion	Coastal zone, depth of 20-50m	Ovoviviparous species	lines, trawl
Whiting *Merlangius merlangus euxinus*	All the year, specially in December - March, temperature of 6- 0ºC, salinity 17 - 18‰	Whole continental shelf at depth 60 m	Pelagic, from surface to 40 m depth	pound nets, trawls
Red mullet, *Mullus barbatus ponticus*	June - September, temperature 9 -23ºC	Whole continental shelf	Pelagic	pound nets, trawl
Pontic shad *Alosa immaculata*	Spawning starts when temperature rises above 15°C in April-August	In the rivers (Danube, Dnieper, etc.)	Pelagic eggs	mainly with gill nets
Danube sturgeon *Acipenser colchicus gueldenstaedti*	End of March until middle June (8-11ºC)	Danube river	-	long lines, gill nets, pound nets, trawl
Starry sturgeon *Acipenser stellatus*	April - May, water temperatures 8 -11ºC	Danube river	-	long lines, gill nets, pound nets, trawl
Beluga *Huso huso*	March until May, optimum temperature 15 - 17ºC	Danube river	-	long lines, trawl, gill nets, pound nets

In 2015, in the Romanian Black Sea coast were used: trap nets (29), turbot gillnet (2,360), shad gillnets (319), gobies gillnets (153), dogfish gillnets (137), beam trawls (35), and pelagic trawls (3). The main species reported in the catches have been: *Rapana whelk* (4,460 tons / 92.02 %,

of total catches); anchovy (112 tons); sprat (110 tons); turbot (31 tons); horse mackerel (14 tons); shad (22 tons) and gobies about 24 tons (Table 22).

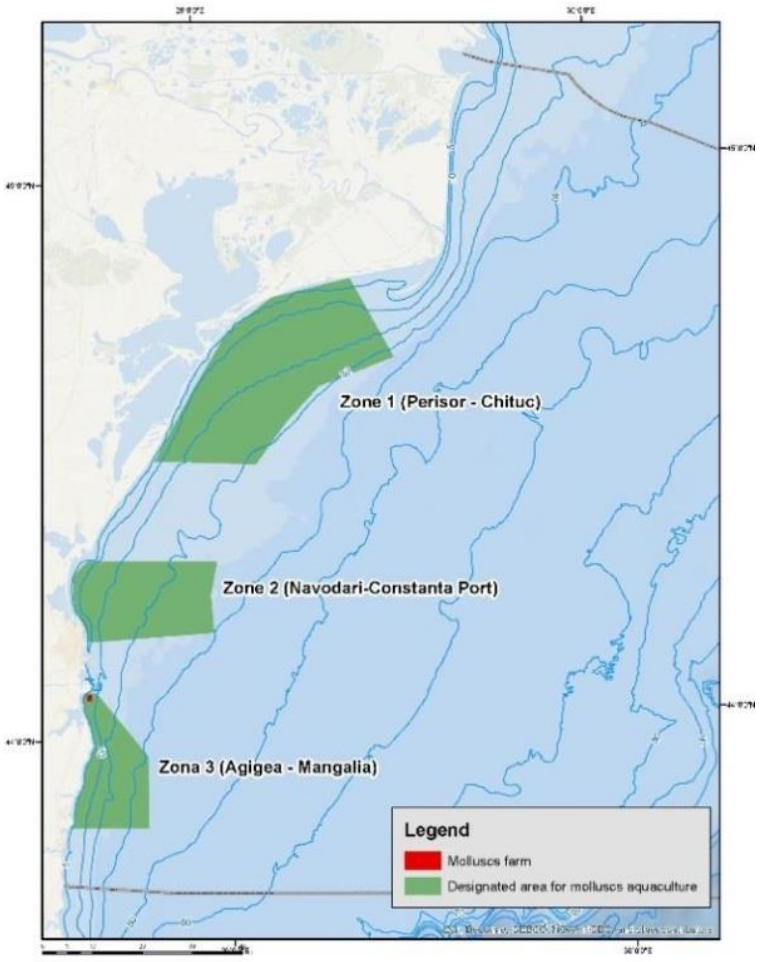


Figure 22. Areas proposed for rearing of molluscs proposed by NIMRD based on water quality established according to the Law No. 467/2006

The Marine aquaculture in the Romanian Black Sea area have shown a relatively recent development. In the future, the technology and production in the region is expected to grow, but depends of the level of profit and possibilities of funding. The most important cultivated species were rainbow trout - *Onchorhyncus mikiyss*; mullet - *Mugil cefalus*, turbot - *Psetta maeotica*, plaice - *Platichthys flesus luscus*, sturgeons.

In present, only one private company (SC Maricultura Ltd.) has been dealt with the cultivation of the Black Sea mussel *Mytillus galloprovincialis* in Romanian waters. The farm consists of 10 structures long-line system. As regarding the onshore marine aquaculture, the only specialized company, namely ELCOMEX Ltd., ran out of business due to improper management and technical difficulties. After a collaboration with NIMRD for adaptation of North Sea and Atlantic turbot to the specific Black Sea environmental conditions, the company begun to raise turbot in an on-growing onshore Recirculating Aquaculture System located at Cape Midia Navodari.

In terms of Black Sea mussel production in the Romania, there are some factors that negatively influenced it, such as: conflicts between representatives of the fishing community and aquaculture operators, pollution of any type that could reduce the production and significant increase of Rapana population (predator for the mussels).

- ***Policy strategies/legislation***

- The National Strategic Plan 2007-2013 and the present one for the period 2014-2020, both in Romania and Bulgaria, have been elaborated in the framework of the European Fisheries Policy and in line with the policy of the Romanian government, including the National Strategic Plan and the Operational Program for Fisheries and Aquaculture, as a programming document supported by the European Fisheries Fund until 2020.
- Fisheries and Aquacultures Act, Prom. SG. 41 of 24 April 2001, Last amended SG. No 98/27.11.2018.
- According to the Directive 79/923/EEC, implemented in Romania by Government Decision (GD) No. 201/2002 amended and completed by GD No. 467/2006, consisting in technological norms regarding the quality of waters for molluscs, along the Black Sea coast, four areas, suitable for bivalve culture, have been identified (Fig. 21).
- Working Group for Fisheries and Aquaculture for the Black Sea belonging to GFCM are focused on achieving the first stage of the programming process, namely the development of the socio-economic analysis.

- ***Knowledge gaps***

In Bulgaria:

- No existing spatial database for fishing areas and catchment;
- Data for aquaculture areas are not in spatial format.

In Romania is a lack of legislative framework related to:

- marine waters concession in order to implement aquaculture projects based on European funding schemes or private capital;
- the implementation of a national program for the classification of harvesting and cultivation zones for mollusks, according to the European regulation 854/2004.

- ***Conclusion***

From a spatial point of view, the mariculture could be developed, only:

- in naturally sheltered coastal areas (but they are almost non-existent);
- in artificially sheltered zones, that should be built and arranged in suitable areas, which requires high funds, difficult to access and recover;
- on platforms or in arranged basins, supplied with water directly from the sea, from suitable areas for adduction/collection in agreement with European and national legislation for water quality and/or natural protection.

For offshore marine areas, further research needs to be conducted to evaluate the interaction between maritime activities and environmental components, the state of climate instability and the associated impact.

References

1. Fisheries and Aquacultures Act, Prom. SG. 41 of 24 April 2001, Last amended SG. Issue 98 of November 27, 2018.
2. Shliakhov, V., Daskalov, G. 2008. BSC, 2008. State of the Environment of the Black Sea (2001-2006/7). Chapter 9 - State of Marine Living Resources. Black Sea Commission Publications 2008-3, Istanbul, Turkey, 419 pp.
3. Targeted Investment Program as support of the development of Northwestern Bulgaria, the Rhodopes, Strandzha-Sakar, border, mountainous & semi-mountainous underdeveloped regions, *https://www.mrrb.bg/static/media/ups/articles/attachments/%D0%94%D0%BE%D0%BA%D0%BB%D0%B0%D0%B4%20%D0%9F%D0%9E%20%D0%BC%D0%BE%D1%80%D1%81%D0*

%BA%D0%B8%20%D1%81%D0%B5%D0%BA%D1%82%D0%BE%D1%80%D0%B8286cdb96e5f04230defa0cca202ae63c.pdf.

4. National programme for collection, usage and management of data at fisheries sector, *http://iara.government.bg/*
5. GFCM Capture Production database en (Accessed November 2013), *http://www.fao.org/fishery/statistics/gfcm-captureproduction/*
6. Ivanov L. and Beverton R.J.H., 1985 – The fisheries resources of the Mediterranean. Part two: Black Sea. FAO studies and reviews, 60: 135
7. Pusanov I.,1967- Studii privind mediteranizarea succesivă a Mării Negre. Int.Rev.Ges.Hidrobiol. N52(2), p.219-236.
8. *Marine Research*, 12, No. 2, p. 549-558, ISSN 1311-5065, NIMRD.
9. Radu G., Aurelia Ţoţoiu, Mădălina Galaţchi, 2015 - *Evolution of the Sprat Fishery at the Romanian Black Sea Coast during 1950-2014*. The International Symposium Protection of the Black Sea Ecosystem and Sustainable Management of Maritime Activities (PROMARE 2015). Seventh Edition 29-31 October 2015 Constanta, ROMANIA.
10. Radu G., S. Nicolaev, 2009. National Fisheries Report 2008. BSC, Istanbul
11. *** NIMRD Constanta Scientific Reports, 2000 – 2015
12. *** Interim Evaluation of the Operational Program for Fisheries in the period 2007 - 2011. Ministry of Agriculture and Rural Development

4.2 Extraction of non-living resources (oil and gas, incl. infrastructure, salt, water, etc.)

- ***Socio-economic trends***

Non-living natural resources include minerals, fossil fuels, fertile soil, forests, water resources etc. The exploitation/extraction of non-living natural resources encompass a wide range of human activities, all of which influencing the marine environment. Rational planning of non-living natural resources, but not limited to, hydrocarbon exploration, shipping, tourism and seafood production and/or aquaculture is be required to ensure that sustainable development can be achieved.

Along the Bulgarian coast, oil is exploited in the areas of Burgas (oil refinery) and Shabla (oil and gas extractions). According to the Ministry of Energy of Bulgaria, three deposits of oil and natural gas have been exploited on the territory of the coastal municipalities. The deposits are under exploitation by mining concessions issued in favour of "Exploration and Production of Oil and Gas" JSC, Sofia.

In the Bulgarian Black Sea waters, four natural gas fields are registered. The Galata Platform and associated infrastructure (pipelines) is the only one production facility operated in the Bulgarian Black Sea waters. It is a natural gas field located on the continental shelf, approximately 25 km southeast of Varna Bay. The field was the first to be developed and at peak production provided more than 16% of Bulgaria's domestic gas needs. Potential conflicts are related to oil spills, marine accidents, increasing pressure on environment (Figure 22).

The extraction of seawater has a long history in Bulgaria, mainly for salt production. Data, published by the Black Sea Basin Directorate-Varna, Bulgaria show 7 sites for seawater extraction (Figure 23). The purposes are for fire-fighting needs, industrial (salt production), aquaculture, livestock breeding and others. The total water quantity permitted per year is 167241 m^3.

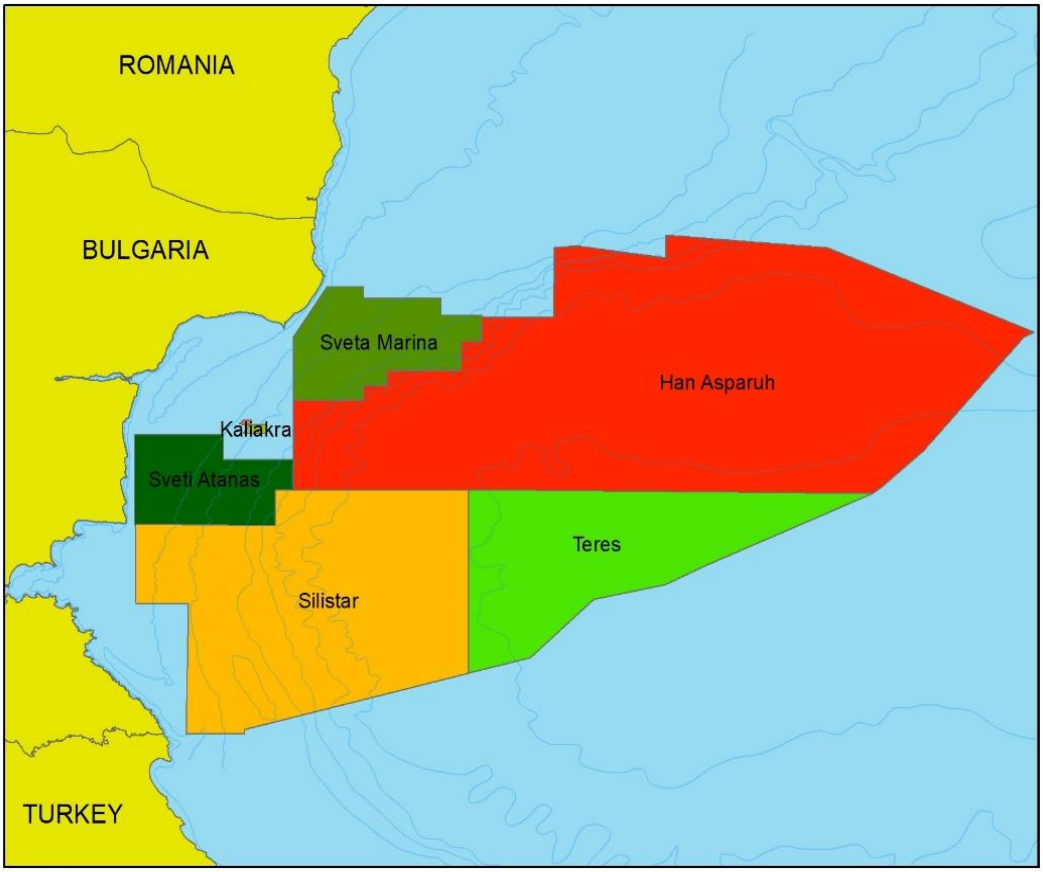


Figure 23. Offshore blocks for exploration and extraction of oil and gas (*Map produced by CCMS*)

From centuries, the coastal lagoons have been subject of salt production through solar evaporation of seawater. Such lagoon type lakes in Bulgaria are Pomoriysko and Atanasovsko Lakes, located in the area of Burgas Bay. The following companies operate in Bulgaria by extracting mineral resources from the Black Sea:

- "Chernomorski solnitsi" JSC. Company mining sea crystal salt, lye for winter road maintenance, medical lye for the pharmaceutical industry and for physical therapy.
- M-Pomoriyski solnitsi SJSC. M-Pomoriyski solnitsi SJSC is separated as a branch from "Chernomorski solnitsi" SLLC and extracts about 32-34 thousand tons of salt per season. Besides sea salt, it extracts as by-products lye for winter road maintenance, medical lye, magnesium salts and others.

Other enterprises for extraction of salt in the municipality of Pomorie are "Solari 98" Ltd and BSCS (Bulgarian Salt-extracting Cooperative Society) "Anchialski solnitsi".

In general, the region has the necessary resources for the production of sea salt, whose current production capacity is not fully loaded. Available resources have an alternative purpose outside the main one (for consumption), such as winter road maintenance, medicine, and pharmacy. The development potential of the sector is largely based on more efficient use of resources for alternative purposes, mainly in medicine and pharmacy. There are spa treatment facilities functioning in the target area, that use sea salt and its derivatives. The seawater extraction uses are presented in the Figure 24.

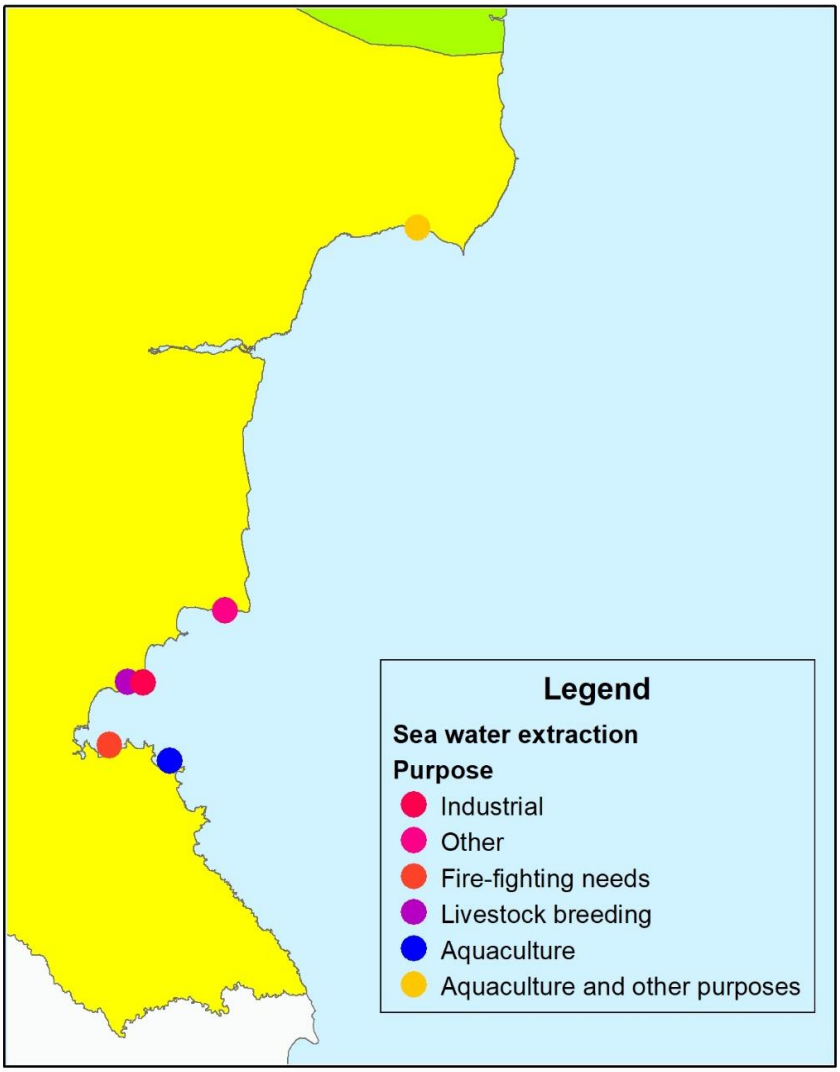


Figure 24. Purpose of sea water extraction (*Map produced by CCMS*)

Potential conflict is related to the increasing pressure on the environment, in case of increasing the sea salt production and the number of visitors. Furthermore, the area used for the extraction of salt cannot be utilized for other economic activities and the possible extension will lead to the seizure of additional areas from the coast.

There is currently no data on the mineral extraction of sand and gravel from the seabed and underground mining in the Bulgarian part of the Black Sea.

In Romania discussions and prospects related to offshore oil and gas activities were first initiated in 1967–1969 with the purpose of enhancing the national oil and gas production through potential offshore drilling and exploitation of the Black Sea continental shelf.

Consequently, in 1975, the first offshore drilling platform was installed, leading to the first Black Sea oil production, in 1987. Despite this relatively long history of upstream offshore activity in shallow waters, it was only in 2012, that the first deep-water discovery was made in the Black Sea, when Domino-1 well found an estimated 42 to 84 billion cubic meters (bcm) of potentially recoverable gas, thus becoming the largest single discovery in the Black Sea, as of today.

In 1975, the first offshore drilling platform was set in position on the continental platform of the Black Sea. The first location, Well 1 Ovidiu East, had water depths of 84 m, while the platform was designed for maximum water depth of 90 m and maximum wave height of 12 m. The well reached a depth of 5,006 m and collected a sample rich in geological information, but there were not significant signs of oil.

A second borehole was drilled in the Midia block with another unsuccessful result. This led to a third location, in the XVIII Istria block. This field, named Lebada (the Swan), is in an area with water depths of 50 m, located approximately 80 km northeast of Constanta. Here, crude oil was discovered in significant quantities.

Currently, around 8% of crude and condensate oil is produced offshore, whereas the rest comes from onshore. Crude oil production in 2016 was around 27 million barrels, while total consumption exceeded 82 million barrels. At this rate of production, the proved reserved of the 330 million barrels that belong to OMV Petrom, the biggest domestic oil producer, will be sufficient for only another 4 years and 4 months (Figure 25).

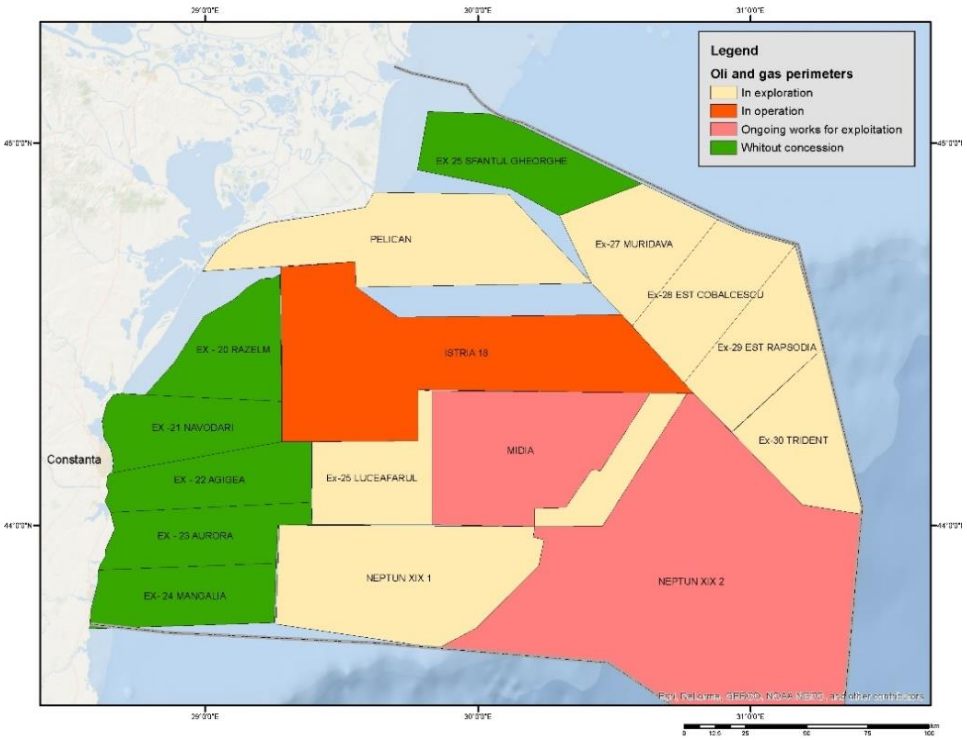


Figure 25. Black Sea exploration, development and exploitation perimeters (*Map produced by NIMRD)*

Romanian offshore area covers 22,000 square kilometers and reaches depths beyond 1000 meters. The whole area is divided in blocks of different sizes, some of them being awarded to operators for exploration, development and exploitation activities (Fig. 24).
Lebada East (production started in 1987), Lebada West (production started in 1993), Sinoe (production started in 1999), Pescarus (production started in 2003) and Delta (production started in 2009) fields, located in the XVIII ISTRIA block, are the oldest discoveries. Together, they accounted for 185 million barrels of oil, 8 million barrels of condensate and 48 bcm of gas. Due to their long history exploitation, the oil and condensate reserves are almost depleted, while the remaining gas resources are around 6 bcm, according to market reports.

In the XV MIDIA A block, two relevant discoveries were made: Doina (in 1995) and Ana (in 2008). Together, they hold recoverable resources of 9.5 bcm of gas. The exploitation is expected to begin before 2020.

In the EX-27 MURIDAVA, the exploration has shown possible quantities of 4.85 bcm of gas and 11.7 million barrels of oil. The explorations in the EX-28 EST COBALCESCU, EX-29 EST RAPSODIA, XV MIDIA B blocks did not shown any commercially viable quantities to date. In 2014, a small discovery was announced in Istria XVIII block, Marina field, with a production potential of 1,500-2,000 boe/day.

In March 2012, OMV Petrom S.A. and Exxon Mobil Exploration & Production Romania Ltd. (as Operator) announced that, through the Domino 1 well, part of XIX 2 NEPTUN (DEEP) block, recoverable resources estimated between 42 and 84 bcm of gas have been discovered.

In October 2015, Lukoil, PanAtlantic and Romgaz have announced the discovery of a field in EX-30 TRIDENT block. According to the seismic data and following the analysis of the data obtained during the drilling, the preliminary results indicate reserves that exceed 30 bcm of natural gas.

Potential conflicts are related to the increasing pressure on the environment, in terms of chemical pollution (potential accidents) and noise (affecting the marine mammals).

According to the data provided by the National Agency for Mineral Resources, in 2016 there were granted exploitation licenses for mineral resources, other than oil and gas, in the following administrative-territorial units situated on the Romanian Black Sea coastline (Table 23. Figure 26):

Table 23. Exploitation perimeters of mineral resources on the Romanian Black Sea coastline

Perimeter name	Mineral resource name	Locality and County name
Mangalia Hercules	Natural mineral waters	Mangalia, Constanța
Mangalia Laborator	Natural mineral waters	Mangalia, Constanța
Mangalia Sanatoriu I	Natural mineral waters	Mangalia, Constanța
Jupiter-Aurora F8-SAFAR	Thermal-mineral waters	Mangalia, Constanța
Jupiter-Aurora F10-SAFAR	Thermal-mineral waters	Mangalia, Constanța
Vanoord 1	Sand	Tomis Nord, Constanța
Vanoord 2	Sand	Tomis Centru, Constanța
Vanoord 3	Sand	Tomis Sud, Constanța

Source: National Agency for Mineral Resources, 2016.

- ***Policy strategies/legislation***

Policy strategies and legislation for extraction of non-living resources in Bulgaria are mainly related to:

- Law of Underground Natural Resources (Promulgated SG. No. 23/12.03.1999, Last amended SG. No. 19/13.03.2009) regulates the terms and conditions for *"…prospecting, exploration and extraction of the underground natural resources on the territory of the Republic of Bulgaria, on the continental shelf and in the exclusive economic zone in the Black Sea*".
- Water Act, 2000. Promulgated State Gazette No. 67/27.07.1999, last amended SG. No. 25/26.03.2019.

- Law 256/2018 regarding some measures necessary for offshore titleholders implementing petroleum operations (the Romanian "Offshore Law").

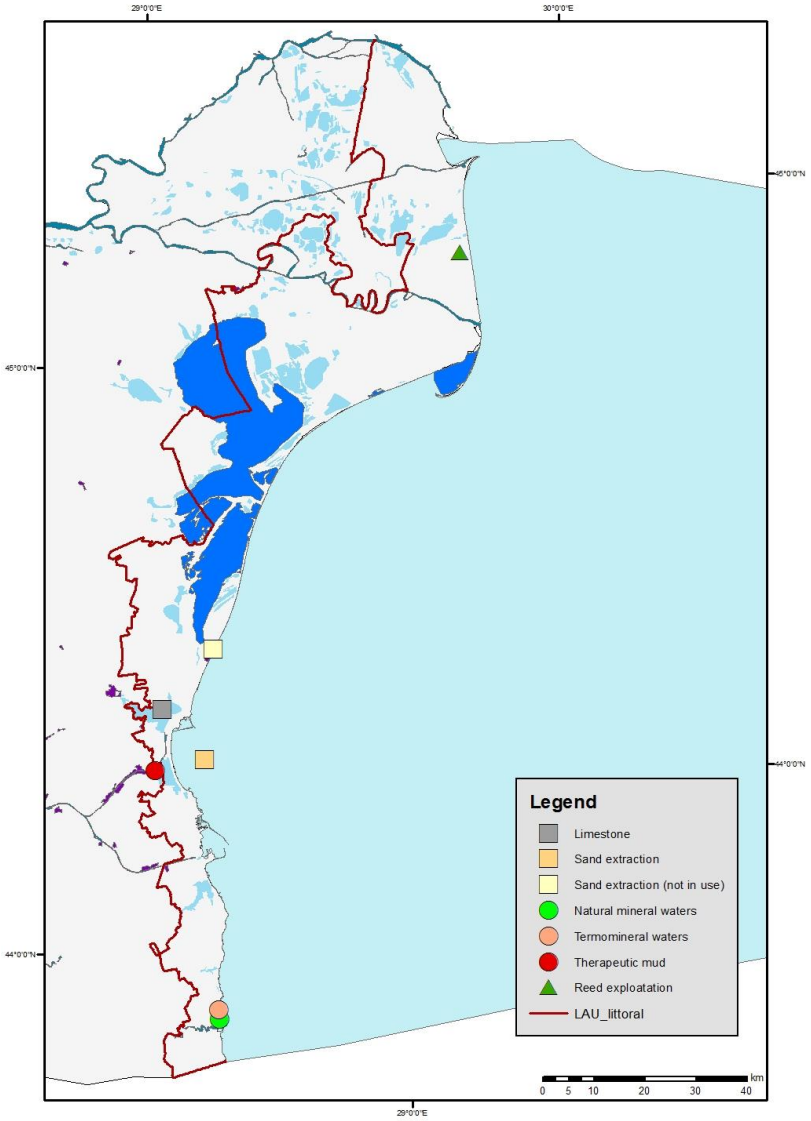


Figure 26. Exploitation of mineral resources on the Romanian Black Sea coastline and marine space (map *produced by NIMRD*)

- ***Knowledge gaps***

- No existing spatial database for extraction of non-living resources;
- Data for extraction of non-living resources are fragmented and in unfriendly formats.

4.3. Maritime transport (infrastructure, shipping, ship building, shipyard, etc.)

Shipping in Bulgaria is of particular high socio-economic importance since it directly affects the development, mainly in terms of employment, of other sectors such as tourism and fisheries. There are 61 functioning sea berths-ports in Bulgaria (Table 24), as 35 of them are located in the area of the Maritime Administration - Burgas and the other 26 - in the area of Maritime Administration – Varna (Figure 27).

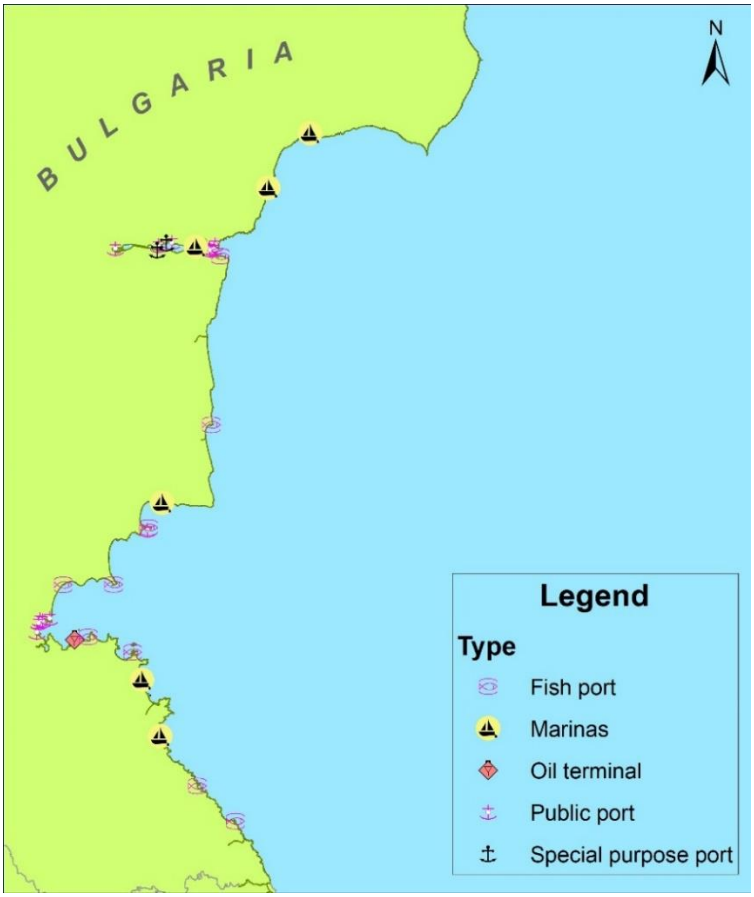


Figure 27. Ports type and location in Bulgaria (*Map produced by CCMS*)

Bulgaria supports sufficient number of sea ports for servicing passengers, cargo and fishing activities. The two largest Harbours are located in the district centers - Burgos and Varna, they are secured with the necessary capacity and technical capabilities and function as multi-purpose port terminals. The existing port facilities make it possible to handle virtually all types of bulk and general cargo. The potential for the development of port infrastructure is mainly in the further modernization of the technical base and the development of passenger and tourist transport. There are several main shipping routes crossing over the entire Black Sea (Figure 28).

Table 24. Port types in Bulgaria

	Port types	Number of ports
1	Ports for public transport with national importance	13
2	Ports for public transport with regional importance	9
3	Fishing ports	13
4	Yacht ports (marinas)	14
5	Ports of special purpose	11
	Total	***61***

Data source: Executive Agency "Maritime administration", www.marad.bg

There are few shipyards in Bulgaria, located at Varna, Burgas and Ruse. Ship repairing is situated in Varna and Burgas.

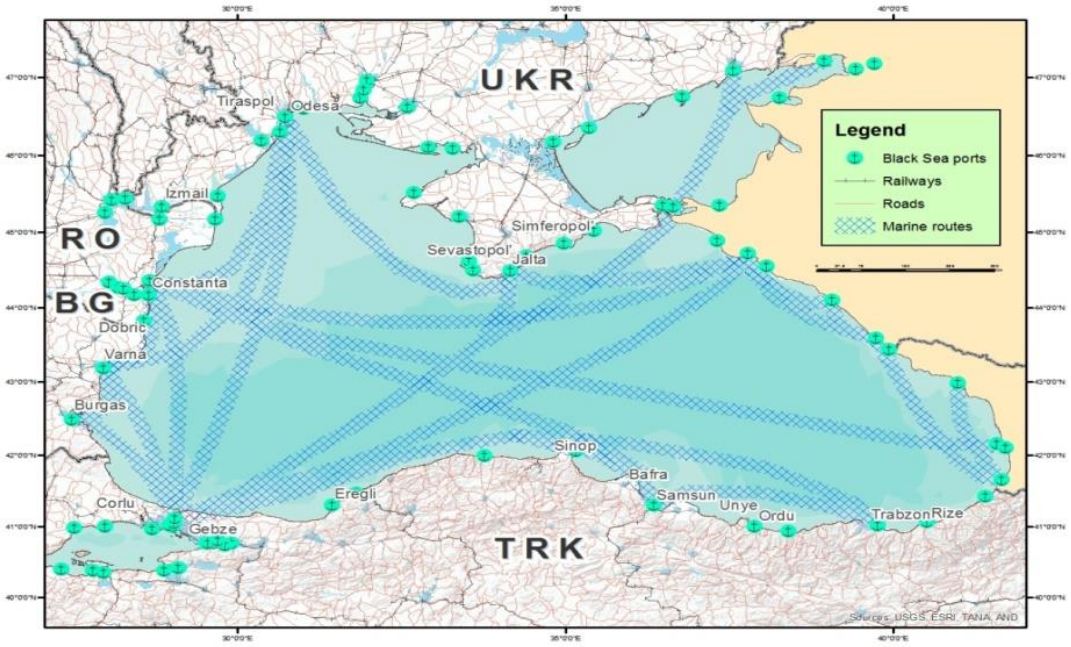


Figure 28. Black Sea shipping routes *(map produced by NIMRD*)

Potential conflicts are related to environmental pressures, as well as limiting the development of other maritime sectors (e.g. tourism, fishing and aquaculture, etc.) due to the existing territorial and structural solutions.

In Romania, there are three maritime ports, namely Constanta, Midia and Mangalia Ports. They are part of the Romanian maritime port system under the coordination of Maritime Ports Administration SA Constanta (Figure 29).

Leader in the western Black Sea region and an important hub for Central and Eastern Europe, Constanta Port has the advantage to be located at the crossroad of trade routes that link the western and central Europe to Asia and to the Far East. Constanta Port is the terminus point of the Pan-European corridor VII (Danube) that connects the North Sea to the Black Sea through the Rhine-Main-Danube corridor. Due to the Danube-Black Sea Channel, which represents one of the main key points of its infrastructure, the Port of Constanta is also a river port offering mooring facilities for all category of maritime and river vessels.

Port of Constanta has a total area of 3.926 ha. It is divided into three subdivisions:

- Seaport with annual handling capacity of 100 million tons, 140 berths served by allowing access functional vessels with a capacity of 220,000 dwt to,
- River port allows access to any type of river vessel having an annual handling capacity of 10 million tons,
- Tourist Harbour, a major milestone for passenger ships sailing along the Black Sea.

Besides the maritime ports mentioned above, at the eastern extremity of the Danube on Sulina channel there is located the Sulina Port (148 km north of Constanta).

There are 3 marinas in Romania – Tomis, Mangalia and Belona (Eforie) - offering mooring places, storages, lifting and launching facilities for small and medium sized boats. Small touristic ports with mooring facilities are also located in Costinesti, Sf. Gheorghe and Sulina.

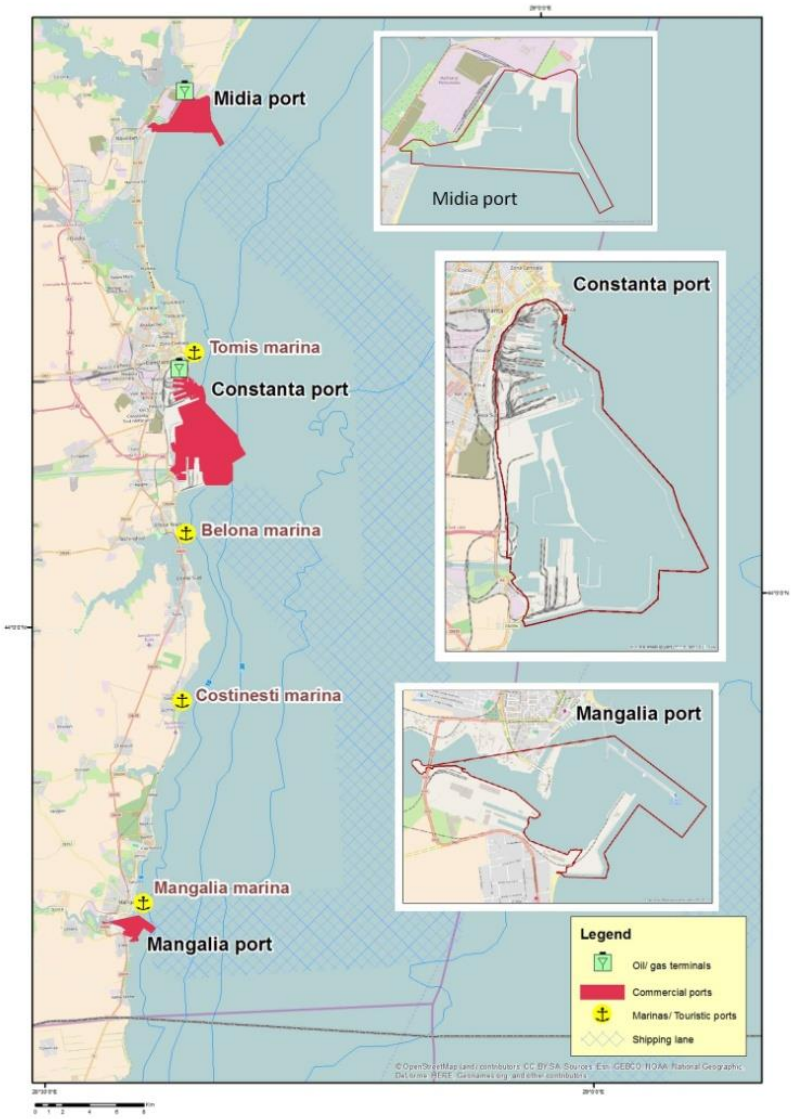


Figure 29. Romanian maritime ports

In Romania, the shipyards are situated at Constanta, Mangalia. Midia – Navodari (on the Black Sea coast) and Tulcea and Galati (on the Danube River). Apart from previously locations, the ship repairing is located at Sulina.

- ***Policy strategies/legislation***

- Law on Maritime spaces, Inland waterways and Ports of the republic of Bulgaria. Promulgated SG, No. 12, 11.02.2000, Last amended SG No. 28/29.03.2018.
- GO No. 22/1999 for the administration of ports and inland waterways, infrastructure for waterborne transport and waterborne transport activities (Romania).
- GO No. 42/1997 for maritime and on inland waterways transport (Romania).
- Governmental Decision No. 876/2007 for establishing and sanctioning of violations to the regime of waterborne transport (Romania).

- ***Knowledge gaps***

- Lack of statistical information on the number, tonnage, type of ships visiting the Bulgarian ports – difficult to find;

- Lack of information on number of yachts visiting the ports;
- Vessels traffic data are not freely available;
- Lack of data on number and location of shipyards.

References

1. Law on Maritime spaces, Inland waterways and Ports of the republic of Bulgaria. Promulgated SG, No. 12, 11.02.2000, Last amended SG No. 28/29.03.2018
2. *http://www.marad.bg/*
3. *https://dolphin1.bg/en/home/*
4. *https://bulyard.com/en*
5. *http://mangalia.ro/index.php/2012/10/04/portul-turistic-2/*
6. *http://snmangalia.ro/ro/constructii-si-reparatii-nave-si-corp-nava/*
7. *https://www.damen.com/en/companies/damen-shipyards-mangalia#history*
8. *https://www.portofconstantza.com/apmc/idx.do?method=showIndex*
9. *http://mangalia.ro/index.php/2012/10/04/portul-turistic-2/*

4.4 Submarine cables and pipelines

A submarine communication cable is a cable laid on the sea bed between land-based stations to carry telecommunication signals across stretches of ocean and sea. Currently 99% of the data traffic that is crossing oceans is carried by undersea cables. Several submarine cables pass through the Black Sea (Figure 30):

1) KAFOS: Mangalia (Romania)–Varna (Bulgaria)-Rumeli-Igneada (Turkey)–504 km;
2) Caucasus Cable System: Balchik (Bulgaria) – Poti (Georgia) - 1,182 km km
3) Black Sea Fiber Optical Cable System (BSFOCS): Varna (Bulgaria) - Odessa (Ukraine) - Novorossyisk (Russia) is a 1,300 km (~ 335,4 km Bulgarian marine sector) submarine telecommunication system, that went into operation in September 2001 with a total capacity of 20 Gbit/sec along 2 fiber pairs.
4) ITUR: Italy - Turkey - Ukraine – Russia
5) Georgia-Russia

Figure 30. Black Sea cable lines *(Map produced by CCMS, Bulgaria)*

Galata Gas Platform is located 23 km east of Varna, at a depth of 34 meters. Initially, a gas pipeline was built connecting the platform to a land-based compressor station.

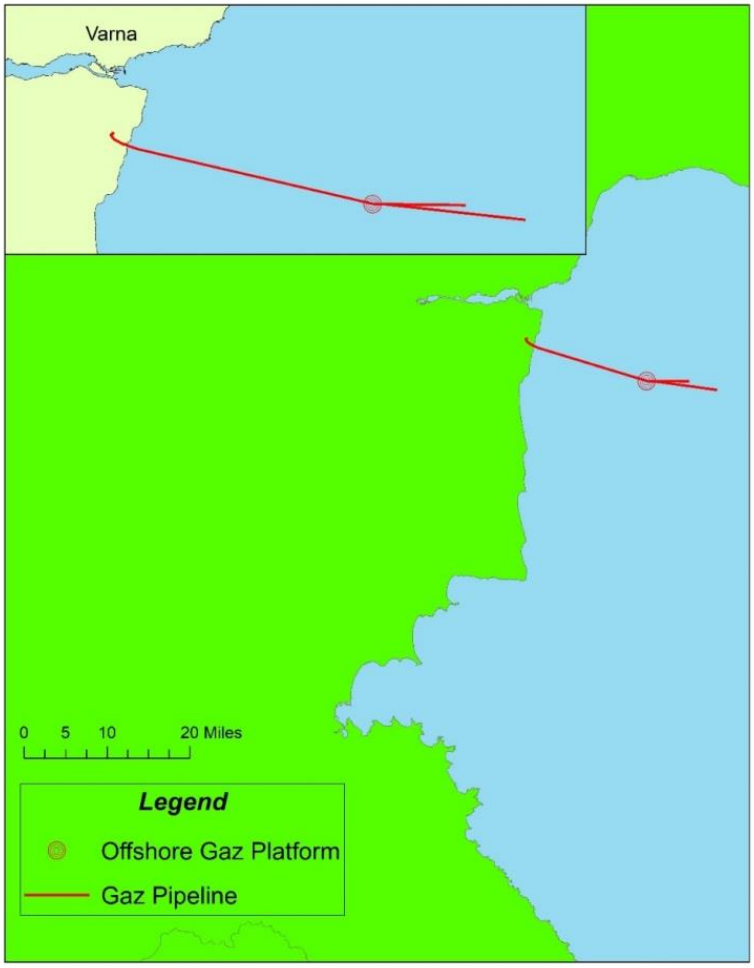


Figure 31. Marine Gaz Platforms and Pipeline *(Map produced by CCMS)*

has a length of 23 km. With the development of new gas fields (located east of the platform, at a bottom depth of 52 meters), new gas extraction wells were made, as well as new gas pipelines connecting the wells to the gas platform (respectively the old gas pipeline). The total length of the gas pipelines is 45 km (Figure 31).

In February 2011, the pipeline connecting the Galata gas platform to the land-based compressor station was damaged. During a cruise from Turkey to Ukraine, a ship crashed in the Varna area and, when anchoring, hit the pipeline. The field lies at a water depth of 35 m and has gross proved and recoverable reserves of 49 billion cubic feet (bcf), and proved and probable reserves of 81 bcf. The development of the Galata field, a 100% interest in the exploration permit for the remainder of block-III and block Kaliakra offshore Bulgaria are the activities involved in the Galata Field project.

Since July 2012, the company Total, in partnership with Repsol and OMV, has had a permit for oil and gas exploration the in Block 1-21 Khan Asparuh in the deep Black Sea. In February 2016, a contract for oil and gas exploration in the Block 1-14 Silistar/Khan Kubrat was signed with Shell for 5-year period. Many concessions for natural gas production were awarded in the country, whereas their production is of limited resource and covers insignificant part of the

annual consumption. At present, gas field Kavarna-Iztok in the Block Galata is a reliable source for local production with proven reserves of approximately 3,724 – 4,255 GWh of natural gas.

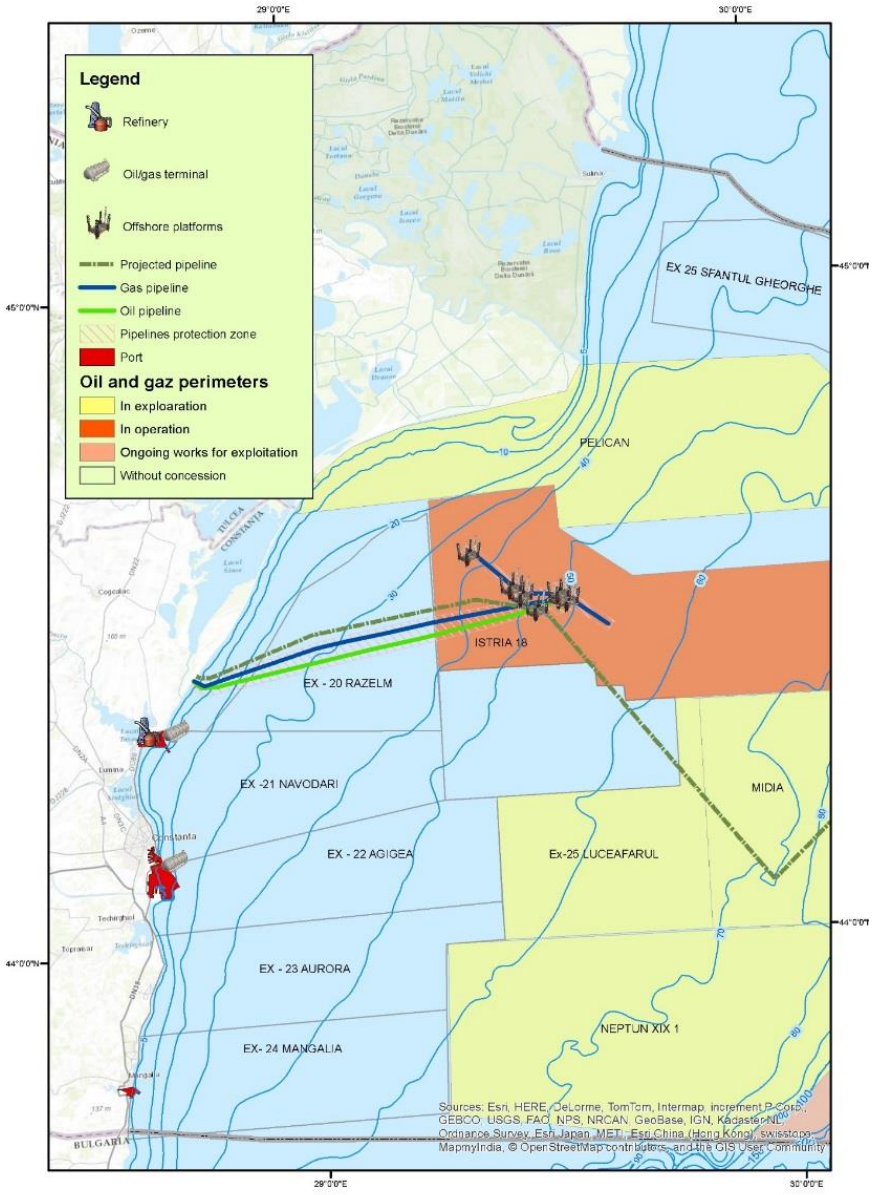


Figure 32. Oil and gas marine platform in exploitation and pipelines
***(Map produced by NIMRD*)**

Installations as submarine cables and pipelines increase noise, pollution, turbidity and physical disturbance of seabed habitats (increase in suspended sediment concentrations and deposition, potential contaminants release from sediment, electromagnetic fields, etc.).

Diamond Link Global is an undersea cable system with landing points in Poti, Georgia and Constanta, Romania as part of a system that will directly connect Tbilisi, Georgia and Bucharest, Romania. This system will significantly increase the capacity and connectivity in the region. Desktop study for the system has already been completed and route survey operations will begin in the first quarter of 2019. In addition to its rapid construction and availability, the Diamond Link Global cable will benefit the Black Sea Region by offering significantly higher design capacity, lower unit costs, lower latency through direct

connectivity, and the ability to leverage additional branching units in the future (SubCom 2018).

The Romanian national system of oil transport on the Black Sea shore comprises a terminal owned by the State (Oil Terminal SA Constanța, in the Constanta Port) and one run by KMG International (Midia Marine Terminal in Năvodari), main pipelines and local pipelines which are transporting crude oil from perimeters operating in the country and crude oil imported and delivered to refineries. The national network of pipelines connects the port with the main refineries in the country, ensuring a fast and safe transport.

References

1. Greg's Cable Map, ZA (*https://dev.networkatlas.org/*)
2. *https://www.emodnet-humanactivities.eu/*
3. *https://www.newsweek.com/undersea-cables-transport-99-percent-international-communications-319072*
4. *www.bulgartransgaz.bg/files/useruploads/files/amd/tyndp%202017/TYNDP%202019-2028%20EN.pdf*
5. *www.offshore-technology.com/projects/galata-field/*
6. *https://www.capital.bg/biznes/kompanii/2017/06/20/*

4.5. Tourism (coastal and marine)

- ***Socio-economic trends***

In **BULGARIA**, the tourism plays a key role in the national economy, generating more than 10% of Gross Domestic Product (GDP). The Bulgarian tourism industry is heavily concentrated in the Black Sea coastal resorts. Almost 2/3 of tourist infrastructure and the number of tourists are concentrated in the coastal areas. In 2014 the Gross Value Added (GVA) generating by the coastal tourism was 769.4 million Euro and the sector accommodated 109,519 visitors.

The first large beach resorts were established during 1950s-1960s. The most significant influence of the coastal tourism development began at the end of the 1990s, and has been expanded steadily since 2005. Much of the revenues from the nights spent come from these large resorts with national importance, such as Golden Sands, Albena, Sunny Beach, etc. The Bulgarian coast is a popular tourist destination for many visitors (both Bulgarians and foreigners) as it is distinguished by a beautiful landscape and existence of large sand beaches and dunes. Bulgaria is also a safe destination and travels to Bulgaria are still affordable from many European visitors. Due to the region`s outstanding swimming beaches, the country relies, and will continue to rely further, on traditional model of bathing tourism or mass beach tourism. Still, the range of traditional coastal tourism activities is becoming more diverse including also ecotourism, cultural tourism, health and wellness, and even wildlife viewing in some areas – activities that would extend the tourist season. However, the development of these aspects of coastal tourism remains limited with seasonal mass beach tourism driving the vast majority of visits. As most of the world's beaches become overdeveloped, there remains the possibility for Bulgaria to highlight the touristic potential of those beaches and shorelines that remain natural (ecotourism).

In general, adverse impacts of coastal tourism in Bulgaria have resulted from expanded human pressure on limited land area and resources, and the conflicts between tourism development and protection of natural environment. Direct impacts have been related to overbuilding of

protected dune and beach areas (hotel and residential construction, roads, parking structures, and other related infrastructure), unregulated camping and "temporary" construction on the dune), destruction and loss of valuable dune habitats including mining of sand, and loss of green areas. Also, the water quality is degraded by pollution (sewage treatment capacity of coastal municipalities exceeded during the peak vacation periods).

Coastal and maritime tourism sector has been identified as an area with special potential to foster a smart, sustainable and inclusive Europe. Coastal tourism covers all beach-based recreation and tourism (e.g. swimming, surfing, sun bathing), and non-beach related land-based tourism in the coastal area (all other tourism and recreational activities that take place in the coastal area for which the proximity of the sea is a condition), as well as the supplies and manufacturing industries associated to these activities. The other types of tourism in the coastal area are:

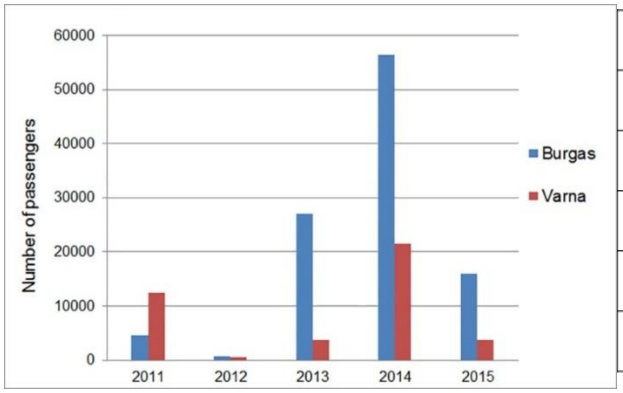
- **Natural Tourism** includes tourist visits to natural protected zones, natural monuments, reserves, natural parks, dunes and rocky cliffs, birdwatching, etc. In this subsector are also included some activities as: kayaking, snorkeling, cliff climbing, cycling and walking along the coast, etc.
- **Cultural Heritage Tourism** involved visits to museums, archaeological reserves, monuments along the coasts, etc. It also includes scuba diving activities such as visits to Underwater Cultural Heritage (UCH) places.
- **Recreational Boating Tourism** includes maritime operations such as sailing, yachting, motor boating, tours with tourist boats, surfing, operation in marinas, etc.
- **Health Tourism (Balneo, Wellness and Spa)** include all travels for the purpose of promoting health and well-being through physical, psychological, or spiritual activities (e.g. wellness destination, spa, health resorts, baths resorts, mud baths, salt baths, etc.). The medical tourism is not included.
- **Cruise Tourism** include all tourists' tours, with specially chartered vessels, mainly on sea and rivers. In general, cruise tourism does not connect with the Bulgaria. Cruise tourism in Bulgaria is represented mainly by foreign ships passing through the two main Harbours - Varna and Burgas. However, this sector is not much important as it provides low GVA and employment: it forms 0.23 % of the GVA produced by the tourism sector and provides only 2.2 % of the sector employment. Cruise tourism has little socio-economic value as voyages are infrequent even during the summer season (Country Fiche Bulgaria, 2014). In the last few years, there has been a decrease of number of the passengers; as possible reason being the ongoing crisis in Crimea and overcharges for passing the Bosphorus as can be seen from the table below (Table 25).

Yachting in Bulgaria – in the last years the investments in this sector have increased due to port constructions for small and medium sized yachts. The number of yachts and motor boats in Bulgaria however remains very low (around 1,000) and only 14 marinas are licensed. Despite the increase in investment, the socio-economic indicators have shown only moderate growth as the end users are a limited number of citizens. The total employment in this activity is estimated at 0.8 thousand people (Country Fiche, 2014). Recreational boating tends is a seasonal activity with peaks in the summer, weekends and public holidays or sporting events. The challenge for the boating industry is to secure adequate space for the development of marinas and access to the waterfront and for safe navigation even during peak seasons.

Potential conflicts are related to areas where boating/yachting may not occur due to the presence of infrastructures (e.g. aquaculture farms, oil and gas platforms, etc.) and other marine activities such as maritime transport, scuba diving etc. It is expected an increase of marine

tourism developments and therefore more maritime uses and activities should be regulated in the MSP process.

Table 25. Number of cruise passengers at Varna and Burgas Harbours



Year	Burgas	Varna
2011	4479	12495
2012	712	590
2013	26971	3769
2014	56361	21457
2015	15885	3733

Data source: EAMA, Bulgaria

In **ROMANIA**, the tourism, especially the coastal tourism, is recognized as a socio-economic priority as it ensures a wide range of tourist services. The sector stimulates economic growth by generating incomes, employment and investments as well as through its exports to origin markets worldwide. It contributes to sustain the cultural and natural heritage, providing revenue to fund facilities and infrastructure that is appreciated by visitors and residents, and promotes an awareness of a common European identity and citizenship distinguished by its diversity.

The Danube Delta Biosphere Reserve is one of the most attractive landscapes in Europe, but its promotion is not properly made and the transport infrastructure is poorly developed. The seasonality of non-fishery sector is prevalent for tourism and agriculture. Although the length of the tourist season has expanded from April to October, the peak is August-September, when the "mosquito" season has passed. This also means that the income from the tourism activities has a seasonal peak in the summer period.

The coastal area comprises approx. 40% of the total Romanian accommodation capacity, although, through its specific nature, the tourism activity is characterized by a significant seasonality (June-September). Besides the accommodation offer from the standard network (hotels, motels, houses, camping etc.), on the coast one can see the development of a real accommodation „industry" as „board and lodging" system at the locals', by choice in rural accomodation (Schitu, Costinesti, 2 Mai, Vama Veche), but also in towns. The number of accommodation places on the Romanian coast is approximately 120,000 (Figure 33).

Since 2006 a series of tourist resorts on the Romanian seaside have been classified as resorts of national interest: Mamaia, Eforie, Costinesti, Jupiter, Mangalia, Neptun-Olimp, Saturn, Techirghiol and Venus. Demand for the coastal and spa tourism is declining - especially on international markets. The number of seaside tourists constantly increased since 2000 reaching1.5 million persons in 2015 and 1.67 million in 2016. During the 2016 summer season, 12% more tourists came to the seaside, as compared to the summer of 2015, but the average period of the trip was reduced from 3 accommodation nights to 2.9 nights. The summer of 2016 represented a touristic boom for Romania.

Black Sea cruise tourism - Constanta Port, which is the fourth largest in Europe, has developed sea and river cruise tourism activities. In 2005 it was inaugurated in the port of

Constanta a new cruise terminal for passengers in order to continue development of cruise tourism activities.

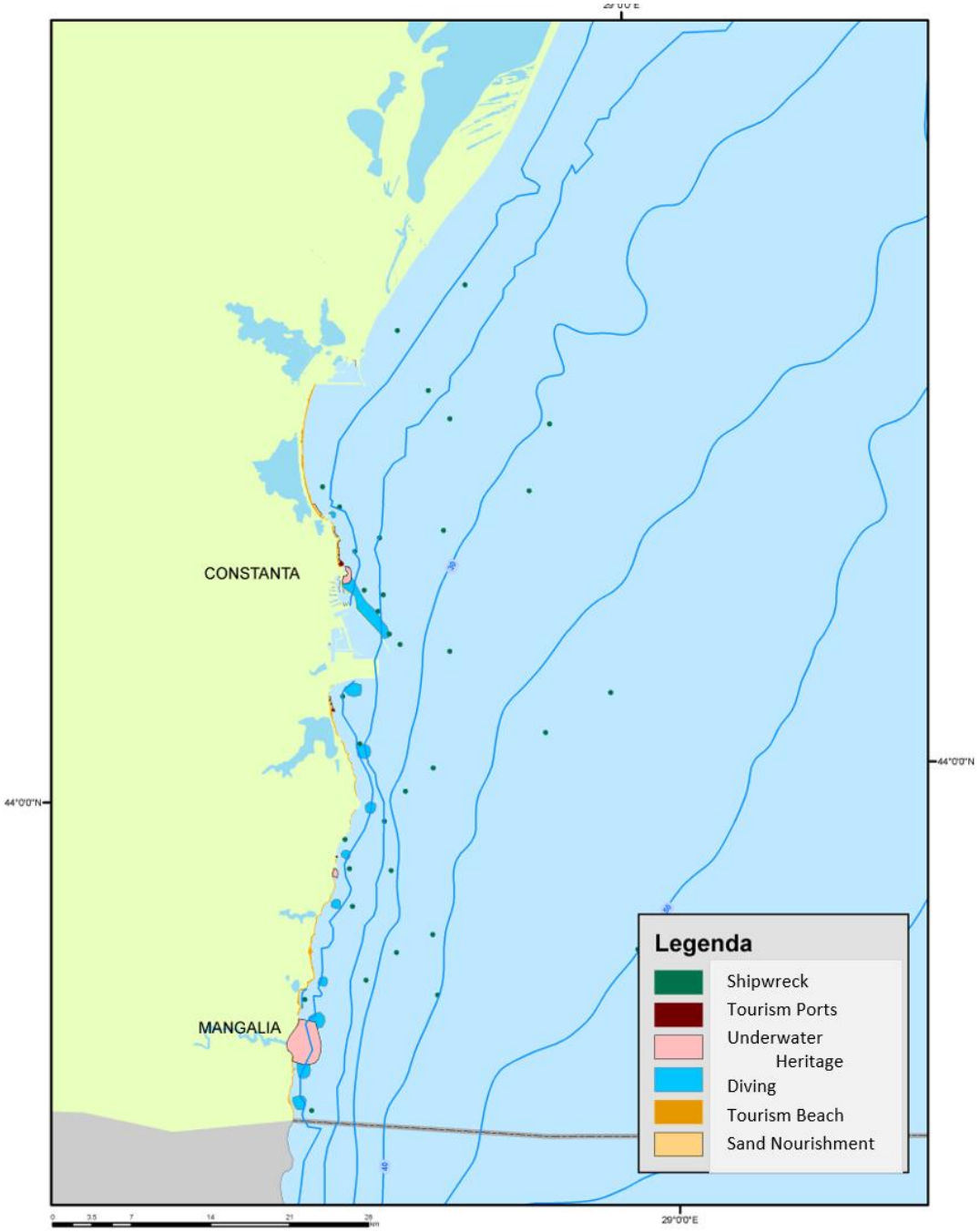


Figure 33. Marine tourism and other activities in Romania (*map produced by NIMRD*)

The adventure tourism market has experienced a positive evolution and continues to grow. The touristic offer of the resorts from the Romanian coast is extremely varied in regards to marine sports. Resorts from the coast with accommodation bases and different recreational possibilities are: Navodari, Mamaia, Eforie Nord, Eforie Sud, Techirghiol, Costinesti, Olimp, Neptun, Jupiter, Cap Aurora, Venus, Saturn, Mangalia, with modern hotels, and facilities for practicing adventure sports.

Rural tourism (agritourism) is widespread in the entire Danube Delta Biosphere Reserve territory, including the Razelm Sinoe Lagoon System and is an important source of income for local communities. A large number of local inhabitants use their own houses to accommodate tourists. In the south part of Romanian coastal area, rural tourism is practiced in 2 Mai and Vama Veche.

Also, on the Romanian coast can be practiced **seasonal sports** such as: sea trips and catamaran sailing or yacht rides, fly boarding, kite surfing, water skiing, windsurfing or scuba diving, cycling. The practicing adventure tourism on the western Black Sea coast offers diverse opportunities. Also, in order to capitalize the benefits of heritage tourism is recommended the ecotourism development (entertainment and sport): Scuba Diving, Off Road (Chituc Hill and Wolves Hill in the Danube Delta Biosphere Reserve) Paragliding (in Mamaia, Eforie Sud, Cape Tuzla and Vama Veche), Parachute Jump (in Tuzla), Cycling, Riding, (Mangalia Herghelia and Hippodrome), Leisure Fisheries (Sinoe and Siutghiol, Corbu and Tatlageac Lakes).

- ***Policy strategies/legislation***

Policy strategies and legislation for coastal and marine tourism in Bulgaria and Romania are mainly related to:

- Tourism Act, to regulate the social relations associated with the implementation of governance and control in tourism, State Gazette No 30/26.03.2013, last amended State Gazette No 17/26.02.2019
- Act on the Black Sea Coast Spatial Development, State Gazette No 48/2007, last amended State Gazette No 56/16.07.2019. This Act also provides the conditions and procedures for concessions of the sea beaches
- National Strategy for Sustainable Development of Romania - Horizons 2013-2020-2030
- National Strategy for the fisheries sector 2014 – 2020
- National Strategy for Regional Development 2014-2020
- Master Plan for the Development of National Tourism 2007-2026
- MASTER PLAN on the protection and rehabilitation of the coastal area
- The Strategy for the Development of the Metropolitan Area of Constanta
- The Regional Development Plan of the South-East Region for 2014-2020
- Low No. 165/2018,regarding holiday vouchers -Tourist Pass Card
- Government Emergency Ordinance No. 23/2008 on fishing and aquaculture

- ***Knowledge gaps***

- Lack and poor comparability of data;
- No existing spatial database for coastal and maritime tourism;
- Tourism data are mainly statistical provided from the National Statistical Institutes and most are not free of charge;
- Lack of data for development of maritime tourism, mostly for yachting, cruise tourism, recreational boating etc.

References

1. Black Sea Coast Development Act. 2008. Promulgated, State Gazette No. 48/15.06.2007, effective 1.01.2008, last amended State Gazette No 56/16.07.2019.
2. Coastal and Maritime Tourism sectors and the implementation of the MSP Directive. 2015. Information to stakeholders and planners. Draft version November 2015.
3. Country Fiche Bulgaria, 2014. Studies to support the development of sea basin cooperation in the Mediterranean, Adriatic and Ionian, and Black Sea. Contract Number MARE/2012/07 - REF. No 2 REPORT 1 - ANNEX 2.3.

4. Stancheva, M. 2010. Human-Induced Impacts along the Coastal Zone of Bulgaria. A Pressure Boom versus Environment. Compt. Rend. Acad. Bulg. Sci, 63 (1): 137-146.
5. Stancheva, M., Ratas, U., Orviku, K., Palazov, A., Rivis, R., Kont, A., Peychev, V., Tõnisson H., Stanchev, H. 2011. Sand dune destruction due to increased human impacts along the Bulgarian Black Sea and Estonian Baltic Sea coasts. J Coast Res., Special Issue 64: 324-328.
6. Stanchev, H., Stancheva, M. Young, R. 2015. Implications of population and tourism development growth for coastal zone in Bulgaria. Journal of Coastal Conservation, Vol. 19, Issue 1, pp 59-72, DOI: 10.1007/s11852-014-0360-x.
7. Tourism Act. 2013. Promulgated State Gazette No 30/26.03.2013, last amended State Gazette No 17/26.02.2019.
8. Tourism Sector, Bulgaria. 2012. Ministry of Foreign Affairs of Denmark: Retrieved in pdf from: *http://bulgarien.um.dk/da/~/media/Bulgarien/Documents/Sector%20reports%20May%202012/Sectoranalyses_Tourism.ashx)*, last accessed on 08.09.2019.
9. Romanian Ministry of Tourism: www. turism.gov.ro
10. Romanian Ministry of Environment and Climate Changes: *http://www.mmediu.ro*
11. National Institute of Statistics Constanta County Statistics Department: *www.constanta.insse.ro.*
12. National Institute of Statistics Tulcea County Statistics Department: *www.tulcea.insse.ro*
13. FRTE -Federation of Romanian Tourism Employers.
14. Study on the economic profile of the Constanta Growth Pole CCINA Constanta -2015.
15. Constanta Metropolitan Area.
16. Constanta Town Hall: *www.primaria-constanta.ro.*
17. Strategic Assessment of the Environment (SEA) Implementation of the appropriate structure for the prevention of natural risks in the areas most exposed to the risk. Major area of intervention 2 - Reduction of coastal erosion.
18. The Danube Delta Tourist Destination Management Association.
19. HERAS Project, *www.herasprojectcbc.eu*
20. EASME/EMFF/2015/1.2-"Western Black Sea Underwater Cultural Touristic Routes" Project, *http://wbsunderwatertours.eu*
21. EASME /EMFF/ 2015/ 1.2. "Western Black Sea Underwater Cultural Touristic Routes" Project : Comparative transnational analysis of the service quality and the tourist offer of "Scuba Diving" adventure tourism for underwater cultural heritage of the Western Black Sea.
22. National Spatial Development Concept for the period 2013-2025 (Update 2019) *https://www.mrrb.bg/bg/regionalno-razvitie/strategichesko-planirane/dokumenti/*
23. Concept for tourist zoning of Bulgaria, adopted 2015. *http://www.tourism.government.bg/bg/kategorii/strategicheski-dokumenti/koncepciya-za-turistichesko-rayonirane-na-bulgariya*
24. National Strategy for Sustainable Tourism Development in the Republic of Bulgaria 2014-2030 (Update 2017) *http://www.tourism.government.bg/bg/kategorii/strategicheski-dokumenti/nacionalna-strategiya-za-ustoychivo-razvitie-na-turizma-v*
25. National Register of accommodation, restaurants and entertainment, tour operators and travel agents, travel associations. Ministry of Tourism. *https://ntr.tourism.government.bg//*
26. Regional Development Plan for the South-East NUTS 2 region (2014-2020), Bulgaria

4.6. Physical restructuring of coastline seabad

4.6.1. Coastal defence/flood protection

- ***Socio-economic trends***

Along the Bulgarian Black Sea coast hard stabilization structures have been widely used since 1980s, such as solid groins, coastal dikes and seawalls. 402 technogenous segments were classified (port/coast-protection structures and artificial beaches) with a total length of 69.89 km by engineering criteria: i) 178 different types of groins; ii) 31 dikes; iii) 26 seawalls; iv) 73 embankments/rip-raps; v) 62 ports, marinas/quay walls and navigational channels; vi) 14 segments, representing artificial beaches (Figure 34). Construction of these structures mostly depends on requirements for defending the shoreline and infrastructure at sections most hazard-prone to flooding and erosion. There have been isolated cases of applying soft defense measures along the coast more associated with recreational rather than with protection purposes. These mostly include creation of artificial beaches or beach nourishment and 14 artificial beaches were identified along the Bulgarian coast.

One of the current problems in applying nourishment projects is the shortage of appropriate size and amounts of sand, both from terrestrial and offshore sources. Beach fill or nourishment is also very expensive method, one that must be periodically repeated. A common inventory of the variety of Harbour and coast-protection structures along the Western Black Sea littoral is presented in the table below (Table 26).

Table 26. Catalogue of port and coastal-protection structures at the Bulgarian-Romanian Black Sea coast (*modified from: Burkhart, Hughes, 2006, after Stanica et al., 2012*)

Type of Structure	Objective	Principal Functions	Type of Construction
Sea/coastal dikes	*Prevent or alleviate flooding by the sea of low-laying land areas*	*Separation of shoreline from hinterland by a high impermeable structure*	*Concrete armour units or rubble-mound (rock-fill) and composite type*
Similar structures			
rip-raps	*Prevent or alleviate flooding by the sea of low-laying land areas*	*Covering less tightly specified dumped or placed rock structures*	*Made from a variety of rock types or concrete rubble from building and paving demolition*
Groins (Y, T, Z, I- shape)	*Prevent beach erosion*	*Reduction of alongshore sediment transport*	*Impermeable, concrete sheet-pile or rubble-mound (rock-fill) design*
Seawalls	*Protect land and structures from flooding and overtopping*	*Reinforcement of some part of the beach profile*	*Formed of concrete/rock blocks or sheet piling*
Similar structures			
i) revetments	*Protect the shoreline against erosion*	*Reinforcement of some part of the beach profile*	*Consist of a cladding of stone, concrete, or asphalt to armour sloping natural shoreline profiles.*

ii) bulkheads	*Retain soil and prevent sliding of the land behind*	*Reinforcement of the soil bank*	*Vertical wall anchored with tie rods*
Reef breakwaters	*Prevent beach erosion*	*Reduction of wave heights at the shore*	*Rubble-mound structures constructed as a homogeneous pile of stone or concrete armour units*
Detached breakwaters	*Prevent beach erosion*	*Reduction of wave heights in the lee of the structure and reduction of long-shore sediment movement*	*Rubble-mound construction*
Submerged breakwaters	*Prevent beach erosion*	*Retard offshore movement of sediment*	*Rock-armoured, rubble-mound structures or made of commercially available prefabricated units*
Harbour breakwaters	*Shelter harbour areas and harbour entrances, and water intakes against waves and currents*	*Dissipation of wave energy and/or reflection of wave energy back into the sea*	*Shore-connected or detached; sloping-front and vertical-front structures: composite or rubble-mound armoured with rock or concrete armour units, with or without wavewall superstructures, or concrete blocks placed on a rubble stone base layer*
Similar structures			
1) jetties	*Stabilise navigation channels at river mouths and tidal inlets*	*Protect against storm water and cross-currents*	*Shore-connected, construction similar to breakwaters*
2) moles	*Protect harbours and inlets that are important commercial and military navigation links and to stabilise navigational channels*	*Shelter from waves and storm winds, provide adequate depth/ manoeuvring room within the harbour, secure minimal navigation channel dredging*	*Shore-connected, construction similar to breakwaters*
Navigation channels	*Provide safe, reliable, and efficient waterway navigation*	*Maintained by constant dredging activities to a required depth for modern ships*	

Coastal protection has been implemented by an institutional organisation „Geozashtita“, established in the early 1980s with a long-term shoreline defence programme.

Despite numerous protection measures applied so far, erosion and landslide problems have not been solved (Figure 34,35). There is still lack of relevant coast-protection management plans, which invariably involve hard engineering structures. Current cliff and beach erosion is associated with these, which have reduced sediment inputs and interrupted sand movement. The economic assessments of beach and cliff erosion and coast-protection structures are difficult and inadequate as they consider only the value of recreational and tourism-related

sectors, excluding other equally important sectors (fishing, shipping, etc.) and in general, neglect the induced effects associated with other coastal activities. These issues required more relevant regulations during the MSP process.

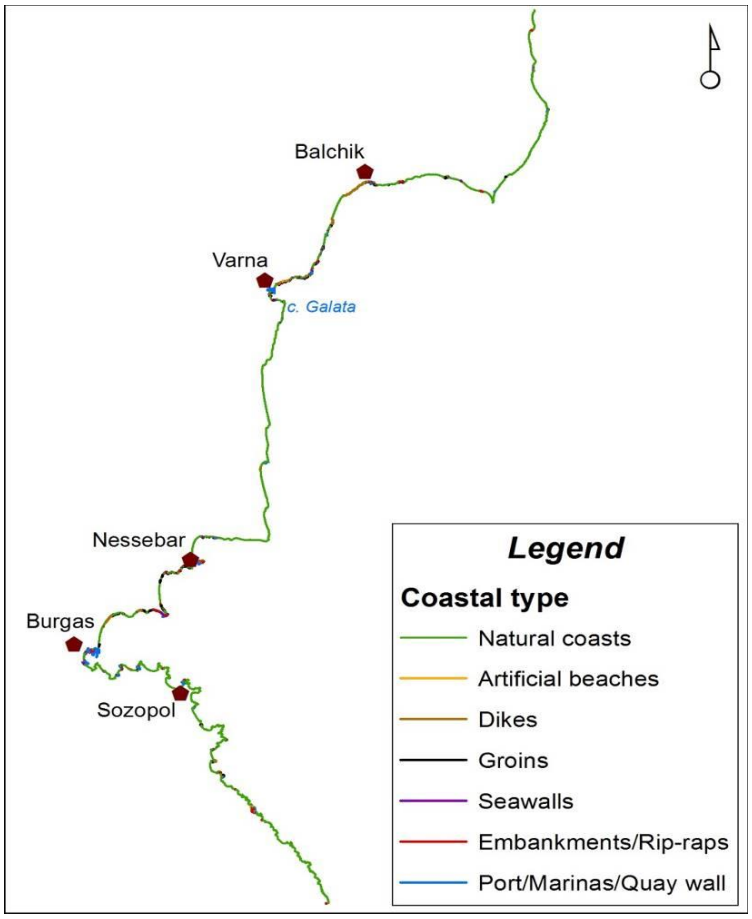


Figure 34. Port and coast-protection structures along the Bulgarian coast, 2013 (*Map produced by CCMS)*

In accordance with the requirements of Art. 6 of Flood Directive 2007/60 / EC and Art. 146d of the Water Act of Bulgaria, maps of the areas under threat and maps of the areas at risk of flooding shall be drawn up for the approved by the Minister of Environment and Waters. Drawing up maps of threatened areas and floodplain maps is a key step to meeting the requirements of the Directive - based on that a Flood Risk Management Plan is developed that addresses all aspects of flood risk management, taking into account the characteristics of the particular river basin. Flood threat maps cover areas that can be flooded in the following scenarios:

- Floods with a low probability of occurrence are floods in which the probable period of recurrence is greater than or equal to 1000 years, as well as in unpredictable events;
- Floods with an average probability of occurrence are floods in which the probable recurrence period is greater than or equal to 100 years.

High probability of occurrence of floods - these are floods in which the probable occurrence of recurrence is greater than or equal to 20 years, where appropriate.

Physical loss of the seabed include permanent changes to the seabed substrate from different human activities: permanent changes to natural seabed substrate or morphology because of physical restructuring, infrastructure development and loss or substrate because of extraction of seabed materials.

The maps are available on the website of the Black Sea Basin Directorate-Varna, *https://www.bsbd.org/bg/index_bg_1307410.html.*

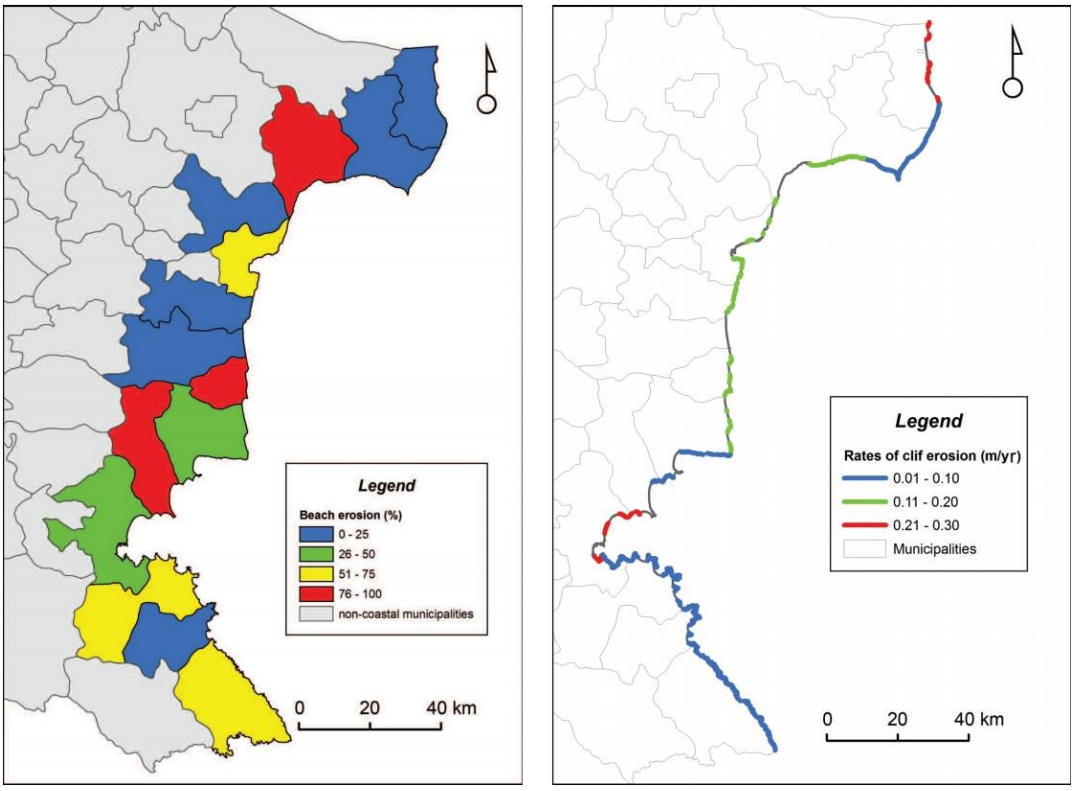


Figure 35. a) Rates of beach erosion; b) Cliff erosion, 2013
(*Map produced by CCMS*)

Studies conducted show that the Romanian seaside is in a serious condition in terms of expanding erosion (in approx. 60-70% of the length of shoreline), (Figure 36).

At the local level, the protection structures in the area of tourist beaches have modified both the hydrodynamic processes, as well as the configuration of the emerge and submerged beaches. Although a large part of this sector was protected by coastal constructions, these had not the expected effect in the shore stabilization.

In order to minimize coastal erosion, increase the value of coastal zone and create new tourist beach areas, there were developed during 2005 – 2013 scientific and technical documentations for development of a Master Plan of the Romanian coastal zone of the Black Sea based on two projects:

- "*Study on the Protection and Rehabilitation of the Southern Romanian Black Sea Shore*" (2005 – 2007, JICA)
- "*Technical Assistance for the Preparation of Projects under Priority Axis 5*. Implementation of adequate infrastructure of natural risk prevention in the most vulnerable areas. Major intervention domain 2 - Reduction of coastal erosion"(2010 – 2013, beneficiary ABADL).

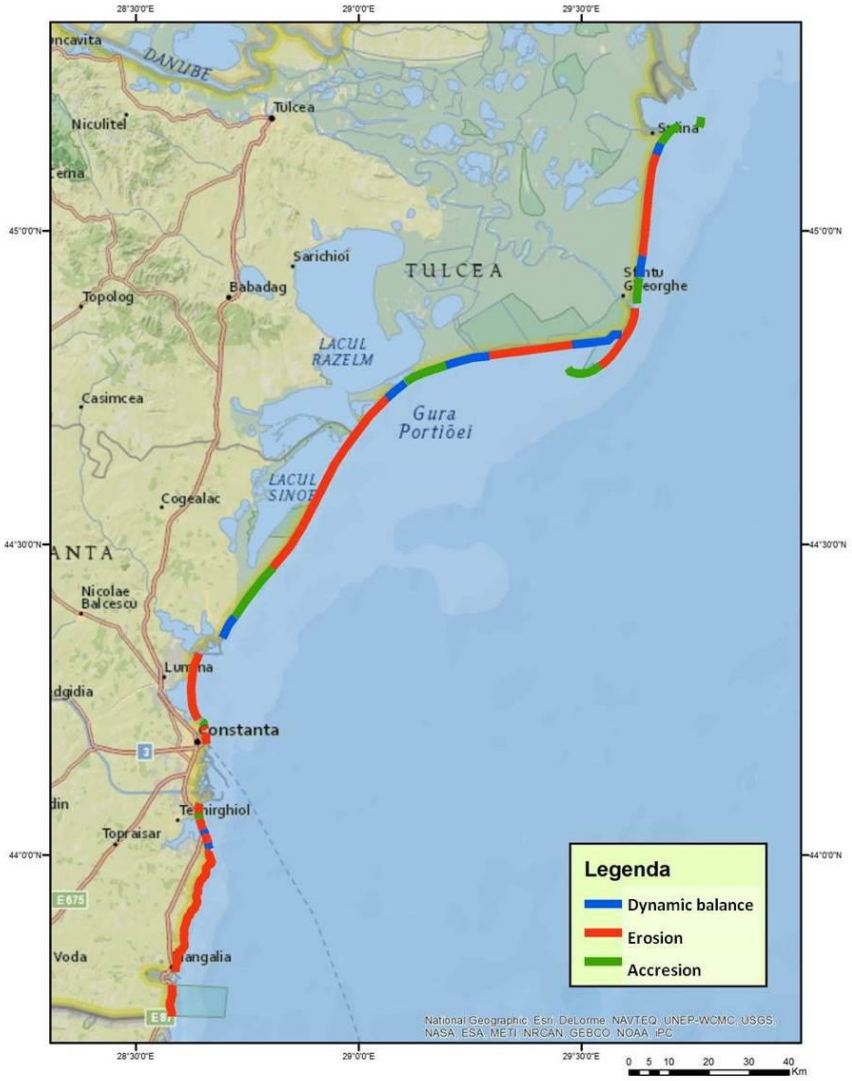


Figure 36. Morpho-dynamic processes, at the Romanian littoral: accretion, erosion, balance (*Map produced by NIMRD)*

Within these projects, it has drawn up a plan to protect the coast, consisting in protection measures for short, medium and long term, which will run for more than 30 years. These works include measures to reduce wave energy (height) that reach the shore, silting of beach with dams for sand stability (spurs) and measures to retain sand on the beach (by building new dams, repairing the existing "breaking wave" dikes and construction of dikes perpendicular to the shore).

On short term (2013-2015), five priority projects were planned in the southern Romanian coast, in order to reduce the risk of coastal erosion and rehabilitation for 7.1 km of shore in the next location: South Mamaia, North Tomis, Tomis Center, South Tomis and North Eforie. The beach area resulted after nourichment is about. 33.7 ha.

- ***Policy strategies/legislation***

National policy and legislation in Bulgaria for coastal and flood protection is mainly related to the Black Sea Coast Development Act (Promulgated, State Gazette No 48/2007, last amended State Gazette No 56/16.07.2019), intended to encourage the development of improved strategies for shoreline management. Basically the act aims to create conditions for protection,

sustainable development and planning of the coast; preservation and reasonable use of natural resources; decreasing pollution of the Black Sea coast; protection of shoreline against erosion and landslides; protection of natural landscape and historical heritage.

- ***Knowledge gaps***

- Lack of data about onshore and offshore sand deposits, as well as on long-shore sediment transport;
- Lack of modern spatial data about the existing and potential coastal hard works (newly built seawalls, groins, dikes, breakwaters, etc.) and about soft engineering solutions (beach nourishments) - reclamation works.

References

1. Black Sea Coast Development Act. 2008. Promulgated, State Gazette No. 48/15.06.2007, effective 1.01.2008, last amended State Gazette No 56/16.07.2019.
2. Stancheva, M. 2013. Bulgaria. In: Coastal Erosion and Protection in Europe - A Comprehensive Overview – Eds, E. Pranzini, A.T. Wiliams; ISBN 978-1-84971-339-9, 457 p., Rutledge Taylor & Francis Group.
3. Stancheva, M., J. Marinski. 2007. Coastal defense activities along the Bulgarian Black Sea coast – methods for protection or degradation? Coastal structures 2007: Proc. of the 5th International Conference, Venice, Italy, 2-4 July 2007; DOI No: 10.1142/9789814282024_0043; pp 480-489.; eds. (L. Franco, G. Tomasicchio,& A. Lamberti).
4. Stanica, A., M. Stancheva, G. Ungureanu, V. Peychev, A. Palazov, H. Stanchev, F. Dutu. 2012. Types and Impacts of Maritime Hydraulic Structures on the Romanian - Bulgarian Black Sea Coast - Setting-up a Common Catalogue for GIS-based Coastline Classification. Geo-Eco-Marina Journal, vol. 18, 105-113.
5. Stancheva M., 2013. Coastal Erosion and Protection in Europe – Bulgaria
6. Stanchev, H., Young, R., Stancheva, M. 2013. Integrating GIS and high resolution orthophoto images for the development of a geomorphic shoreline classification and risk assessment - a case study of cliff/bluff erosion along the Bulgarian coast. Journal of Coastal Conservation, Vol. 17, p. 719-728. DOI 10.1007/s11852-013-0271-2.

4.6.2. Dredging and dumping

- ***Socio-economic trends***

Dredging and dumping of sediments in the marine waters of Bulgaria are limited in scope. Dredging and less frequent dumping (at certain locations) are done due to the periodic need to maintain the navigational channels and port areas. EMODNET data reveal that for the period 2006-2015, the dredging activities were carried out at 12 locations along the Bulgarian Black Sea coast (Table 27). The purpose of dredging is mainly maintenance dredging and capital dredging. The extracted amount of sediment materials is 1,387,702 m^3. All dredging activities are for harbour's maintains purposes.

Dredged material is sediment excavated or otherwise removed from the bottom of the navigable waters of the Bulgaria to maintain navigation channels and sea ports. The permitting process for marine disposal of dredged material requires the identification and designation of a site where materials may be disposed. Marine disposal sites are precise geographic areas within which marine disposal is permitted subject to specific conditions.

Table 27. Dredging sites along the Bulgarian Black Sea coast (*source: EMODnet*)

Region	Extraction area	End use	Extracted Amount (m^3)	Extraction type	Purpose	Year	Data source
Varna	Port of Varna – West	Lake disposal	211000	Harbour dredging	Maintenance dredging	2013	EmodNET
Varna	Port of Varna (Port Lesport S.A.)	Lake disposal	242000	Harbour dredging	Maintenance dredging	2009	EmodNET
Varna	Port of Varna (Port Odesos PBM)	Lake disposal; Sea disposal	16282	Harbour dredging	Maintenance dredging	2015	EmodNET
Varna	Port of Varna (Odessos Ship repair Yard)	Lake disposal	1200	Harbour dredging	Maintenance dredging	2012	EmodNET
Varna	Port of Varna (PCHMV Base Oil Terminal)	Lake disposal	820	Harbour dredging	Maintenance dredging	2014	EmodNET
Varna	Port of Varna (Oil Terminal of Petrol)	Sea disposal	400	Harbour dredging	Maintenance dredging	2013	EmodNET
Varna	Port of Varna	Lake disposal; Sea disposal	309000	Harbour dredging	Maintenance dredging	2015	EmodNET
Burgas	Fishing Port of Sarafovo (Burgas Bay)	Sea disposal	64000	Harbour dredging	Maintenance dredging	2013	EmodNET
Burgas	KRZ Port of Burgas JSC & FISH Port of Burgas (Burgas Bay)	Sea disposal	375000	Harbour dredging	Maintenance dredging	2006	EmodNET
Burgas	Burgas Bay - aquatory of Port of Burgas – West, 4 Container Terminal	Sea disposal	128000	Harbour dredging	Maintenance dredging	2008	EmodNET
Burgas	Port of Burgas	Sea disposal	N/A	Harbour dredging	Capital dredging	2007	EmodNET
Burgas	KRZ Port of Burgas JSC (Burgas Bay)	Sea disposal	40000	Harbour dredging	Maintenance dredging	2008	EmodNET

In the Bulgarian part of the Black Sea there are two designated areas for the deposit of dredged sediments that fall into the territorial waters of the Republic of Bulgaria (12 nm zone) against the Varna and Burgas bays (Figure 36).

In order to reduce the risk of adverse impacts, it is necessary to conduct studies (monitoring) and an in-depth analysis of the suitability (including capacity) of existing landfills and the identification of possible new sites. No such activities are currently underway.

Dredging is violating the integrity of the seabed and destroying the seabed ecosystems. One of the main concerns over dumping and dredging is the release of contaminants to the water column (such as heavy metals), which is associated with temporary increases in turbidity.

- ***Policy strategies/legislation***

- Maritime spaces, Inland waterways and Ports of the republic of Bulgaria Act. Promulgated SG, No. 12, 11.02.2000, Last amended SG No. 28/29.03.2018;

- Water Act (in force from January 28, 2000, Last amended. SG No. 25 of March 26, 2019).

- ***Knowledge gaps***

- Lack of freely available spatial data;

- Lack of information on environmental impact and monitoring of the dumping sites.

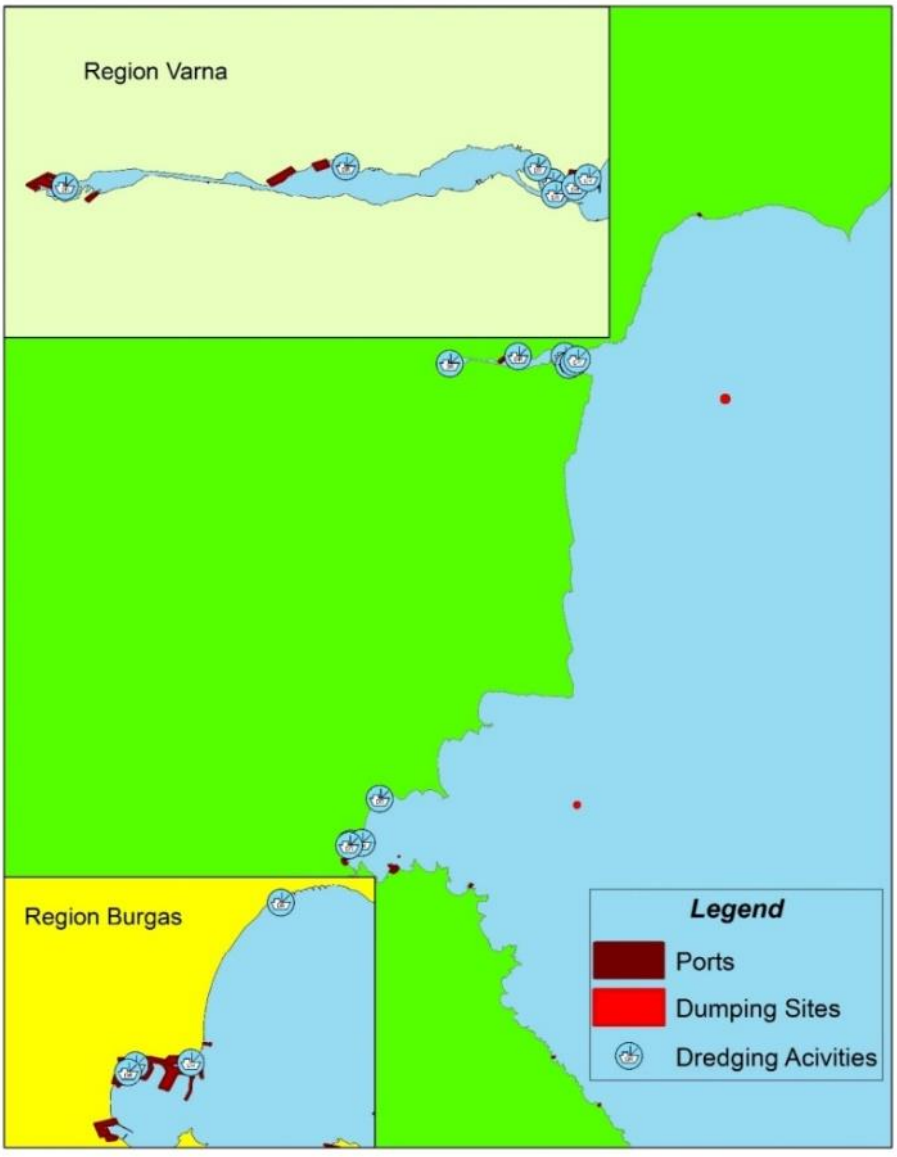


Figure 37. Dumping sites at the Bulgarian coast (*Map produced by CCMS*)

References:

1. *https://www.bsbd.org/UserFiles/File/PURB/2016/PURB%20II%20-%202016%20Reziume.pdf*
2. *https://www.emodnet-humanactivities.eu/*
3. Law on Maritime spaces, Inland waterways and Ports of the republic of Bulgaria. Promulgated SG, No. 12, 11.02.2000, Last amended SG No. 28/29.03.2018.

5. National program for prevention and limitation of landslides on the territory of the Republic of Bulgaria, erosion and abrasion along the Danube and Black Sea coast (2015-2020) and Supplemented with the newly formed landslides by April 15, 2015. Ministry of Regional Development and Public Works. (MRDPW) *https://www.mrrb.bg/bg/nacionalna-programa-za-prevenciya-i-ogranichavane-na-svlachistata-na-teritoriyata-na-republika-bulgariya-eroziyata-i-abraziyata-po-dunavskoto-i-chernomorskoto-krajbrejie-2015-2020-g-i-dopulnenie-kum-neya-s-novovuzniknali-77199/*
6. A. Spinu, Alexandrov L., Mateescu R., *GIS for coastal and marine environment – an integrated tool for Coastal Zone Management Study case – Razim Sinoe Lagoon*, Proceedings of the tenth International Conference on the Mediteranean Coastal Environment, ISBN 978-605-88990-6-3, vol II ISBN 978-605-88990-8-7, pag. 901-913
7. A.Spinu, Timofte F., Buga L., Petrisoaia S., Diaconeasa D. - *Opportunity of using uav/drones for coastal surveillance of Romanian littoral*, 16th International Multidisciplinary Scientific GeoConference SGEM 2016, www.sgem.org, SGEM2016 Conference Proceedings, ISBN 978-619-7105-60-5 / ISSN 1314-2704, June 28 - July 6, 2016, Book2 Vol. 3, 351-358 pp
8. Mateescu R., Diaconeasa D., Spinu A., Malciu V., *Hydro-geomorphological processes in the transitional romanian Black Sea coast, its conceconces on the masterplan for coastal protection implementation*, Journal of Environmental Protection, JEPE Bena 13, no: 3a, p. 1664-1672, 2012 *http://www. jepe-journal.info*, ISSN 1311-5065
9. Spinu A., Diaconeasa D., Petrisoaia S., Patrascu V., Mihailov E. - *Preliminary results regarding beach behavior in the context of coastal protection works in Constanta-Mamaia sector*, Proceedings "15th International Multidisciplinary Geoconference 2015", SGEM2015 Conference Proceedings, ISBN 978-619-7105-35-3 / ISSN 1314-2704, June 18-24, 2015, Book2 Vol. 2, 1035-1042 pp
10. Spinu A. D., Alexandrov M. L., Doru Mateescu R., Nita V.& co– Eforie Case Study, Cross Border Martime Spatial Planning in the Black Sea – Romania and Bulgaria (MARSPLAN-BS Project), ISBN 978-606-565-131-9, Editura Dobrogea 2017,
11. *** Masterplan "Protection and rehabilitation of coastal zone in Romania"

11.6. Underwater Cultural Heritage

- ***Socio-economic trends***

The underwater cultural heritage (UCH) of the Black Sea represents the unique history and identity of the region. Numerous remains, for example, shipwrecks both wood older than 2000 years, and modern metal ones have been discovered. These shipwrecks are subject of interest for researchers and tourists (scuba divers). The location of some wrecks is already known, nevertheless they still need to be further explored and protected for the future generations.

In Bulgaria one of the main underwater archaeological discoveries are the submerged settlements, ancient harbour installations and neighbourhoods of ancient cities, as well as the ancient shipwrecks. These are submerged prehistoric settlements, discovered along the northern and southern of the Varna-Beloslav Lake and on the Strandzha Mountain coast, from the Eneolithic and the early Bronze Age, submerged parts of ancient cities, such as Bizone (currently Kavarna), Mesambria (currently Nessebar), Apollonia Pontica (currently Sozopol), ships, their loads and ship anchors.

Within the HERAS Project (CBC Programme Romania-Bulgaria 2007-2013) an Underwater Heritage Tourism Management Plan was developed targeted to sustainable development of the border areas, social and cultural cohesion through cooperative actions between people and communities; supporting the development and promotion of integrated tourism products between borders.

The "Western Black Sea Underwater Cultural Touristic Routes" project selects and classifies the most attractive transnational tourist objectives (wrecks, archaeological sites, artifacts,

protected marine areas, underwater landscapes, and artifacts exhibited in the museums of the Romanian and Bulgarian coastal areas) in a new transnational tourist package "Western Black Sea Underwater Cultural Tourist Routes", which contents 4 transnational visitables routes: 3 Western Black Sea underwater destinations and 1 on the shore destination:

- Wrecks and Artificial Reefs,
- Underwater Archaeological Artefacts Inland Route,
- Ancient Underwater Trade Route (underwater archaeological sites and artefacts),
- Routes for Natural Heritage areas (underwater protected areas).

Protection of underwater cultural heritage might be an issue due to many existing and potential conflicts and synergies with other sea uses, including coastal and marine tourism. Threats to the preservation of UCH can come from natural processes or be human-induced: events disturbing the seabed (e.g. earthquakes, storms, coastal erosion, etc.); physical threats (e.g. currents); biological threats (e.g. bacteria, fungi and wood-borers); chemical threats (e.g. corrosion); coastal and offshore infrastructure developments such as ports, coastal defence works, cables and pipelines, oil and gas platforms and other activities disturbing the seabed such as trawling, dredging or anchoring may also pose a threat to cultural heritage.

In Romania, besides the natural resources of the Black Sea continental shelf, the underwater heritage also includes ancient archaeological sites, which were the subject of scientific research through the HERAS Project.
UCH means all traces of human existence having a cultural, historical or archaeological character which have been partially or totally under water, periodically or continuously, for at least 100 years such as: sites, structures, buildings, artefacts and human remains, together with their archaeological and natural context; vessels, aircraft, other vehicles or any part thereof, their cargo or other contents, together with their archaeological and natural context; and objects of prehistoric character.
The UNESCO Convention on the Protection of the Underwater Cultural Heritage, adopted on 2 November 2001 is an international treaty aimed at saving the underwater cultural heritage. Romania and Bulgaria have joined the UNESCO Convention on the protection of the underwater cultural heritage. The Western Black Sea shelf was defined entirely as an archaeological site. In Romania, the main underwater archaeological discoveries are submerged settlements (Tomis, Callatis and Histria), wrecks (more than 70 targets) and six MPAs Romanian submerged landscapes (protected areas) as follows:

- ROSCI0094 Underwater sulphide seeps from Mangalia,
- ROSCI0273 "Cape Tuzla" marine area,
- ROSCI0197 - The submerged beach from Eforie Nord – Eforie Sud,
- ROSCI0269 2 Mai - Vama Veche Marine Reserve,
- ROSCI0281 Cape Aurora,
- ROSCI0293 Costinesti - 23 August.

- ***Policy strategies/legislation***

- UNESCO Convention on the protection of underwater cultural heritage, adopted on 2nd November 2001. The convention seeks to improve the international collaboration and conservation practices. It sets common principles such as the *in situ* preservation of cultural heritage when possible and prohibits the commercial exploitation of cultural heritage. Bulgaria and Romania acceded to the UNESCO Convention concerning the protection of the UCH and this poses great challenges to meet the demands imposed by the Convention and to combine their efforts and expertise to develop a new joint Black Sea model for the protection of UCH.

- Law of the Sea (UNCLOS, 1982) requires contracting parties to preserve and ensure the safeguard of archaeological and historical objects in their national waters (up to 24nm).
- Cultural Heritage Act, promulgated in State Gazette No. 19/2009, last amended State Gazette No. 1/03.01.2019. This Act regulates the preservation and protection of the cultural heritage of Bulgaria. Cultural heritage encompasses intangible and tangible immovable and movable heritage as an aggregate of cultural values which bear historical memory and national identity and have their own academic or cultural value.
- Law No. 182/2000 regarding the protection of the movable national heritage institutes the statutory regime of goods pertaining to the movable national heritage, as part of the national cultural heritage, and regulates the specific activities for its protection.
- Law No. 36 of 16th January 2002 on the statutory regime of inland maritime waters, of the territorial sea and of the contiguous area of Romania. According to Art. 1 to this law, Romania's territorial sea includes the stretch of water adjacent to the coast, or, as case, to inland maritime waters, with a width of 12 nautical miles (22 224 m), measured from the baselines.
- Law No. 99/2007, on protecting underwater cultural heritage was adopted through the UNESCO Convention Law No. 99/2007. According to the provisions of this law, activities directed at underwater cultural heritage must use non-destructive techniques and survey methods in preference to recovery of objects.

- ***Knowledge gaps***

- The UCH in the cross-border area of Bulgaria and Romania still remains insufficiently explored and there is no map of the points, types and periods of underwater archaeological finds;
- Lack of regulated zones for UCH sites exposure and monitoring, and information of the exact perimeter for underwater surveys, control over the zones explorations respectively, both in terms of maritime traffic, and in terms of protection of the underwater archaeological artefacts;
- Lack of information on identified zones for visiting UCH sites the exploitation of which will increase the tourist visits and pressure on the environment respectively.
- Insufficient knowledge of national legislation and the UNESCO Convention in the field;
- Inappropriate use of the underwater heritage of the Black Sea;
- Lack of support and a low degree of awareness of local authorities for underwater heritage.

References

1. Cultural Heritage Act. Promulgated State Gazette No. 19/2009, last amended State Gazette No. 1/03.01.2019.
2. HERAS Project (*http://www.herasprojectcbc.eu).*
3. United Nations Convention on the Law of the Sea (1982) Articles 149 & 303.
4. UNESCO (2009-2014) Underwater Cultural Heritage, About the Convention on the Protection of the Underwater Cultural Heritage.
5. Contact UNESCO – Section of Museums and Cultural Objects Division of Cultural Objects and Intangible Heritage 1, Rue Miollis – 75732 Paris cedex 15 – France Tel. + 33 (0) 145684406– Fax+33(0)145685596; Email *u.koschtial@unesco.org; www.unesco.org/culture/en/ underwater*.
6. EASME/EMFF/2015/1.2/ "Western Black Sea Underwater Cultural Touristic Routes" *//wbsunderwatertours.eu/.*

:

4.8. Military trainings

- ***Socio-economic trends***

Military trainings are important for national security and defence and they contribute to international cooperation of military activities. The EU MSP Directive (article 8) suggests that military training areas might be covered under the MSP planning process as one of the 14 sea uses listed in this article. However, enhancing national defence and security is not directly mentioned among the MSP objectives in article 5 of the Directive. Therefore, it is up to Member States to decide how to tackle national defence and security in maritime spatial plans (*Source: www.msp-platform.eu*).

Zones of military trainings and warnings are publicly announced in Bulgaria and Romania before the trainings; however, data on military trainings in maritime areas are not fully publicly available. Areas for military areas are more known and available for the terrestrial zone including coastal areas. There is no available official information on legally ensured maritime zones for military trainings in the study area of Romania and Bulgaria.

An important driver of conflict is the secrecy that often surrounds military activities. Very often, the military cannot be explicit about its spatial needs. Coexistence is often possible with more fleeting uses that do not impede military activities in principle, such as tourism, fishing, or even shipping; in these cases, measures such as temporary closures can often be used.

The **conflicts** that exist between the conservation necessities and the economic activities.

- The rights of exploitation of natural resources in the Danube Delta
- Competencies and roles of different institutions, including the rights of control over how compliance with the legislation in force
- Conflicts between local population, local councils, County Council and Danube Delta Biosphere Reserve Authority regarding: Access in different areas and poaching.
- The need for communication and coordination between institutions and organizations. Institutional coordination may be complicated by lack of communication, or the existence of incompatible interests.

- ***Policy strategies/legislation***

Military exercises in Bulgaria are conducted by the Ministry of Defence and most recently also by the Border Police in connection with the increased migration pressure on Europe. The Port Infrastructure Company is the competent authority for the production and dissemination of navigational warnings and notices to mariners.

- ***Knowledge gaps***

- Lack of strictly defined data on military and defence areas - data on military trainings in maritime areas are not fully publicly available.

References

1. C.N.R.N. RADIONAV S.A. (n.d.). *http://www.radionav.ro/index.html*
2. "Mircea cel Batran" Naval Academy. (n.d.). *https://www.anmb.ro/: https://www.anmb.ro/*
3. „OVIDIUS"UNIVERSITY OF CONSTANTA . (2018). About: University Ovidius . http://en.univ-ovidius.ro/uoc/brief-presentation; *http://www.univ-ovidius.ro/: http://www.univ-ovidius.ro/*
4. Romanian Waters Administration, Dobrogea Littoral. (n.d.). *http://www.rowater.ro/dadobrogea/default.aspx*
5. Navigable Channels Administration, *http://www.acn.ro/index.php/ro/*

6. International Airport "Mihail Kogălniceanu" Constanța. (n.d.). *http://www.mk-airport.ro/ro/aeroport*, *http://www.mk-airport.ro/ro/aeroport*
7. Romanian Naval Autorithy, (2018). *https://www.roris.ro/Portal/ro.aspx*
8. Constanța County Conseil. (n.d.), *www.cjc.ro: http://www.cjc.ro/sectiune.php?s=4*
9. Constanța County Conseil (n.d.), www.cjc.ro: http://www.cjc.ro/sectiune.php?s=5
10. Garda de Coastă Constanta-Contact, (2018), *www.politiadefrontiera.ro*, *https://www.politiadefrontiera.ro/ro/structura-teritoriala-garda-de-coasta/*
11. GARDA NAŢIONALĂ DE MEDIU Constanta. (2018), *https://www.gnm.ro/*
12. Public Institutions (n.d.). *http://www.justitia-romana.org*, *http://www.justitia-romana.org/curtea-de-apel/Curtea-de-Apel-Constanta/Constanta*
13. National Institute for Marine Research and Deevelopment "Grigore Antipa", (n.d.). *http://www.rmri.ro/Home/Home.html*
14. National Institute for Marine Research and Deevelopment for Marine Geology and Geoecology – GeoEcoMar, (n.d.). *https://www.geoecomar.ro/website/despre-noi.html*
15. Joint Technical Secretariat (JTS). (n.d.). *http://blacksea-cbc.net*/
16. The Ministry of Internal Affairs – The Institution of the Constanta County Prefect ct.prefectura.mai.gov.ro: *https://ct.prefectura.mai.gov.ro/contact/*
17. Ministry Of Internal Affairs - Institution of the Constanta County Prefect. (2017, 12 22).: *https://ct.prefectura.mai.gov.ro/wp-content/uploads/sites/39/2018/03/ROF-aprobat-1.pdf* ct.prefectura.mai.gov.ro
18. Ministry Of Internal Affairs. (n.d.). *www.mai.gov.ro: http://www.mai.gov.ro/index07.html*

12. Summary of the main conclusions and transboundary issues – *based on the SWOT analysis*

An analysis were done according to identified maritime field from the first project MARSPLAN I, to can emphasise the relation between them in transboundary approach.

Table 28. SWOT ANALYSIS, COMMON PROBLEMS of the Maritime Activities and other connected
General perspective, including Blue Growth, MSFD, MSP, covering both countries

Summary Analysis resulted from the STRUCTURE AND FUNCTIONS OF MARINE ECOSYSTEM					
Natural environment, Natural environment protection, Protected natural areas					
➢ ***Natural Environment***					
General → Some	**BG Specificity**	**RO Specificity**	**General → Some**	**BG Specificity**	**RO Specificity**
Strengths			**Weaknesses**		
• Environmental attractiveness is still high due to its specific dynamic enforcing its sustenance • Diversity of the shore components • Mild regime of natural factors, including sea-level, salinity regime, fine sediment deposits on the beach areas, biodiversity			• Habitat fragmentation • Lack of coastal zone delineation and natural landscape promotion.	Sediment transport fragmentations, existence of certain sediment cells and pocket beaches, isolated by three major maritime ports infrastructures	Concentration of socio-economic activities on the southern unit of the Romanian shore; as a pressure
Opportunities			**Threats**		
Existence of potential of reconstruction of coastal infrastructure Intense investment pressure in private sector Existence of regional / European funds for infrastructure arrangements			Long term disturbance of shore habitats Coastal erosion, marine/coastal pollution, socio-economic/mass-tourism pressure Growth of terrestrial port activities with indirectly impact on the marine space	Impact of Ports activities coming in conflict with city functions (Burgas, Nessebar, Sozopol, Pomorie)	-Sandy beaches represent about 70% of the Romanian -Impact of Ports activities coming in conflict with city functions (Sulina, Midia, Constanța, Mangalia, etc.)
➢ ***Marine Protected Areas***					
Strengths			**Weaknesses**		

• Existence of legal framework for **MPAs protection / delineation** • Existence of the afferent custodian framework for marine MPAs in the close past	Availability of MPAs mapping and Integrated management plans		Small representative / demonstrating of smart/forecast systems for environmental protection and environmental base management	Unity concerning the vision for MPS management and protection	Lack of the afferent custodian framework for marine in present
			Non-extractive Users (e.g., divers, eco-tourists) damaging marine ecosystem		Loss of traditional fishing community
Diversity of marine environment -Marine Protected Areas, Natura 2000 sites			**Overexploiting of living resources** Some of the fish stocks are overexploited at the Black Sea level (turbot, mackerel, anchovy)		Traditional migration routes are affected or lost
Opportunities			**Threats**		
Low sea-level rise in the Black Sea basin makes coastal ecosystems less vulnerable and susceptible to biogeophysical effects of global warming and other threats			**Global warming**: - accelerated coastal erosion - increasing of extreme storms and flooding of coastal areas - high ground temperatures affect physiochemical and biological processes		
Existence of marine protected areas and Natura 2000 sites both on coastal and marine sectors			**Absence of common spatial plans** for coastal and maritime areas management		
• Existence of historic monitoring for MPAs; • Availability of research infrastructure/consortium for transboundary areas/MPAs.			**Weak institutional capacity** **Lack of awareness to general public** **Users conflicts (**fisherman with MPA**)**		
The instability of the Black Sea western coast inducing a **high plasticity/adaptability to the marine organisms and a quality of accommodation** to oscillation of the environmental variables as water temperature, salinity, density, etc.	Good environment conditions for the development of aquaculture	Good qualities of candidates for the development of aquaculture	Coastal navigation / socio-economic activities, overfishing, unappropriated human intervention in case of environmental management and emergency situation management		**-Loss of marine biodiversity** **-Loss of traditional fishing community,** because of heavy conditions of life and work, pollution, limitation of rights

					financial conditions, lack of support
➢ ***Coastal Protected Area***					
Strengths			**Weaknesses**		
Shoreline geomorphology supportive for natural life - strand vegetation offers more biotic and erosion protection, as well as temperature and wind regulating systems - high relief shore (cliffs) on large sections of the coastal area provide more resilience for shore ecosystems	rocks, gravel and boulders texture and composition, nonlinear shoreline provides a better response to ecosystems	very large wetlands areas sedimentary processes affecting coastal line	**Flat shoreline geomorphology less-supportive for natural life** - sandy beaches less resilient and susceptible to biophysical changes - shoreline is object of anthropogenic pressures and changes due to seasonal tourism activities and urban development		
Shoreline wetlands offer extension areas for marine ecosystems - Marshes, rivers and lakes of the shoreline offer favourable conditions for coastal biological productivity		Danube Delta & coastal lagoons are the most valuable wetland area interacting with the marine ecosystems	**Shore waters become less supportive for marine ecosystems**: - Shallow waters are the most-stressed ecosystems because of their sedimentary and discharges loads and close proximity to ports and development areas		Danube and rivers are sources of increased pollution
• Existence of legal framework for **MPAs protection / delineation** • **Large areas of the shore are declared protected areas** (nature parks biosphere reserve, SCI and SPA) **which include a great number and diversity of habitats** • Existence of the afferent custodian framework for coastal MPAs	Availability of MPAs mapping and Integrate management plans	Existence of the afferent custodian framework for marine/coastal MPAs	- Small representative / demonstrating of smart/forecast systems for environmental protection and environmental base management	Unity concerning the vision for MPS management and protection	Lack of the afferent custodian framework for coastal MPAs, in present
Diversity of coastal environment representing great habitat complexity and diversity	marine dunes, rocky cliffs and beaches (Marine areas of Sivriburun,	Danube Delta, marine dunes, beaches (Marine areas of Cape Tuzla,			

	Silistar, Shabla, Kaltarburun, Crapets, Kaliakra, Ilandzik, Cerni nos, Kochan, Emine, Masiennos, Arapya, Sinemorets, sandy beaches				

Summary Analysis resulted from MAIN MARITIME ACTIVITIES AND USES: TRENDS AND PLANNINGS

Macroeconomic profile in the supra-territorial context - summary underlying key points

Strengths	Weaknesses
The area is crossed by two trans-European transport corridors (road, rail and water): VII Rhine-Danube Corridor and IX Orient/East-Med Corridor **The area has several gate-cities, major centres** with important airports and ports with a high traffic capacity (Constanta, Varna) **Transport** (shipping, inland and Danube navigation, road transport and rail) **is a key sector for cooperation** (especially within the Black Sea Synergy, through the EU commitment, to support regional transport cooperation)	**The full potential of the Danube river and the Black Sea is not used enough for commercial and touristic, purposes**: - low level of accessibility by road, rail and water transport, in connection with the European macro-regional transport corridors **Limited cross-sectorial cooperation and integrated governance on maritime and coastal issues in the region**: - regional environmental cooperation still in the early stages of its development in the Black Sea - no formally established environmental cooperation between Russia, Armenia, Georgia, Azerbaijan and Turkey, in spite of the region's exceptional natural/biodiversity value & severe threats **The target area is geographically reduced** and all activities are concentred in less than 80km shoreline (on each country), thus overpassing the macroeconomic indicators, which implies a decline in the sustainable development - Only two countries (Bulgaria and Romania) from Black Sea basin are UE members **Existence of discontinuities and hot points for traffic/transport fluency** at regional scale

	Uncoordinated development along the coastline hinders the joint exploitation of the area and an efficient protection of the environment and natural resources - **environmental impacts of oil and gas production** & transportation in the Wider Black Sea Region on the study area
Opportunities	**Threats**
Existing regional organizations and governmental agreements supporting joint projects and promoting the improvement of the administrative capacity and governance through international cooperation and exchange of best practices: - the potential of maritime and coastal tourism as an area of cooperation to ensure the inclusion of a large number of stakeholders - interest of the main maritime stakeholders in participating in the development of integrated policies and projects - EU support through policies & programmes (Blue Economy, Integrated Maritime Policy, EUSDR, The Fisheries Code of Conduct) and availability of European funds for major infrastructure development projects in the Black Sea Region	Existence of cultural and life (traditions, customs) differences which could hamper cooperation **Political and economic instability: embargoes, possible conflicts between other Black Sea countries might impact the area.** **Instability of the area by geo-ecological point of view** and the existence of the Danube Delta reduce the entire coast use for economic development
The Black Sea potential to become a commercial regional /international hub, (a transit area connecting East and West, North and South**) is a priority role for the region** - Favorable values of the macroeconomic indicators which determine growing socio-economic development - Presence of active maritime clusters, which plays a catalytic role in the maritime economy - Existence of free trade zone within port area, the necessary infrastructure and also the technical resources in some ports and area	
Industrial production and storage	
Strengths	**Weaknesses**
Presence of some **main production centers**, on the basis of which is developed the rest of the regions (ex: Constanta, Mangalia, Varna, Burgas, etc.) Presence of **secondary development centers** of industrial production and storage of production (ex: Pomorie – related to Burgas and Aksakovo - to Varna) Favourable geographical location as a **gateway** to Europe, transport network on land, river and sea, relatively good coverage of gas and energy network	• **Lack of industrial production** in rest of the rural part of counties, focused of socio-economic activities to service; only tourism exists in the summer season in some areas; • **Lack of an effective cultural and environmental promotion** for research and development conducted to creating innovative products and ecosystem services. • **Unbalanced regional development** and significant urban/ rural disparities • Weak road and railway **links with EU networks** • Insufficient and degraded **transport infrastructure**

	• **Pollution** in hot spot areas, mainly as result of emissions and water discharges, liquid and solid discharges (floating by rivers) • Poor environmental and **risk prevention** management and low environmental awareness • **Employment**, especially in subsistence activities; urban-rural differences in terms of education, skills and mobility of labor force
Opportunities	**Threats**
• **Connection to EU networks** • **Structural changes** in the whole economy fueled by new sources of investment • Tendency for increased **employability, adaptability and mobility** of the workforce, reintegration on the labor market of people from the black market • Stronger **integration** of all regions, including rural areas in economic circuit • Growth of **entrepreneurship** development, development of **clusters and competitive supply chains** • Increased **accessibility** of resources **and mobility** of the workforce • Improved **national transport** network • Increased **energy efficiency** and use of renewable energy sources • Higher rate of **waste recycling** • Better **environmental and risk prevention** management • **Privatization** of markets and modernization of business models • Increased **export potential** • Increased **partnership**s between the **public and private sectors** for **research** • Rising **productivity and quality** of products and services • Increased **domestic consumption** - *Large and expanding consumer **market**	• **Low absorption** of EU funds • Further increase in regional development **disparities** • External **migration of the labor force** • Continuation of imbalanced, inadequate development of transport **network** in relation to the market needs • Increased **transport costs** due to under-development of transport infrastructure • Further **degradation of infrastructure** • Infrastructure **investment** potentially affecting the environment • Reduced **efficiency and safety of the energy supply network** • **Migration of current sectors** to lower costs locations • Increased **exposure to global markets** • Periods of **stagnation or economic decline** in European and global markets
Fisheries and aquaculture	
Strengths	**Weaknesses**
• Fish, as main living exploiting resource are common for all Black Sea countries • Transboundary character of it imposed the necessity for: - coordinated efforts for fish exploiting and protection, at regional level - fisheries sustainable development • Commercial fisheries lies in the European coordination According to European Union regulation • The Directorate-General for Maritime Affairs and Fisheries (DG MARE) is responsible for the fisheries management policy	• Decline of the Black Sea natural resources • Dynamic changes of the Black Sea ecosystem directly related to **over-fishing and illegal fishing, climate change and pollution** seriously affecting fish stocks - catches and fishing effort increase beyond the natural recovery capacity of stocks in spite of evident decline of stocks, in particular in the case of threatened species as sturgeons, turbot, spiny dogfish, bonito, etc., even in

• Absorption of EU funds for marine aquaculture • As MS, Bulgaria and Romania have elaborated National Strategic Plan and Strategy for Fisheries and Aquaculture, in developing • The Black Sea provides a mosaic of habitats for the continued survival and reproduction of all native species; they should be protected • Many possibilities exist for the cultivation of Black Sea **native mussels** in Bulgaria • Creation of the **Demonstrative Center for specialists** in aquaculture • **Favorable conditions** for the establishment the **fish market** during summers season, needing more support of officialities • Existence, extending, designation of marine areas protected with regional significance and possibilities of valuable species conservation • It is extended the ***Rapana*** in the last years catches	same country fishing effort and other management instruments are used currently. - utilization of the destructive fishing tools and techniques. • Lack of the fishing fleet • Less suitable areas for mariculture - Shore exposure and weather conditions in the western Black Sea, requiring the use of artificial sheltered coastal areas, which increases the cost of production from aquaculture • Not yet developed cooperation with riparian countries regarding fishing, fisheries, aquaculture activities,production, marketing, processing • Lack of spatial explicit information on fisheries related parameters such as: - occurrence of productive areas, - habitats relevant for recruitment and spawning of target fish, - priority areas for fish stocks concentration and for fishing
Opportunities	**Threats**
• EU funds for fishery sector: programs, research, infrastructure, fishing tools, gears, equipment, people employment, fish and seafood processing • Request for processed products; marketing potential for new fish species and products • The transboundary character of the living resources from the Black Sea imposing the necessity for: - coordinated efforts for fish exploiting and protection, at regional level. - fisheries sustainable development • Accurate analytical and scientific research opportunities, coordinated at a regional, national and European level to preserve and improve fisheries resources - Possibilities for continuous, long-term system of fisheries observation, with all the Black Sea states participation • Site selection for mariculture from the European recommendations • Delineation of fish stocks boundaries based on Integrated Maritime Spatial Planning. Methodologies included. • Deepen cooperation among all stakeholders in the fisheries sector, including the representatives of industry, scientists, policy makers in different regions	• All kind of Black Sea instability: ecologic, demographic, economic, politic • Impredictibility of climatic anomalies in the Black Sea, identification of hot spots • Decline of fish catch in recent years due to the decline of the Black Sea fish stocks • Illegal, unoeported and unoegulated fishing in the Black Sea • Fishing effort continually increasing in spite of evident decline of fish stocks, • Lack of a regional fisheries management system and incompatible national practice • Production, not consistent with the market expectations: - simple diversity of fish products - lack of wholesale fish markets - lack of centres for the first sales and conditioning equipment - poor organization of producers - insufficient promotion of the fish products • Incompatible and incomparable data and methodologies for assessment purpose
Non-living natural resources	
Strengths	**Weaknesses**

Diversity of the non-living natural resources: - hydrocarbons resources (oil and gas: new marine areas for extraction in extensions/developing stages: Black Sea continental shelf and Black Sea basin - ferrous and non-ferrous ores ○ manganese ores ○ cooper ores: - limestones - construction limestones - granite, quartz and limestone - geothermal resources, - natural mineral resources - therapeutically mud - termominerale waters - coals - salt is exploited - other underground resources - sand - crystalline schists	-Shabla, -Balcik – Obrochishte; Burgas, Sozopol, Tsarevo -Pomorie -Varna, Burgas -Pomorie, Kavarna – Doubroudja, Burgas – Troyanovo, Shabla on the Bulgarian coast	-Sf Georghe, Costinești, Vama Veche, -Corbu, 2Mai-Vama Veche -Sulina, Corbu -Sulina Mangalia,Constanța Techirghiol Mangalia,Constanța -Constanța/Ovidiu, Jurilovca -Săcele	**Irrational exploitation of various non-living natural resources**: - non-living natural resources (oil, gas, coals etc.) and thus the increasing of Romanian and Bulgarian energy dependence - increasing the price of oil and gas at global level **Pollution due to the exploitation of the non-living natural resources** affecting the marine environment: - changes in coastal dynamics – erosion/accretion, sediment dynamic - changes of the topography of the areas including the sea bottom: holes, sterile material on significant surfaces, inducing changes on the marine environment quality and biodiversity - unbalanced sediment situation on all western BS shore, due to dramatic sediment load reduction on rivers and inland arrangements		Due to **Danube input** there is no salt extraction facilities on Romanian littoral - Case of Danube, Hagieni-Limanu-Mangalia
			• **The gas and oil exploration adversely** affecting **the marine mammals** • **Visual impact negatively affecting tourism activities transmission**		
The existing, in the both areas, of *FACILITIES* for processing and *TRANSPORT* of oil and gas	*Burgas Refinery	-Năvodari Refinery –	**Negative effects of non-living natural resources exploitation**:		

	*ports & dedica-ted facilities	Constanta, Midia, Varna, Burgas	- increased development of petrochemical industry, oil refinery, extractive industry, mass tourism in the area - lack of historic/reference data, modern facilities implementation for assessment / continuous monitoring	oil refineries, Năvodari	oil refineries, Burgas, etc.
Others: • **The existence of renewable energy sources** (wind, solar etc.) and thus reducing the emission of greenhouse gases • **Marine sand for beach nourishment** (Constanta offshore area – fossil sands ***The existence of curative muds**	Such as alternative to fossil fuels, alternative fuels (biodiesel, ethanol)	sapropelic mud - Techirghiol Lake	- intensification of coastal hazards due to climate changes and anthropugenous pressure - increased coastal pollution level generated by the maintaining of polluting technologies		
Opportunities			**Threats**		
Sustainable economic development of the coastal zone: **The development new technologies of exploitation** non-living natural resources and alternative functions: - oil refining - industry and construction limestone	Burgas Pomorie	Năvodari Năvodari, Sulina, Corbu,	- **Insufficient knowledge** of the marine and coastal mineral resources; or lack of available data - The **rate of investments** for Black Sea coast and adjacent areas development well ahead of the planning and development of the necessary infrastructure for water and sewerage; there are some masterplans drafts - **Coastal line,** sometime affecting much marine space		**Huge investment pressure** of certain sand belts, as well for construction and urbanization of the coastal areas till the
- **Existence of new exploration activities concerning oil and gas resources** in Black Sea basin - Existence of new remote sensing technologies and European services for monitoring and forecast		Existence of **mud treatment facilities** in the area and SPA touristic resorts			
Transport infrastructure					
Strengths			**Weaknesses**		

• Romania and Bulgaria are located in important points of entrance to the EU and have good potential for **new multimodal transport links** to neighboring countries and to the Black Sea for international trade - Prime location along key axes on TEN-T and on Corridor IX that provides **good accessibility to neighboring countries** - **Danube and other inland navigation waterways** are well connected to provide new potential for low cost bulk freight, development of intermodal container traffic and leisure use - **Availability of major maritime ports to service oil, container/cargo and fishing activities** • **Presence of the necessary infrastructure capacity and technical ability to function as a multi-purpose port terminals** - Constanta (Romania) and Burgas port (Bulgaria) are on TEN-T having adequate space for expansion and increased through put with sufficient draught for largest ships and shipping lines which are expanding their operations and trade routes • **Multimodal transport** (sea/river/road/rail) is an environmentally friendly mode and has a high share of the current Romanian inland container transport that provides a costeffective alternative to road transport • **Existing transport infrastructure linking coastal localities**: - transport routes running from N to S of the coast line - modernized railroad infrastructure serving major coastal cities (Varna, Burgas; Constanta, Mangalia) - good connections of the ports to the national road and rail network (Varna, Burgas, Constanta) - regional ports (for passenger traffic and fishing) making cities more attractive (Balchik, Nessebar, Pomorie in Bulgaria; Sulina, Constanta, Mangalia- Romania) - international coastal routes Burgas and Constanta to Turkey, Greece - international navigation routes (Varna-Constanta-Odesa) - Availability of all main types of coastal transport infrastructure (marine, road, rail, air) at the regional scale, particularly in Romanian southern shore unit	• **Road network** is underdeveloped throughout country and coast and poorly maintained, producing high accidents risk, resulting **unsatisfactory traffic** on **existing transport infrastructure:** - local roads in a poor state (Shabla, Burgas, Dobrich; Sulina, Eforie, resorts) - lack of transport infrastructure in isolated coastal localities (Tulcea county) - reduced traffic capacity (from Mangalia to Constanța on DN39) - overload of some parts of the street network (e.g. in the centre of Constanța, Mangalia, Mamaia) - lack of east- west connections increases the traffic along the coast and within localities (ex. in Sozopol; Agigea - Tuzla) • There are few **motorways** with almost no links to EU, development regions or neighboring countries. **Excessive use of them, especially of private cars (**at the peak of tourist season): - air pollution, in summer season (Shabla, Varna, Burgas, Pomorie, Tsarevo; Mamaia, Constanta) - noise pollution from heavy road traffic disturbing environmental conditions (Shabla, Kaverna, Balchik, Nessebar, Burgas, Pomorie) - less of alternative modes of transportation on long distances • **Low investment** in new construction and maintenance of fluvial and maritime ports infrastructure, including handling facilities • **Lack of strategy for development of multi-modal transport**, as well as of a well-functioning and integrated transport system. • **Insufficient coordination** between the transport modes • **Transport infrastructure** design and construction quality was not at EU standards; significant investment is needed for rehabilitation to the EU standards - lack of modern systems for regulated circulation; accidents/traffic-jams mitigation - lack of forecast systems and support systems in emergency situations • Limited depth range for big-container and cargo transport than other ports in Europe due to the closed type of the Black Sea as a marine basin
Opportunities	**Threats**
• **Sustained economic** growth leading to greater international trade • New opportunities to **use EU funds** for development of transport infrastructure • Increased mobility within Europe creating the **potential for economic growth** in all economic regions	• **Delays in implementation of reforms**, restructuring and modernization of transport sector and sub sectors • **Delays in carrying out priority projects** • **Projects and feasibility studies preparing** as well as land acquisition issues, carried out during long periods of time

• Strengthening the **business climate** aiming improvements in manufacturing, agricultural and industrial sectors, leading to greater transport demand • Potential for providing greater access to Europe from the Black Sea countries and creating cost effective **transhipment point** between the maritime network and the road, rail and inland waterway networks of Romania and Bulgaria • Development of **multi-/inter-modal corridors and logistic chains**. • **Development of transport infrastructure programs**: - road rehabilitation programs, including streets (ex. Corbu village) - potential for developing intermodal transport in some coastal cities- hubs for railway infrastructure), prerequisites created for combined transport (Constanta, Varna, Burgas) - the interest of some municipalities to reduce air pollution from motor vehicles transport • Supporting the **less polluting transport modes** (by developing sustainable transport infrastructures) contributing to the human health, environmental improvement, and economic competitiveness • Plans and actions to phase-out vehicles without exhaust emission control, new engines and techniques leading **energy efficiency** improvement and **air pollution reducing** • **Alternative transport Development at local level: small bikes** (design, space) **tram,** combined transport **road/railway/maritime** (Varna, Burgas; Constanta)	• **Further development of transport** causing significant adverse environmental effects (habitant fragmentation, landscape degradation) - **Increased accumulation of nuisances related to transport affects the quality of coastal and marine environment**: - unlimited use of motor vehicles in poor condition (Balchik, Pomorie) - lack of infrastructure adaptation to the environment conditions (Burgas area, Tsarevo, Ahtopol, Mangalia) • Ineffective links between the different types of coastal transport infrastructure (road, rail, air) • Repairing of bridges, uderdimensionnig according to the auto transport network • Oil pollution (oil-spills) from maritime transport and old technologies extraction facilities

Energy generation and transmission					
Strengths			**Weaknesses**		
The presence of **oil and gas resources** located on Black Sea continental shelf The presence of a **national infrastructure** for the transport of electricity, gas, oil. **Developed power grid on the coastal area:** -thermal power plants -transformer stations -overhead transmission lines:	-Varna, Burgas - 750/400 kV Varna, -400/110 kV Burgas -750 kV Isaccea-Varna -400kV,Varna-Dobrogea	-Constanta -400/110 kV Constanta North -400 kV Constanta North -Tulcea West	**Air pollution due to conventional energy sources** based on fossil fuels: thermal power plants - low tide sea/shore - low energetic potential for waves efficient plants, comparative with ocean zone **Exhaustion of viable locations for onshore** wind farms leading to development of offshore wind farms (> 60% more expensive investments than similar onshore projects) with negative impact on environment and landscapes	Varna, Burgas	Constanta, Impact on the marine habitats and biodiversity

	-400kV,Varna-Burgas				
• **High renewable energy potential:** - significant capitalization of existing wind potential on the coast - mechanical force of waves for energy purpose	high wind energy potential solar energy on the coast	high wind energy potential solar energy on the coast			
• **Numerous existing renewable energy sources**: - possibility of extensions for coastal and offshore wind farms	-wind farms on Balchik, Kavarna, Shabla -photovoltaic plants – Balchik, Kavarna, Aksakovo, Avren, Varna, Burgas, Nesebar, Pomorie, Primorsko, Sozopol., Tsarevo	-wind farms on Murighiol, Dunavatu de Jos, Jurilovca, Sarichioi, Mihai Viteazu, Corbu, Agigea, Eforie Nord, Tuzla, Costinesti, Limanu - development of hydropower plants – Agigea			

Opportunities	**Threats**
• A geopolitical position and favorable geo strategically to participate actively in the development **of major pan-European electricity**, **oil and gas** • **Development of projects for power transmission between Black Sea countries** through submarine cables • **National legislations** encourage renewable energy development • **Subsidy programs** for renewable energy and environmental protection	• **Negative impact of submarine power cables** on the marine environment - landscape influences - possible impact on benthic organisms due to vibration and pollution on the static organisms due to their accumulative features - possible impact on waterfowl

Telecommunications	
Strengths	**Weaknesses**
Developed telecommunication network: - on shore cables – optical fiber Dobrich – Varna – Sunny Beach – Burgas; Tulcea-Constanta, Constanta-Mangalia - submarine cables –Caucasus Cable System (Balchik-Poti), BSFOCS (Varna-Odessa-Novorossyisk), KAFOS (Mangalia–Varna–Rumeli-Igneada),	**Negative impact of submarine communication cables** on the marine environment: seabed disturbance, habitats disturbance
Opportunities	**Threats**
Protection, assessment and identification applying **new, modern systems**	**Damage from trawling, sand and substrate dislocation, resources exploiting, navigation**

Tourism sector

Strengths	Weaknesses
• The **geographic position, favourable for the development** of new tourism products (itinerary tourism, cruise tourism, business, cultural and ecological tourism etc.) • The **easy access to touristic areas** (highways, roads, railways, international airport) connected to the main European transport corridors • **Existence of enough developed tourist infrastructure** (accommodation and beds) in almost all municipalities and resorts in the target area - a prerequisite for the preservation of tourism as a key economic sector in the Black Sea region • **Enhanced beach sustainability:** - compliance of beaches with indicators set by EU's Blue Flag strategy on four areas: water quality, environmental education and information, environmental management, safety and services –Varna, Nesebar, Pomorie, Sozopol, Năvodari, Constanța • **Improved bathing water quality**: - mobilization of local stakeholders and monitoring actors towards meeting the minimum defined standards for bathing water quality –Shabla, Kavarna, Năvodari, Constanța, Limanu (excellent bathing water quality, according to EEA 2015) • The **existence of natural and cultural resources** concentrated in a relatively small area (wide beaches with fine sand arranged for touristic purpose, important natural reserves of sapropelic mud and places for treatment bathing, temperate continental climate allows for touristic season from spring to autumn, cultural heritage and archaeological sites over 2000 years old) • **Coastal natural protected areas as buffer zones**: - tourism infrastructures have to meet requirements set by protected lands, thus limiting the impact on marine environments - specifical eco-tourism of Danube Delta in Romania • Recent years shown the **tourism increasing activity** in all tourism regions and categories: social tourism, natural beauty/landscape tourism, seaside and SPA tourism (health tourism), cultural tourism, transit, and other forms of tourism • **Accommodation capacity** with the rapidly expanding at national level (1st place at national level), including new resorts in Bulgaria • Existence of **small private touristic sectors** • The presence on **local market of international tour-operators** (TUI, Neckerman, MSC, etc.)	• **Beach erosion** (more than 70% of Romanian littoral are subject to coastal erosion) • **Crowding of hotels on beaches and in the immediate vicinity of the shore:** - **Deterioration of the beach and coastal habitats** (prevalence of marine litter from coastal/beach tourism), destruction of some valuable protected habitats – Avren, Primorsko, Eforie, Tuzla, Costinești, - **Pollution** from hotel waste discharge into the waterways without treatment • **Obsolete infrastructure in the field of accommodation and entertainment:** - lack of adequate tourism ports facilities for reception of solid waste from cruise ships - increased popularity of tourist vessels adversely affects the marine environment through the dumping of garbage and untreated sewage at sea, and the release of other shipping-related pollutants, including combustible • Underdeveloped **infrastructure for supporting some type of tourism**: business (conference rooms, equipment, etc.), cruise (few touristic and leisure ports) • Underdeveloped tourist infrastructure – **old/damaged tourist facilities**, weak marking of cultural points, lack of information centers, poor maintenance of cultural heritage, insufficient transport facilities in touristic areas, old utility network • **Congestion and overcrowding** caused by: - seasonality (high concentrations of tourists from July to August), - weekend tourism development, discrepancies in the accommodation capacity and quality in different resorts, uneven development of resorts facilities (Nesebar, Sozopol, Varna, Constanța, Eforie, Mangalia) • Still less of permanent tourism products • Organizational delay of state institutions and local governments to manage long-term strategy, mainly in Romania • **Mosaic touristic development of pensions and small private business** and insufficiently organized and systematized facilities
Opportunities	**Threats**

• The **geographical position and natural resources** of the area • The possibility of **cross-border itinerant tourism** Romania - Bulgaria • **The access to European funds** offers the possibility of attracting funding for various projects to promote and develop tourism • **The existence and promotion of a legislative framework** that governing and encourage tourism activity and the establishment of national strategies for tourism development • The **special interest of local authorities and citizens** to develop tourism sector • The including of **big ports** in the current circuit for cruise tourism • **The economic development** of the coastal zone generates the development of **business tourism** • **The obtaining** widespread of **international quality standards** for tourism facilities • The protective work in order to **stop the beach and cliffs erosion** and beach refurbishing • The connected coastal areas with a high relief diversity, forests, hills, Danube Delta, Dobruja (Macin) Mountains, cultural monuments and rural folklore in regions, as an **important support** for the development of tourism in general and itinerary tourism in particular • Strong potential of development and big investment pressure of big centers • **Investments in tourism in favor of ecosystem restoration and conservation**. • local and cross-border projects focus on solutions to the problem of beaches narrowing and water pollution in the Black Sea. Rehabilitation and restoration of cliffs, greening and maintaining beaches • **Connection between ecotourism and sustainable development principles:** • provision of economic alternatives to activities that destroy or deplete marine ecosystems • provision of strong incentive to preserve a highquality environment in case of marine ecotourism providers	• **Erosion of beaches and cliffs collapse** can affect long-term development of tourism activities in the area • Still the absence of **national coherent policies and strategies** for integrated development of the coastal zone (infrastructure and technical infrastructure, protection and rehabilitation of natural and built environment, etc.) discourages some foreign investors wishing to invest in the area tourism • The **competition between coastal areas** of both countries: number of tourist arrivals on Romanian littoral can decrease comparing with Bulgarian ones, where accommodation, conditions and services are better • **Low exploited tourism potential** in the inland and outside of the seaside areas **Failure of land-use planners to apprehend the dynamics of land-sea interactions (LSI):** - tourism development entails a mixture of costs and benefits and conflicting interests between promoting new economic opportunities while ensuring a limited impact on marine and coastal ecosystems • Availability of **overbuilt areas** because of ineffective planning decisions taken, mainly in the big resorts • **Transboundary nature of environment-unfriendly developments in tourism:** - management of tourism in marine environments doesn't grasp a broader understanding of marine specific processes - actions taken in one marine locality could impact another distant one • **Competition exercised on regional tourism market** and low capacity of local businesses to adapt to a unique and competitive market • The **migration of qualified personnel** from tourism in various EU countries • The **lack of specialization** for personnel working in tourism industry in Romania because of very short summer season with two months pick and other two, before and after • **Vicinity of industrial sites** and commercial port is an important risk factor that contributes to environmental degradation and continues generate air and water pollution, diminishing the tourist potential • **Loose of environment attractiveness and specificity** of the coastal landscape in some areas • Lack of public awareness and publicity

<table>
<tr><th colspan="4">Coastal protection</th></tr>
<tr><th colspan="2">Strengths</th><th colspan="2">Weaknesses</th></tr>
<tr><td colspan="2">Existence of Masterplans, including coastal protection against erosion

Existence of the coastal construction for shore protection and experience of building design and maintenance</td><td>Environmental-friendly protection systems are old or not well represented</td><td>High percent of shore in an advanced stage of damage

-Coastal erosion and accretion processes
-Impact of Danube and inexistent protection within DDBRA</td></tr>
<tr><th colspan="2">Opportunities</th><th colspan="2">Threats</th></tr>
<tr><td>Possibility of extensions of new coastal protection systems implementations</td><td>For entire touristic littoral</td><td>Mamaia and Eforie areas and extension possibilities in the Southern littoral</td><td>Hydrogeological influence and soil subsidence due to new coastal construction extension/weighting</td><td>Barrier islands instability /vulnerability</td></tr>
<tr><th colspan="4">Water management works</th></tr>
<tr><th colspan="2">Strengths</th><th colspan="2">Weaknesses</th></tr>
<tr><td colspan="2">Coastal fresh water bodies closely linked to the marine ecosystems nearing the shoreline</td><td colspan="2">• Coastal protection structures and ports infrastructures have consequences of the marine biotope:
- surfaces of shores and watersheds affect aquatic ecosystems
- coastal protection structures and ports infrastructures produce changes of currents and sedimentation
• Storm water and waters from sources coming from settlements areas affect aquatic ecosystems, sometimes contaminating water
• Groundwater quality affected by various land uses and land based activities (including pumping, agriculture, industry and waste disposal) could also contaminate also the sea
• Water Overexploitation and less treated waste water systems during summer/touristic season, or non-treated water released through overflow pipeline</td></tr>
<tr><th colspan="2">Opportunities</th><th colspan="2">Threats</th></tr>
<tr><td colspan="2">- European Directives concerning water qualities and use, obligatory to be implemented in the MS of the Black Se basin
- National legislative framework underlies the integrated water management of coastal areas of the two states</td><td colspan="2">• Global warming affects the natural regime of water circulation by excessive phenomenon
• Absence of monitoring and maintenance of water flow in the main basins are threatening the marine ecosystems (Danube river)
• Salt water intrusion in coastal aquifers</td></tr>
</table>

Summary Analysis resulted from MAIN COASTAL ACTIVITIES AND USES WITH IMPACT ON THE SEA SPACE

Settlements network and cultural heritage

Strengths	Weaknesses
Opportunities	**Threats**
Improvement of **urban growth management**: - increased acknowledgement of the necessity of spatial planning and need for large public and natural spaces (protected areas, parks) on the shoreline - research activities resulting in increased scientific knowledge on marine processes in relation with the coastal processes – Varna, Constanta - Maximum potential of **new implementation**, due to low degree (5%) of the urbanization, thus allowing more effective planning and utilization of marine and land resources for development of inter-related socio-economic activities	**Pollution** due to the imbalance between the provision of infrastructures and the real estate development - informal settlements or districts developed outside the built up areas - concentration in polarization areas - large cities: Varna, Burgas, Constanta - loose enforcement or lack of ICM plans or development without plans - growth of real estate - increase demand for individual homes, tourist compounds and roads, resulting in larger built-up areas in the close vicinity of beaches - Vama Veche, Varna, Sts. Const & Helena, Mamaia, Costinesti, - disruption /removal of indigenous coastal habitats (vegetation, natural drainage, air flow, shoreline physical conditions) - Varna - Sts. Const & Helena - Zlatni Piasti, Slanchev bryag - Elenite/Sveti Vlas, Constanta - Mamaia, Mangalia - Olimp

Demographic and social processes

Strengths	Weaknesses
• Positivity **population growth** in the big cities and coastal villages/rural centers supporting economy development with the necessary human resources • The significant **population with secondary and higher education** increases its potential for development • The share of **unemployed** is almost twice lower than the average for the country	• The **migration** of specialised population to EU developed countries is a growing negative trend at the national • The **concentration of the population** in the urban areas and in the larger regional municipalities, creating negative balance in the inland and rural areas, leading to their depopulation and decline everywhere; special case of Danube Delta • The **lack of the economic compensation** for local people leaving in the coastal areas during summer season, and for the Danube Delta people, all around year • **Lack of** demographic development **planning**, and lack of foreign populations integration planning

6. Findings from the Case Studies: gaps of knowledge and lessons learned

The First MARSPLAN-BS project elaborated five case studies, for three specific areas and two specific domains, as is following presented.

6.1 Eforie Area Case Study

http://www.marsplan.ro/en/results/case-study/433-eforie-nord-eforie-sud-area.html,
http://msp-platform.rmri.ro/downloads/2018%20Eforie%20Case%20Study.pdf

METHODOLOGICAL APPROACH

Eforie North – Eforie South is a complex area, with diverse natural habitats and landscapes which have contributed to the development of important tourist resorts. In the north part of Eforie North sector is the Agigea Harbour, an extension of Constanta Port.

The case study Eforie North - Eforie South was focused on the coastal erosion (Figure 38) with effects on an urban area and sea-land interaction (Figure 39), paying particular attention to:

- Identification of the main uses and their impacts on marine areas (ex. urban development and the tertiary sector of services as trade, tourism)
- Quantification of the natural risks (coastal erosion) and their implications on the natural, social and economic environment (coastal erosion and its implications for tourism development, but also impact of coastal protection structures on the marine environment).

ACHIEVEMENTS

The Eforie study discussed the influence of coastal erosion on the terrestrial and marine domain:

- Mapping of marine bio-geo-physical features and associated human activity
- Quantification of coastal and marine features, human activities, pressures and threats
- Identification of zonal conflicts, concentration of uses, priority conservation areas
- Stakeholder methods and Functional-Spatial Zoning analyses have been some of methods applied
- The study proved the existence of significant pressures from the coastal erosion, and need for a proper beach/cliffs management
- The influence of the coastal erosions on the socio-economic activities, is reflected in associated interactions, conflicts and controls between stakeholder's various activities in study area

CHALLENGES

- Coastal erosion - Erosion of beaches and cliffs degradation (infiltration of surface water wave abrasion on the base of the cliffs) caused the shore to retreat with about 40 - 60 m in the last 75-100 years, in parallel with the gradual collapse of the cliffs.
- Increasing environment risk and impacts – in the Eforie zone there are three Natura 2000 sites (2 under Habitats Directive and 1 under Birds Directive). Coastal protection works, beach nourishment, increasing of demand for space for touristic activities, nautical sports, new construction, mainly holiday houses, and the increase of port traffic influenced negatively the functions of natural habitats and species.

- More than 1.2 km of shore was already subject to coastal protection works (more than 1 km of new or rehabilitated dams/dikes and beach nourishment) witch impacts on the marine habitats and species/aquatic ecosystems
  - *morphological change,*
  - *physical parameter change (increase of turbidity level),*
  - *pollution,*
  - *change in sediment composition (change of medium-littoral texture),*
- The future coastal protection works will extend to another 4.5 km, including the Natura 2000 site Eforie submerged beach (ROSCI0197).

Figure 38. Eforie pilot study - Shoreline changes in the last 10 years (*Maps produced by NIMRD)*

Uses	Coastal constructions	Coastal protection	Harbors	Navigation routes	Anchorage	Urban residues	Urban development	Dumping	Pelagic trawl	Stationary uncovered pounds	Pots and traps	Set gillnet	Manual rapana harvesting	Mussel farm	Natura 2000 sites	Refurbish beaches	Ship wrecks	Beach tourism	Recretional diving	Nautical sports	Marinas	Recretional fishing	Military areas
Coastal constructions		0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	0	2	0	0	0	0	0
Coastal protection			2	3	3	0	0	0	0	0	0	0	0	3	5	3	0	3	0	1	3	0	0
Harbors				3	3	0	5	0	0	0	0	0	0	2	6	0	0	5	1	1	3	3	0
Navigation routes					5	0	0	2	1	5	5	5	2	3	3	0	0	0	1	3	2	1	3
Anchorage						0	0	2	1	5	5	5	2	3	6	0	2	2	1	3	3	2	3
Urban residues							0	0	0	0	0	0	0	4	6	0	0	5	5	3	2	5	0
Urban development								0	0	0	0	0	0	2	6	0	0	5	0	0	5	0	0
Dumping									3	3	3	3	3	3	6	2	4	1	4	2	2	2	3
Pelagic trawl										4	4	4	4	5	3	0	4	0	1	0	0	1	5
Stationary uncovered pounds											4	4	4	5	3	0	3	0	5	0	0	5	5
Pots and traps												4	4	5	3	0	5	0	5	0	0	5	5
Set gillnet													4	5	3	0	3	0	5	0	0	5	5
Manual Rapana harvesting														5	3	0	3	0	4	3	0	4	5
Mussel farm															3	0	4	0	5	5	5	5	5
Natura 2000 sites																3	5	2	3	2	3	6
Refurbish beaches																	0	5	0	0	2	0	0
Ship wrecks																		0	4	2	0	3	4
Beach tourism																			0	2	0	2	2
Recretional diving																				2	0	2	4
Nautical sports																					2	2	4
Marinas																						0	3
Recretional fishing																							2
Military areas																							

Figure 39. Interaction matrix of the human activities carried out in the coastal area of the Eforie study case obtained through the GRID WebGis application; red squares: conflicts; green squares: synergies; white squares: no interaction. The level of interaction is scored between 0 and 6 –(produced by *NIMRD)*

PROBLEM/SUCCESS

The pollution is one of the most critical problems in this case due to the urban development and leads to:

- Decrease of the renewable and non renewable resources together with alteration of key ecological processes;
- Increasing threats to heritage and diversity of the area due to rapid urbanization of coastal areas with consequent impacts on traditional socio economic structure.

IMPACT - Stakeholders meeting and sketch match method

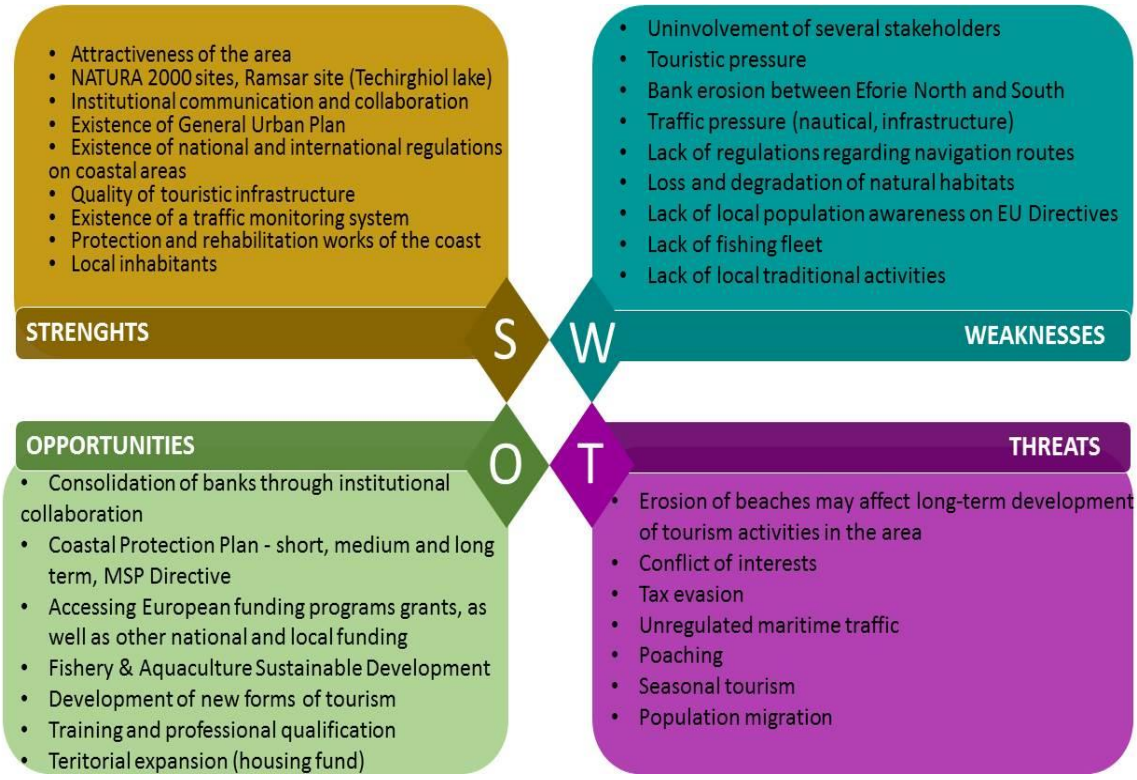


Figure 40. SWOT analysis for Eforie North and South coastal area- (*www.marsplan.ro/en)*

The general objective is to elaborate development plans along the coastline in the Eforie North - Eforie South area, to highlight potential solutions for integrating protective measures of coastal areas in the context of Maritime Spatial Planning. Particular attention was given to the local economy and access to natural resources.

- The sketch match (Figure 40) is a method that is used to identify and visualize potential development paths and to facilitate the decision-making process for managers, policymakers and local stakeholders. The results presented by each group gave an overview of the problems and potentials of the area to our main topic: Eforie North - Eforie South coastal area.

RECOMMENDATIONS/CONCLUSIONS

The area is particularly vulnerable to coastal erosion because of hydrological pressures, geological and geomorphological conditions, such as soft cliffs. Shoreline retreat has been exacerbated by human activities, such as urban development that has led to loss of sand

dunes, dams on the Danube River that have reduced sediment input, and barriers that have impeded sediment flow. The Master Plan for coastal protection recommended measures such as dikes to reduce wave energy, groins to accumulate sand and beach nourishment. However, this has had some unforeseen negative effects, such as clogging of Belona Marina by sediment transported from beach nourishment areas. Relocation of this marina is now proposed to a nearby location where water circulation is greater,

Other potential conflicts have been identified, such as between fishing and navigation, and marine protected areas with economic uses. A Sketch Match exercise, involving stakeholder engagement, was carried out to explore options for integrating these and other uses. This allowed participants to draw maps of possible configurations of uses and develop other management proposals. For instance, routes to fishing grounds could be clearly established, mussel farms could be relocated , and the tourist diving potential could be developed. Finally, an interaction matrix of human activities was drawn up, as a means of defining functional zones, including for nature protection.

6.2. Sfantu Gheorghe Case Study

http://www.marsplan.ro/en/results/case-study/429-the-village-of-sf%C3%A2ntu-gheorghe.html

METHODOLOGICAL APPROACH

The Sfantu Gheorghe Case Study (Figure 41) was aimed to provide new findings on the hydrological impact of the Danube River and sedimentology, in area included in the Danube Delta Biosphere Reserve (particularly Sacalin Island). The Sketch Match method was used within this study in order to identify and visualize potential development paths, thus facilitating the decision-making process for managers, policymakers and local stakeholders.

ACHIEVEMENTS

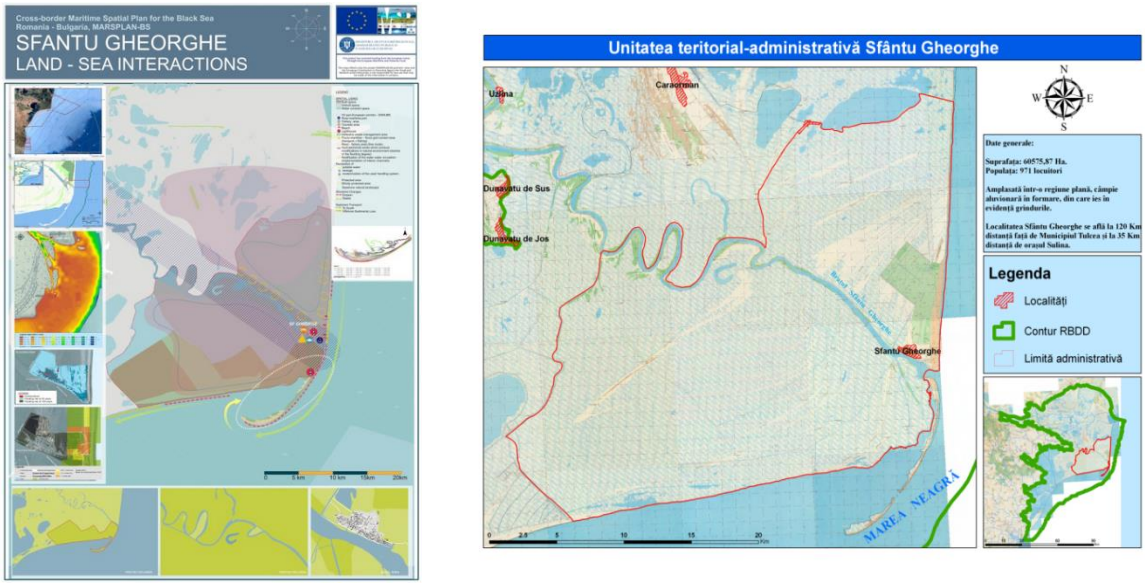


Figure 41. Sfantu Gheorghe Pilot (*www.marsplan.ro/*en)

Sketch Match methodology (Figure 42) for MSP implementation that frames:

- Reliable information on coastal area management, awareness of local community and stakeholders.
- Integration in Danube Delta Biosphere Reserve Management Plan, local regulations and National legislation.
- Practical solutions, lessons learned on how to implement the solutions identified for the Sfantu Gheorghe coastal area.
- Collaboration between institutions present at the session after the project end; institutional collaboration for maritime area clarifications.
- Involvement of local community.
- Scenarios and solutions for MSP.

CHALLENGES

- Solutions for adaptation to MSP Directive;

- Biosphere Reserve and natural dynamic processes that change the Danube/Black Sea water level and also affect coastal dynamics.

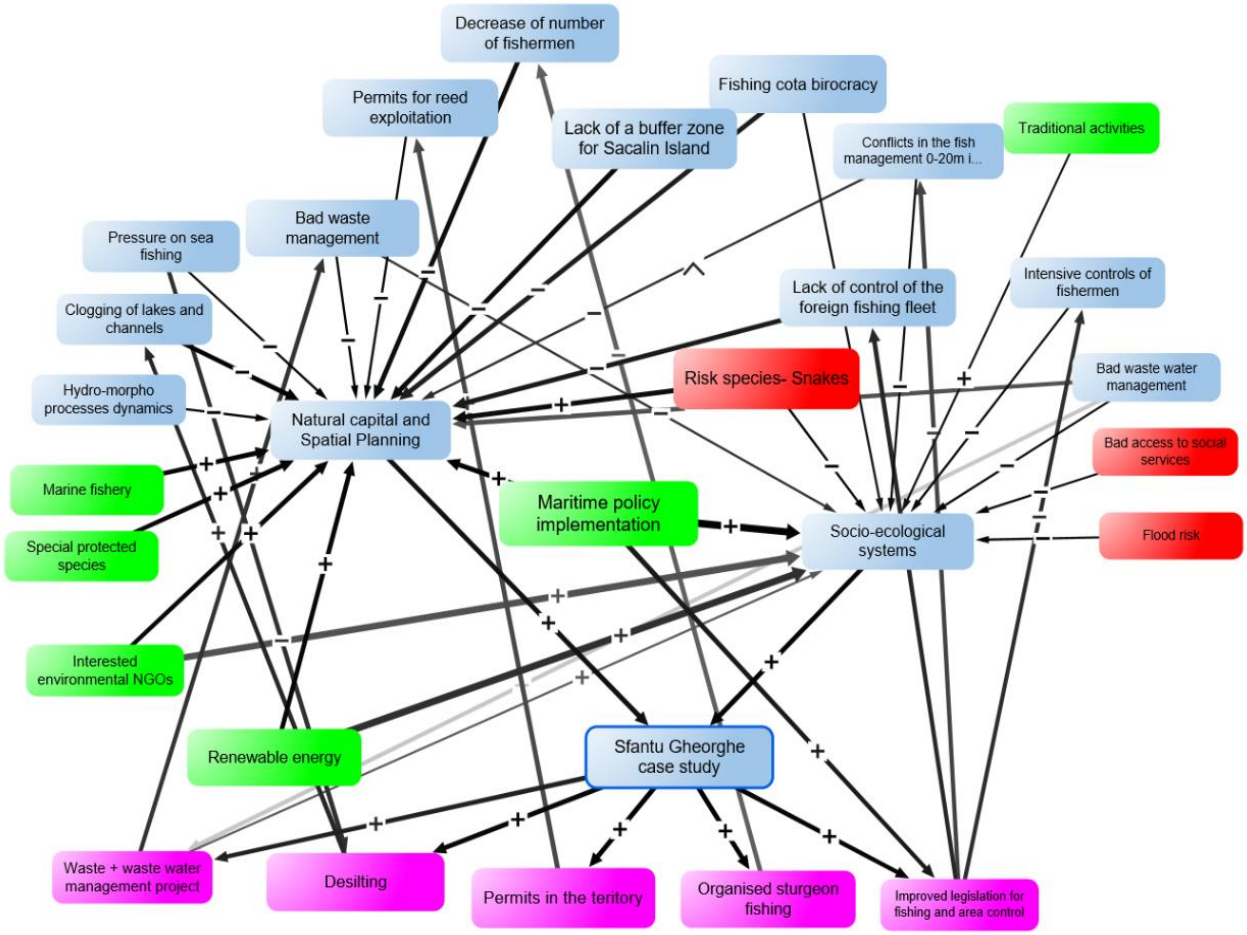


Figure 42. Sfantu Gheorghe system analysis (*hwww.marsplan.ro/en*)

PROBLEM/SUCCESS

- Growing morpho-hydrografical processes' dynamics (e.g. clogging of the mouth of the St. Gheorghe arm). Designing of a hydrotechnical structure to reduce the morphohydrographical processes.
- Clogging of lakes and channels/Actions of desilting.
- High pressure over sea fishing/Actions of desilting in the inland delta.
- Bad waste management/Waste management project.
- Permits for the local population to Reed exploitation/Issuance of permits in the territory.
- Decrease in the number of fishermen/Organized sturgeon fishing.Lack of a „real" buffer zone for the strictly protected area Sacalin Zatoane/Delimitation of strictly protected areas and buffer areas and incorporate this area into a tourist route covered.
- Institutional bureaucracy to establish the total allowable quota and fishing effort admissible/Improved Flow decision to establish quotas of fishing.
- Institutional overlap on fish resources (ARBDD, ANPA) and conflicts in the management of fish resources up to 20 m isobaths/Improved legislation on appointment of competent authority.
- Absence of control of foreign fleets fishing in territorial waters novels Romanian/Improvement of legislation on the control fleets.
- Excessive control of fishermen.
- Absence of integrated management of wastewater/Establishing a competent authority.

IMPACT

The Sketch Match planning methodology proved to be a success for Sfantu Gheorghe Case Study, enssuring a good cooperation process with different stakeholders and experts, raising the stakeholders' awareness as regarding to a sustainable use of their coastal area and their particular landscape. The success of this approach was enssured also because of the interdisciplinary topics debated during the design workshop, thus combining and integrated the land planning with biodiversity, social and economic aspects.

RECOMMENDATIONS

- Application of the ecosystem approach in the field of human activity management.
- Taking into account all characteristics of the case study area (dimensions, density and character of maritime uses, environmental vulnerability, political and administrative structure).
- Spatial planning objectives take into account the broad and long-term prospects that start with the agreed strategic objectives, and which are then defined through operational objectives (clearly measurable and quantifiable).
- Elaborate MSP process transparently. Transparency is the basis for responsibility and legitimacy. All decision-makers and all stakeholders have been mobilized, and the stages of the project have been comprehensible.
- Involvement of stakeholders is essential for achieving synergies and for clarifying the objectives and benefits of the MSP process.
- Simplifying decision-making processes.
- Monitoring and evaluation of the MSP process for adaptive management of marine areas and addressing socio-economic, environmental and governance aspects.
- Coherence of MSP with existing territorial systematization.
- Integrate monitoring and evaluation into the planning process through Sketch Match sessions.

6.3.Burgas Case Study: Land-Sea Interactions (LSI)

https://www.msp-platform.eu/sites/default/files/marsplan-bs-burgas_lsi.pdf,
http://www.marsplan.ro/en/results/case-study/432-bourgas.html

METHODOLOGICAL APPROACH

Burgas is the fourth largest city in Bulgaria, located along the southern Bulgarian Black Sea coast and one of the most important ports at the Black Sea with significant infrastructure for supporting the economic activities. At the same time within the study area there are several valuable natural protected areas (Natura 2000) and wetlands, important Ramsar sites, such as the lakes of Atanasovsko, Burgas (Vaya) and Mandra-Poda. These lakes, together with the adjacent Pomorie Lake, form the largest wetlands in the country with exceptional conservation value of international and national importance.

The Burgas Case Study aimed to:

- Follow the land-sea interactions with a special focus on biodiversity;
- Identify the impact of land infrastructure on wetlands and maritime space;
- Find out what are the interactions, conflicts and impacts between uses, sectors and interests both terrestrial and marine;
- Identify key stakeholders and involve them in the process of identifying current and future trends, sector priorities and interests;
- Develop different agenda options, recommendations and solutions for identified case area issues.

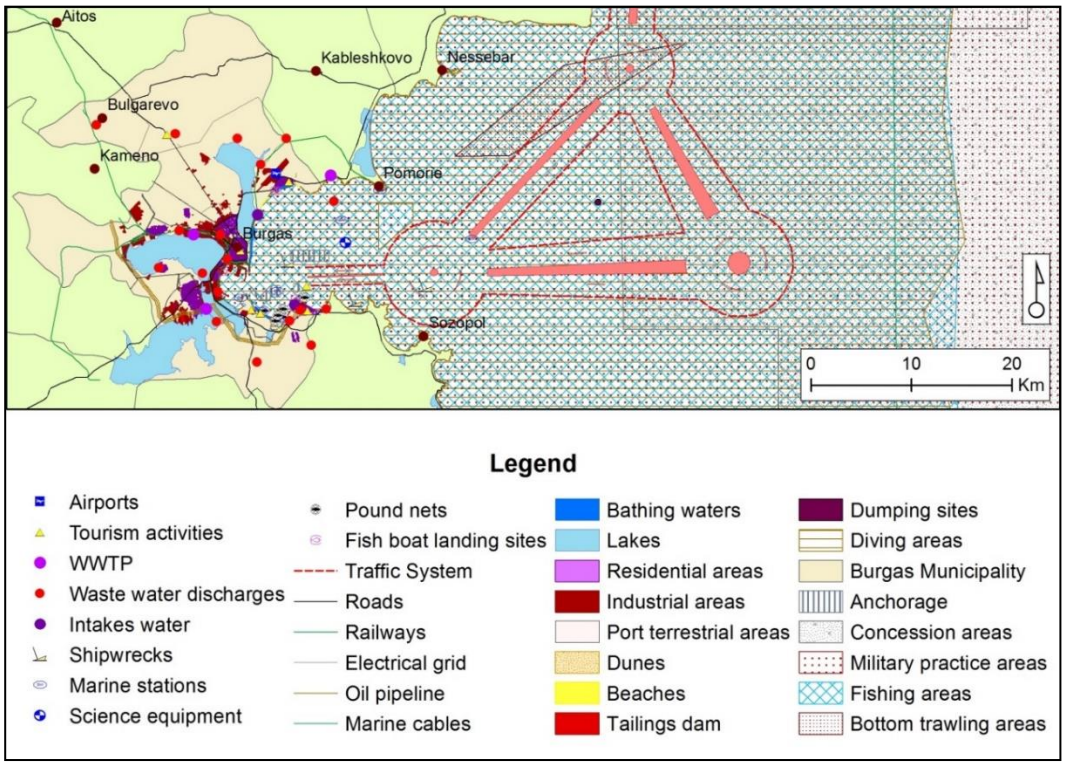


Figure 43. Land and sea uses in Burgas study area, 2017 (*map produced by CCMS)*

ACHIEVEMENTS

- Interactions between land and sea based economic activities and spatial uses, and the environment were identified and analyzed (Figure 43,44).

- Conflict/synergy matrix of land-sea interactions was developed.
- Impact of land infrastructure on wetlands and maritime space was identified and evaluated.
- Main conflicts of use and of environment in the maritime pilot area were identified and analyzed.
- Key stakeholders were identified and involved at the early stage of the study elaboration.
- Recommendations and solutions for identified case area issues were developed.

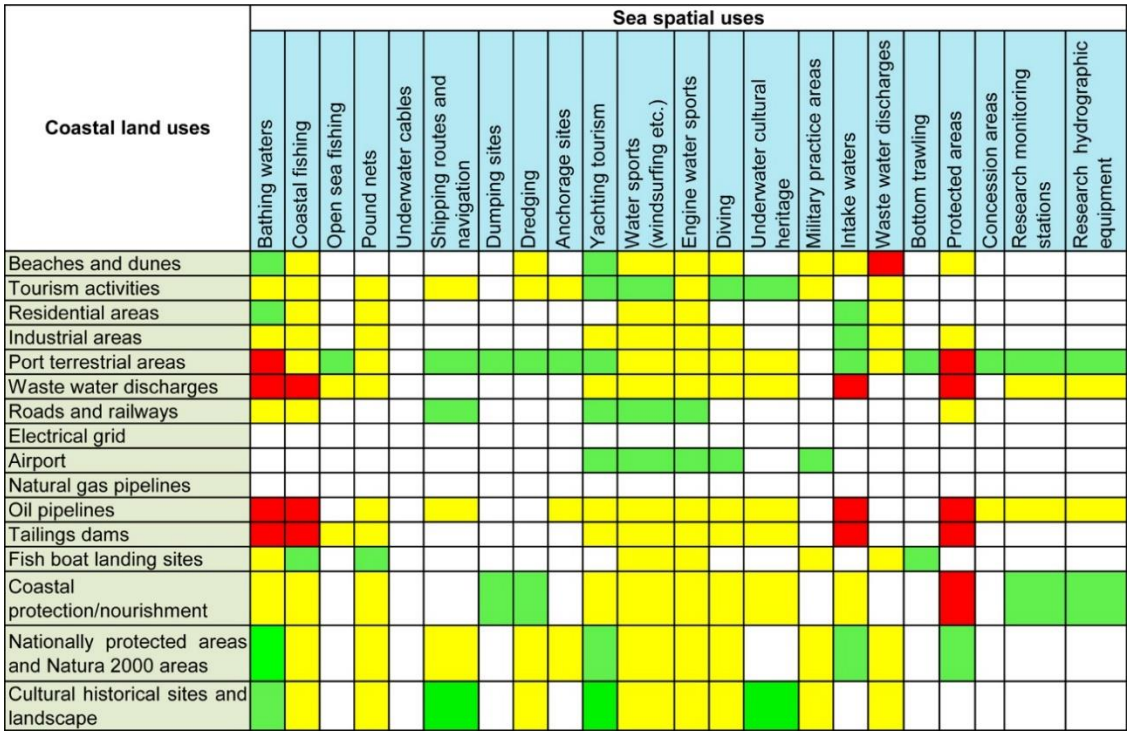


Figure 44. Land-sea interactions matrix for Burgas study area (*produced by CCMS*).

Following the analysis of the natural environment and environmental conditions, the urban development, existing economic activities, potential interests and land/sea uses along the coast and in the marine area of Burgas, a matrix showing the conflicts and synergies between different land/sea uses was produced. With green colour are interactions without conflict and compatibilities between land and sea activities, and with environment; yellow colour indicates weak conflicts between land and sea uses and with coastal and marine environment; red colour indicates interactions with conflicts in the land-sea uses and environment; empty boxes denote to no interactions identified.

- ✓ **16** different **coastal land uses** and **22 sea uses** were identified.
- ✓ Land-sea interactions without conflict numbered **44**, weak conflicts - **100**, **16** conflicts were identified and **192** no interactions between land and sea uses were indicated.

The highest number of land-sea conflict interactions was indicated for the oil pipelines, waste water discharge and tailing dams (with quality of bathing waters, coastal fishing, intake waters and protected areas).

CHALLENGES

- Establishment of proper legal basis for MSP in accordance with the Directive 2014/89/EU, including land-sea planning and harmonisation in accordance with the principles of MSP.
- Human resources and information basis for MSP are still insufficient at municipality and national level.
- Mobilisation of the key stakeholders and major players and involving them more actively in study case.

PROBLEM/SUCCESS

- Lack of reliable data and up-to-date knowledge for LSI and impact of economic activities on the wetlands.
- Data gathered could be used as guidance for further repetition models for the Black Sea Basin that would be developed with a more consistent methodology and approach.
- The LSI conflict/synergy matrix and maps of human uses and spatial overlay in marine area could be used as models for further studies on land-sea interactions along other study areas.

IMPACT

- Positive impact on environment (both coastal zone and maritime space).
- Positive impact from identified conflicts and synergies of LSI (human uses and environment) and avoiding future conflicts.
- Impact on project level results and developed policy recommendations.

RECOMMENDATIONS

- A dedicated maritime spatial planning is needed to reflect all complex LSI.
- Addressing properly LSI should also include a relationship with the terrestrial spatial plans.
- As coastal and marine research for LSI is time and costs consuming, relevant research and monitoring should be provided.
- Ways must be found to involve actively the key stakeholders, and much more cooperation is needed amongst them.

6.4. Elaboration of detailed study on the establishment of a new ship routing system in territorial seas of the Republic of Bulgaria

http://www.marsplan.ro/en/results/case-study/431-organization-and-operation-of-shipping-routes-in- the-maritime-area.html

METHODOLOGICAL APPROACH

The case study took into account the requirements of the Directive 2002/59/EC establishing a Community vessel traffic monitoring and information system and repealing Council Directive 93/75/EEC. The study took into account *inter alia:*

a. Traffic intensity
b. Vessels navigating usually in the area
c. Type of cargoes carried in the area
d. Extent of threat against environmental pollution
e. Concentration of fishing vessels
f. Specific conditions and hazards to shipping

The content of the case study consisted of the following pillars:

- Physico-geographic characteristics of the Bulgarian Black Sea coast.
- Intensity of the vessel and aircraft traffic.
- The existing system of zones in the marine waters of the Republic of Bulgaria.
- Legal Framework.
- Criteria for analysis of the existing system for vessel traffic in territorial and internal waters of the Republic of Bulgaria.
- Analysis of the existing system for the movement of ships in territorial and internal waters of the Republic of Bulgaria.
- History of accidents and collisions.
- Damage to the marine environment at the southwestern coast of the Black Sea.
- Concept for amendment of the system for separation of the vessel traffic.
- Methodology for creating a new traffic system.
- Analysis of the project for a new traffic system.
- Guidelines for technical equipment and adapting national regulations for introduction of the new system in operation.

ACHIEVEMENTS

- For the purposes of the study, a system of specific criteria to assess the suitability of the traffic separation system (TSS) was developed in the areas (Figures 45, 46).

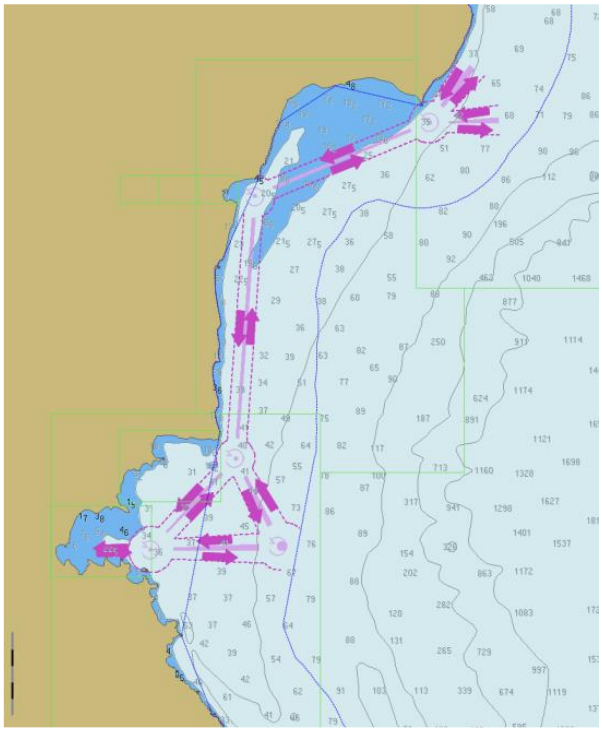


Figure 45. Existing TSS in the Republic of Bulgaria

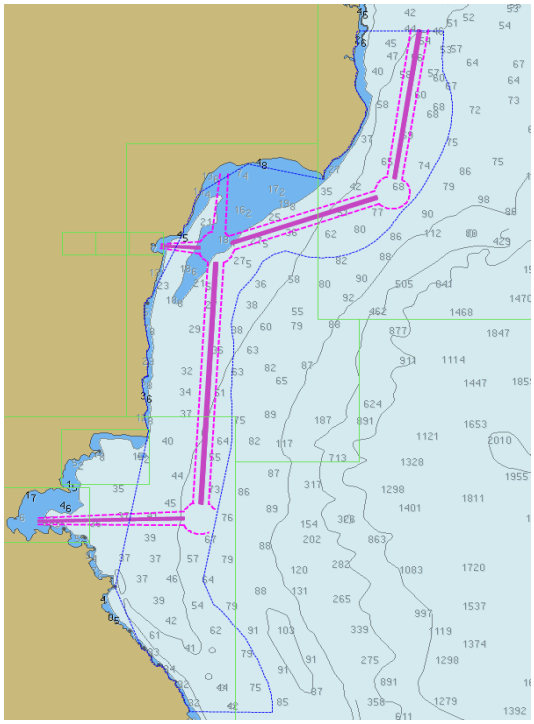


Figure 46. Proposal for Proposal for a new TSS for Republic of Bulgaria

- An analysis of the existing TSS was performed, including: advantages and disadvantages of the existing system under the developed criteria; recommendations for compensation of the disadvantages in combination with retention of the advantages were formulated; a new system formulated; the advantages and disadvantages of the newly formulated system were determined; measures to overcome disadvantages of the new system were proposed.

- On the basis of a detailed analysis of the existing vessel traffic system, a new traffic separation system was proposed.
- A comparative analysis between existing and new TSS was done and it showed that the new vessel traffic system significantly contributes to the enhancing of the safety of navigation due to division of cabotage shipping from classic maritime transport.

CHALLENGES

- Collection of data.

PROBLEM/SUCCESS

- The activities of many institutions are related to the location and functioning of the traffic system.
- There is a clear understanding and support by all institutions regarding the change of the existing system.

IMPACT

- The new vessel traffic system will significantly contribute to the enhancing of the safety of navigation due to division of cabotage shipping from classic maritime transport.
- Ecological orientation of the system. Firstly, the system will minimize the entry of commercial vessels in areas of special ecological status. Secondly, it will provide sufficient time and ease to manoeuvre in overcoming the consequences of the oil spill, coupled with decreasing of possible shoreline contamination due to influence of contra course spill over.

RECOMMENDATIONS

- The deployment of a new system shall be coordinated with the Ministry of Defence and Ministry of Interior of Bulgaria in order to provide reliable surveillance system at all hydro-meteorological conditions, and to counter the detected threats.
- Additionally, the need for conduction of anti-mine actions to ensure the cleanliness of the new areas would be time and costs demanding and these costs will grow exponentially when going beyond the isobaths of 20 m, 50 m and 100 m.
- The new maritime traffic system will be confronted with the polygons and areas, used for military training and exercise. Its introduction will require new zoning of military polygons and areas.
- As for technical equipment and systems for monitoring and control of traffic, there is no significant difference between the two systems.
- Enactment of a new system by the Bulgarian government was recommended.

6.5. Aquaculture and Fisheries Case Study

http://msp-platform.rmri.ro/downloads/Study%20Case%20-%20Marine%20Fisheries_ RO_BG.pdf, http://www.marsplan.ro/en/results/case-study/430-aquaculture-and-fisheries-in-the-cross-border-area-romania-%E2%80%93-bulgaria.html

METHODOLOGICAL APPROACH

Marine fish population is a common natural resource for the Black Sea countries. The marine fishery was the most affected sector by the dramatic changes produced in the Black Sea ecosystem. The fisheries themselves contributed to the worsening of ecological status and fish stocks diminishing, through:

- free access to the resources in the context of a poor legislation and management system for all the Black Sea countries,

- over-fishing and illegal fishing,
- utilization of the destructive fishing tools and techniques.

It is a specific case study aiming at including the marine fisheries and aquaculture in the Methodology for Maritime Spatial Planning also in the Black Sea.

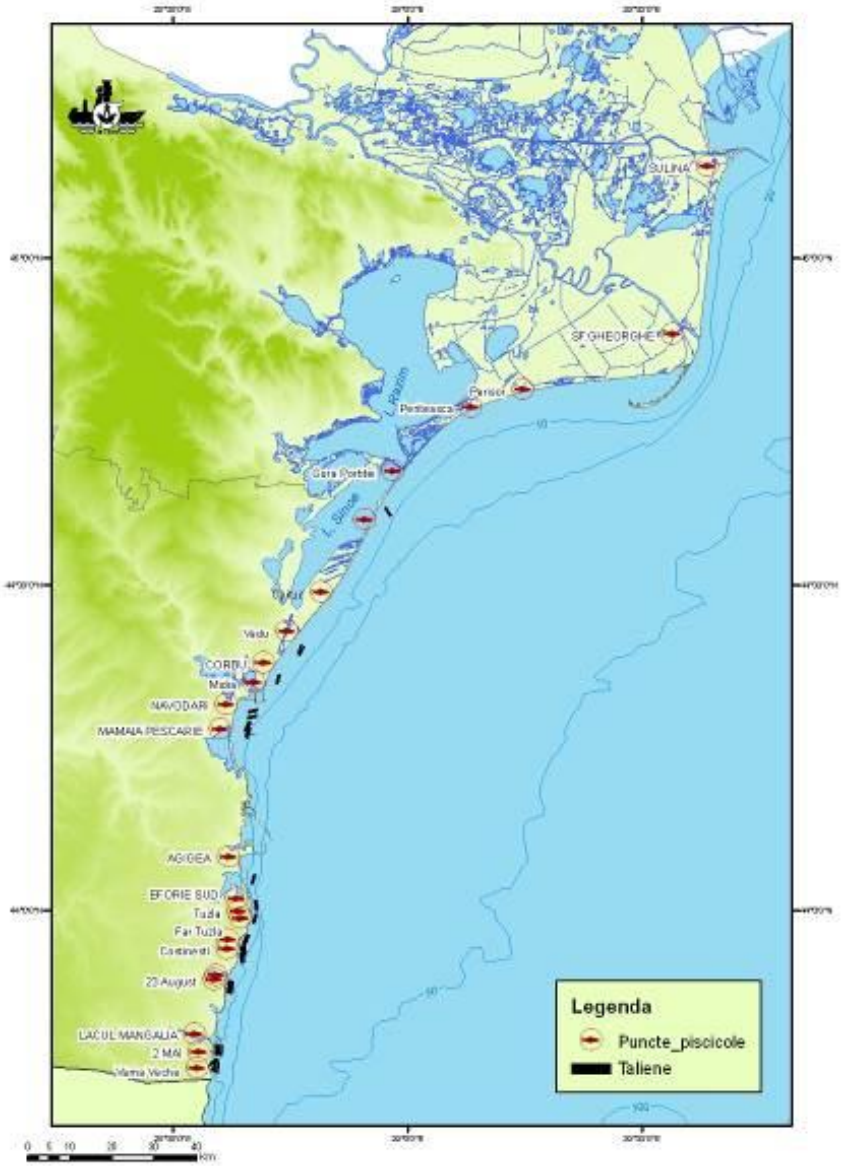


Figure 47. Romanian marine fishing points of discharge
(*Map produced by NIMRD*)

The transboundary character of the living resources, mainly fish population, imposes the necessity for:

- coordinate the efforts for fish exploiting and protection, at regional level,
- fisheries sustainable development,
- identifying ways and possibilities for fish stocks assessment and recovery.

Marine Fisheries (Figures 47) are almost exclusive activities of marine space. Taking into account the migratory species which live in the sea and migrate to freshwater for reproduction or feeding, the study wss focused also on the main causes concerning the link with wetlands, lagoons and important effluent.

CHALLENGES

For an effective fishery management and suitable decisions and actions to be taken promptly and in due time, it is necessary to provide scientific fundamental information.

The identified potential barriers are the lack of spatial explicit information on fisheries related parameters such as:

- occurrence of productive areas,
- habitats relevant for recruitment and spawning of target fish, or
- priority areas for fishing.

PROBLEM/SUCCESS

There are some main problems and interrelation in the Black Sea fisheries such as:

- Decline in natural resources of the Black Sea,
- Lack of a regional fisheries management system and incompatible national practice,
- Poor cooperation between riparian countries for increasing knowledge and rational management of ecosystem and living resources in the Black Sea basin, in compliance with the principles of Code of Conduct for a responsible fishing,
- Fisheries regulatory framework promoted by each coastal country harmonized at regional level for all species, only in the case of shared or migratory species,
- Fishing effort continue increasing in spite of evident decline of stocks,
- Development of fishing sector strategies according the environmental protection, through the implementation of ecosystem approaching concept not well imposed.

The Fisheries and Aquacuture Study included information on:

- National strategy, policy, planning, priorities,
- Current situation of the Romanian and Bulgarian marine fisheries and space,
- Suitability of spatial planning to regulate fishery,
- Legal frame proposed for integrating marine fisheries into spatial planning,
- Combined Methods of Fisheries and Maritime Spatial Planning,
- Thematical Maps elaboration on areas, tools and species.

IMPACT

Unfortunately at regional level it can be observed:

- Fragmented and irregular fish stock assessment and coordinated and joint monitoring activities,
- Lack of annual assessment of fish stocks in the Black Sea basin,
- Still reduced fish stocks assessment for all species, excepting the (whole sea) shared or most abundant, valuable or migratory species,
- Incompatible and incomparable data and assessment methodologies.

The Study Case showed a detailed inventory of specific information from the marine fisheries and aquaculture sector added to the main data and geographical coordinates concerning on fish species, fishing activities, tools and vessels. The aim of these data collection was the elaboration of thematical and integrated maps followed by a spatial analyses linked with the environment and other maritime activities, preparing the domain for the field of Maritime Spatial Planning.

RECOMMENDATIONS

- to undertake joint and/or coordinated actions to combat illegal fishing and to establish regional consultation mechanism between the Black Sea coastal states;
- to harmonize methodologies for assessments and establish well defined objectives for fishery sector;
- to elaborate criteria for selection and designating fishing free zones on the national and regional levels;
- to strenghten the cooperation among all stakeholders in fishery sector, including industry, experts, and policy-makers;
- to conduct detailed, coordinated research on the fishery management and possible impact of fishing methods (e.g. trawling on the seabed).

The Black Sea should take its place in the reformed CFP and in the Integrated Maritime Policy, through harmonize the development strategies of fishing sector with those of environmental protection, through the implementation of concept regarding the fishing management based on ecosystemic approaching and FAO Code of Conduct for a responsible fishing.

New policy mechanism for the Black Sea should aim to preserve and improve biodiversity and the prosperity of the people working in the fisheries sector, which are among the priorities of the European Union.

The need to establish a regional Black Sea fisheries management body, separated from the GFCM. The strongest argument for the establishment of such a body is the different characteristics of the two basins that require different approaches to be taken in managing fisheries resources and fisheries in the Mediterranean and Black Seas.

Collection of data in a standardized manner will require that the cooperating partners meet periodically to agree on the data requirements, the methods to collect the data, the amount of data to be collected and to review the sample design within each independent jurisdiction and their transposition in spatial way.

The specific maps elaborated show first integrated spatial distribution of the Marine Fisheries and Aquaculture activities, stocks and main important variables related to the environment, specific fishing tools and areas.

The scientific research on the Black Sea fishing issues needs to be encouraged, so that the decisions taken by the European, regional and national responsible authorities will take into account their economic, social and environmental consequences.

A very important aspect is also the information sharing and the coordinated, long-term consultation with stakeholders from each region in order to ensure a sustainable fishing in the Black Sea and the exchange of good practices among the stakeholders involved.

7. Experience gained and recommendations for further MSP

MARSPLAN-BS was the first MSP pilot project for the Black Sea at governmental level. It has brought together Bulgarian and Romanian national authorities, research institutions and universities, aiming to identifying cross-border issues, similarities, discrepancies, ways, possibilities, solutions, measures to collaborate towards transposition of the Maritime Spatial Planning (MSP) Directive 2014/89/EU and to contribute to the transboundary Black Sea MSP process.

This synthesis report, based on the short descriptive information and thematic data, has also integrated maps. For that reason, a Bulgarian and Romanian support has been prepared for the official maritime spatial plan, including:

- synthesized information and knowledge from the first MASRPLAN BS Project, concerning the maritime space of Bulgaria and Romania,
- took into account the detailed case studies resulted, the project partners own results and scientific experience and a wide MSP documentation from the European level,
- identified data and knowledge gaps,
- transferred MSP practices and MSP process from international and European level to the Black Sea Basin countries (MS).

Consequently, this exercise has been particularly successful for:

- increasing knowledge and understanding of national and cross-border interests and approaches to MSP, taking into account a large data inventory in developing;
- identification of knowledge gaps and needs for harmonisation of data collection;
- promoted sectoral integration by highlighting conflicts and synergies between different sectors;
- enhanced stakeholder involvement for the encouraging of the development of shared transboundary planning;
- developed concrete recommendations to the transboundary pilot MSP area Mangalia-Shabla and to other specifical pilot areas, sectors, fields and MSP practices.

A first comprehensive description of current existing conditions of the maritime areas of both countries has been made to underline physical, biological, natural preservation features and main maritime human uses as well as coastal and marine infrastructure, in spatial representation.

- The main features and compounds of marine environment have been taking into account: water quality, habitats and marine protected areas (MPA), main marine living and non-living resources: algae, shellfish, fish, mammals, invasive species, respectively oil, gas, salt, etc.;
- The main risks and vulnerabilities from both directions (sea to coast, coast to sea) emphasised: coastal erosion, accresion, floods, main pressures adding dragging and dumping and coastal defence;
- Fields of maritime activities were presented in summary and spatial representation: Marine transport – navigation, submarine cables, pipelines, conducts, tourism, specifical military activities and cultural aspects.

The study defined existing conditions of Romanian and Bulgarian maritime space in terms of human uses both mainly in marine areas in strong relation with coastal ones, taking into account their economic value, environmental conditions and natural valuable areas, legal and jurisdictional aspects acting at the different scales, of existing identified conflicts or compatibilities and other economic and SWOT analysis.

Case Study approach of the first MARSPLAN-BS Project included five case studies on major challenges for three specific areas-locations and for two specific domains (navigation and fisheries-aquaculture).

The case study approach was based on problem and contextual specificities, such as coastal erosion for Eforie Nord-South, Land-Sea Interactions for Burgas, new ship routing system elaboration for Bulgaria and Romania, stakeholder involvement in Sfantu Gheorghe, marine fishery and aquaculture issues.

The results of this study consist in the integration of Bulgarian and Romanian available data concerning marine environment and maritime activities, in transboundary approach. The experience gained and lessons learned resulted from the first MARSPLAN-BS Project, include:

- Creation of stronger links between competent authorities, as well as institutional and organisational learning at national and transboundary level;
- Bringing together key institutions in Bulgaria and Romania with the aim of identifying cross-border issues and solutions, to collaborate towards MSP Directive transposition and to contribute to transboundary Black Sea MSP;
- Increasing knowledge and understanding of national and cross-border interests and approaches to MSP;
- Identification of knowledge gaps and needs for harmonisation of data collection;
- Enhancing transboundary stakeholder involvement;
- Encouraging shared transboundary planning and developing recommendations to a sectoral pilot MSP area of Mangalia-Shabla.

- The increased understanding of MSP specificities is mentioned by increased knowledge and understanding of different national MSP processes, aims and objectives. Several best MSP practices resulted of cross-border cooperation under the first MARSPLAN-BS:
  - **Exchange of information and data** with MSP significance. The open exchange and sharing of national level data, information and coordinates were essential for an effective cross-border MSP information, collaboration and comparative analyses.
  - **Production of common thematic and integrated maps**. Assembling a common knowledge base have been an essential step in cross-border MSP according to European recommendation. Common thematic maps were produced under elaboration of detailed study for a complete analysis of the Romanian and Bulgarian maritime areas and in developing of joint pilot plan for MSP of the cross-border area of Mangalia – Shabla to current situation analysis and to identify common cross-border issues. For the pilot area Mangalia-Shabla integrated maps of environmental components, main uses, conflicts and synergies were produced.
  - **Topic issue study as knowledge base** - for cross-border pilot area of Mangalia-Shabla.
  - **Early stakeholder's involvement (**two meetings with Shabla Municipality and one meeting with Burgas Municipality). More discussions and meetings have to be done with direct involvement of all parties concerned for approaching the cross-border issues in both countries.
  - **The experience** gained in stakeholder coastal meetings and consultation under other case studies developing (Eforie, Sfantu Gheorghe, Constanta, Varna, Burgas), discussion with local authorities from the whole coast in both countries, enlarged the coastal (social, professional, etc.) communities and public MSP perception in tansboundary way.
  - **Identification of the transboundary sea uses and conflicts and synergy areas** answered to a central task in cross-border MSP, which are to identify where current or potential conflicts and synergies exist, capitalized into the pilot transboundary area of Mangalia-Shabla.

According to the MSP Directive 2014/89/EU recommendations and methodology and also with the present MARSPALAN BS II Project, the main recommendations for further process and development of MSP in the Black Sea, are:

- To continue the support for the MSP Directive implementations in the Black Sea member states, Bulgaria and Romania;
- To Define and analyze of existing conditions:
  - collecting and mapping the territorial level information regarding ecological, environmental, geological, cultural, marine characteristics and marine activities;
  - identifying possible conflicts and compatibility elements between existing uses.

Based on this it is necessary and planned to realize:

- the inventory and maps of the relevant marine protected areas, as well as the distribution and area maps of the marine species and habitats in the Marine Spatial Planning area;
- the inventory and maps of current human activities in marine waters;
- the evaluation of the possible conflicts and compatibilities between the existing uses of the marine space;
- the assessment of the possible conflicts and the compatibility elements between the existing uses of the marine space and the environment;
- the data integration and processing according to the Multi-Uses and Land-Sea Interaction concepts evaluations and implementation;
- the development of the GIS infrastructure, data base and spatial representation in both countries;
- the spatial analyse for elaboration of prognosis, integrated maritime spatial plans, MSP scenarios, strategy and visions;
- the continue support for national MSP authorities and inter-governmental strengthening in the MSP field implementation and development;
- the continue stakeholder meetings information and consultation;
- the MSP information and experience spreading and sharing in the whole Black Sea basin.

More than these, in the next future it is important to implement, create and realize:

- An interactive friendly MSP platform for the stakeholders' uses to show the spatial interactions between different land-sea and sea-land activities;
- An interactive graphic tool for the stakeholders' uses to show the cumulative impacts of different sea based and land-sea interaction activities;
- More accent on the relation between the value of ecosystem services in long term and economic and social welfare, during the whole MSP process;
- visibility of the project outcomes' increasing to the local and national authorities;
- Better integration of future local/national and cross border development plans and programmes within the MSP scenarious by promoting a better collaboration among authorities and citizens;
- The role of capacity building enforcement of the MSP committees as to become a real Task Force able to coordinate and give the direction for future sustainable development plans in accordance to the Blue Growth Economy;
- Improvement of the scientific knowledge and science-based tools;
- Improvement of the cost-benefit societal and environmental decisional analysis in the MSP process.

Key recommendations for further development of cross-border MSP in the Black Sea are related to national MSP processes in Bulgaria and Romania and cross-border cooperation:

- Cross-border synergies and conflicts mapping, so Competent MSP Authorities could identify which areas / issues require special approach.
- Competent MSP Authorities focusing or drawin attention to identify common cross-border issues at the national political level to deal with conflicts that cannot be solved through informal dialogue between planners.
- Establishment what planning evidence is required within a cross-border and national contexts, sharing harmonised data for knowledge increasing on MSP planning processes.
- Common approaches development for assessing and evaluating the *cumulative impacts* of human activities on the marine environment (how to integrate the Ecosystem-based approach in MSP).
- Raise awareness on the development and benefits of MU concept as global issue to be addressed with national and cross-border MSPs.
- Develop and apply common methodology for a comprehensive analysis of LSI and integration of LSI in the cross-border and national MSPs (working across different governance and planning systems and select common LSI issues that need a cross-border approach).
- Ensure early stakeholder involvement at national and cross-border context (organise informal meetings, as such meetings are crucial in building understanding and trust with stakeholders, as well as joint stakeholder meetings in the cross-border area of Bulgaria and Romania.
- Provide continuous access to and update the common and national GIS databases for accurate and reliable data and information, knowledge and expertise to MSP process.