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DRAFT MANAGEMENT PLAN OF THE STRANDZHA – IGNEADA AREA

MSFD Guiding Improvements in the Black Sea
Integrated Monitoring System

Document Control Sheet

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LIST OF ABBREVIATIONS

ACCOBAMS	Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and contiguous Atlantic Area, http://www.accobams.org/
BAS	Bulgarian Academy of Science
BBI-MATRA	Funding programmes of the Dutch government
BD	Bird Directive
BG	Bulgaria
BS	Black Sea
BSC	Black Sea Commission (Commission on the Protection of the Black Sea Against Pollution), www.blacksea-commission.org
BS SAP	Black Sea Strategic Action Plan
BSBLP	Black Sea Biodiversity and Landscape Protocol
BSIMAP	Black Sea Integrated Monitoring and Assessment Program
CBD	Convention on Biological Diversity
CFP	Common Fisheries Policy
EEZ	Exclusive Economic Zones
EC	European Commission, http://ec.europa.eu/
EU	European Union
EUNIS	EU Nature Information System
HD	Habitat Directive
GeoEcoMar	National Research and Development Institute for Marine Geology and Geoecology, Bucharest-Constanta, Romania
GES	Good Environment Status
ICM	Integrated Coastal Management; also known as Integrated Coastal Zone Management (ICZM) and Integrated Marine and Coastal Area Management
IMS/METU	Institute for Marine Sciences/Middle East Technical University (Erdemli,

	TR)
IO-BAS	Institute of Oceanology, Varna, Bulgaria
IUCN	International Union for Conservation of Nature
MPA	Marine Protected Area
MSP	Marine Spatial Planning or Maritime Spatial Planning (EU only)
NGO	Non-governmental organization
NBSAP	National Biodiversity Strategic Action Plan
NIMRD	National Institute for Marine Research and Development, Constanta, Romania
SAC	Special Area of Conservation (EU)
SAP	Strategic Action Plans
SEA	Strategic Environmental Assessment
SCI	Sites of Community Interest (EU)
SPA	Special Protected Area (EU Wild Bird Directive); Specially Protected Area (Barcelona Convention)
PA	Protected Area
PEBLDS	Pan-European Biological and Landscape Diversity Strategy *(*http://www.pebld.org/index.php?ido=11&lang=eng*)*
RAC/SPA	Regional Activity Centre for Specially Protected Areas (Barcelona Convention)
RO	Romania
TBPA	Transboundary Protected Areas
TDA	Transboundary Diagnostic Analysis
TR	Turkey
TUBITAK	The Scientific and Technological Research Council of Turkey, www.tubitak.gov.tr/
UNCLOS	United Nations Convention on the Law of the Sea
UNEP-WCMC	UNEP-World Conservation Monitoring Centre
WCPA	World Commission on Protected Areas
WFD	Water Framework Directive

EXECUTIVE SUMMARY

This document must be treated as a provisional one, more specific as a guideline which contains the directory lines of a Management Plan. This will need to be improved once the procedures for designation of Transboundary Marine Protected Area will have been finished.

The Management Plan realized for the proposed Transboundary Marine Protected Area Strandzha - Igneada is structured in accordance with OSPAR Network. It is based on the IUCN model - see Salm & Clark (2000) and Kellerher (1999) for further details. Keeping in mind that none of the areas in discussion have a Management Plan implemented, this document aims to provide a common approach regarding the conservation objectives, identification of management priorities, involvement of community and sharing the social and economic resources and responsibilities in the context of sustainable development.

The Plan has a short introduction in the problematic of MPAs, bringing forward the possition of IUCN General Assembly (1988) on the role of Marine Protected Areas in the protection of and sustainable utilization of the marine environment. It also provide the statement of Kelleher and Kenchington, 1991 regarding the broadly objectives of MPAs.

The Plan comprises a short review of international and national legislative framework in force in Bulgaria and Turkey which adresses to protected areas issues.

In the next chapters are detailed the physical, biological and cultural features of Strandzha and Igneada sites emphasizing on elements representative for conservation and protection.

The part which follows approaches the strategic elements of a Management Plan, referring to effective steps necessary for proper implementation of activities and measures of protection and conservation in an integrative and sustainable way. In spite that information is orientative due to lack of knowledge or sufficient information regarding Strandzha but especially Igneada area, the objectives and goals could be taken as example for future.

The chapter "Administration" introduces the potential managers of the Transboundary Marine Protected Area Strandzha - Igneada in matters related to organizational structure on which any administrative body of a reservation should relay. Thus, issues such staffing, training, facilities and equipment are presented in general term, in order to facilitate a further development of the scheme based on the realities (human and financial resources) from the moment when the plan it is effectively implemented.

In the next chapters referring to Monitoring and Timetable for implementation is given an example of indicators of performance measurable and adaptable used to periodical monitor and evaluate the results of activities performed towards attaining the objectives and targets proposed either concerning the social, economic or biodiversity ones. The Timetable presented at the end of this document represents a schedule scheme offered to managers of the future area to help them to visualize the activities conceived on short, medium and long time in accordance with objectives and targets set.

INTRODUCTION

Purpose and scope of the plan

This statement sets out the position of the IUCN General Assembly (1988) on the role of Marine Protected Areas in the protection of and sustainable utilization of the marine environment. It derives from Resolution GA17.38 of the 17th General Assembly of IUCN adopted at San Jose, Costa Rica in February 1988. This resolution recognized that the marine environment must be managed in an integrated way if it is to be able to sustain human use in the future, without progressive degradation.

This policy statement was derived for application particularly to coastal marine areas that are within the jurisdiction of individual nations or groups of nations acting in concert.

The **primary goal** of marine conservation and management is:

- to provide for the protection, restoration, wise use, understanding and enjoyment of the marine heritage of the world in perpetuity through the creation of a global, representative system of marine protected areas and through the management in accordance with the principles of the World Conservation Strategy of human activities that use or affect the marine environment.

The **term "marine protected area"** is defined as: "Any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment".

Broadly objectives of MPAs (Kelleher and Kenchington, 1992) are:

- to protect and manage substantial examples of marine and estuarine systems to ensure their long-term viability and to maintain genetic diversity;
- to protect depleted, threatened, rare or endangered species and populations and, in particular to preserve habitats considered critical for the survival of such species;
- to protect and manage areas of significance to the lifecycles of economically important species;

- to prevent outside activities from detrimentally affecting the marine protected areas;
- to provide for the continued welfare of people affected by the creation of marine protected areas;
- to preserve, protect, and manage historical and cultural sites and natural aesthetic values of marine and estuarine areas, for present and future generations;
- to facilitate the interpretation of marine and estuarine systems for the purposes of
- conservation, education, and tourism;
- to accommodate within appropriate management regimes a broad spectrum of human activities compatible with the primary goal in marine and estuarine settings;
- to provide for research and training, and for monitoring the environmental effects of human activities, including the direct and indirect effects of development and adjacent land-use practices.

This project addresses to two highly important marine areas from the point of view of biodiversity richness, cultural heritage and socio-economic potential, one situated in the Bulgarian part, the other on the Turkish coast. The common border between those two countries is the cause why the Strandzha area (Bulgaria) is ecologically interconnected with the Igneada region (Turkey), similar as landscape and biological diversity.

Both areas are generally far from direct influence of large land based sources of pollution coming from the land and still have preserved communities in good ecological status. The areas are characterized by high diversity of fishes, mammals, invertebrates, birds and plants. Many different habitats can be found here with high importance for the Black Sea health. The areas are of scientific importance, and can be also used as reference zones as almost undisturbed conditions can be still observed. Besides, environmentally-friendly tourism, non-commercial/sports fishing, underwater sports, scuba-diving, photography and others can be of interest for the people if the areas are kept in their pristine state.

Thus, the preservation of the beautiful and unique landscapes of the areas is of high priority. This is the reason why this plan is addressing to both areas looked as one single transnational MPA in conditions in which the process of enlargement of BG Nature 2000 site into the south direction, to Turkish waters along the Igneada coast, and designating this region as a Transboundary Protected

Area will succeed. The area proposed in Turkish waters was not sufficiently investigated before and there are no protected areas in coastal or marine waters here previously designated or proposed.

The management plan is going to set the pathway for the future organizing, conducting and financial resources management in accordance with the legal framework and needs for conservation of areas analysed.

Legislative authority for the plan (national and international)

Introduce the general legislative framework for the site and the associated legislative authorities that hold legal power over individual aspects of management (including fisheries).

A. BULGARIA

A.1. National Level

A range of secondary legislative acts contain detailed provisions on nature protection and biodiversity conservation. The legal framework for biological diversity conservation comprises also a system of administrative and regulating instruments applied by the MOEW (Ministry of Environment and Water), MAF (Ministry of Agriculture and Forestry), MRDPW (Ministry of Regional Development and Public Works) and other institutions. These instruments serve to control, prevent and impose penalties for potential and actual violation of the law concerning the conservation of biodiversity.

Major administrative and regulating instruments include:

- Environmental impact assessment (EIA);
- Permit regime for trade with medicinal plants, endangered wild flora and fauna species and their products;
- Ensuring minimum admissible run-off in rivers to protect water ecosystems and wetlands;
- Administrative penalties imposed in the field of the environmental protection, respectively in biodiversity conservation.

Strategies and programs

The conservation and sustainable use of the biological diversity is referred to in common and sector national programs and strategies, as follows:

- The National Development Plan 2000-2006 (sector program "Environment")

- National Biological Diversity Conservation Strategy, National Biological Diversity Conservation Plan.

Other important policy documents in the area of biodiversity conservation/protection are:

- National Plan for Priority Actions for the Protection of the Most Important Wetlands in Bulgaria
- National Strategy for Environment and Action Plan 2000-2006
- Strategy for Protection and Restoration of the Floodplain Forests on the Bulgarian Danube Islands (2001) and Action Plan for Protection and Restoration of the Floodplain Forests on the Bulgarian Danube Islands 2003-2007. They are developed as part of the implementation of the Declaration for Creation of Green Corridor "Lower Danube" and represent the main policy framework for the Danube islands for the next 30 years.
- National Ecotourism Strategy. It was developed and adopted in 2003.
- National Forestry Policy and Strategy "Sustainable Development of the Forest Sector in Bulgaria, 2003-2013". They integrate biological diversity conservation.
- National Plan for Development of Agriculture and Rural Areas (2000-2006) under the Special EU Accession Program for Agriculture and Rural Development (SAPARD).

A.2. European Level

The European legislation on nature protection, particularly on protection of biodiversity has been almost completely transposed into the national legislation of Bulgaria.

The level of transposition of the Wild birds and Habitats Directives is high.

Directive 79/409/EEC on the conservation of wild birds as amended by Directives 81/854/EEC, 85/411/EEC, 86/122/EEC, 90/656/EEC, 91/244/EC, 94/24/EC and 97/49/EC ("Wild Birds Directive")

The main transposing acts are the Biodiversity Act of 2002 and the Hunting and Game Protection Act of 2000. The Wild Birds Directive is implemented since 2003. The few obligations still in the process of being implemented concern the designation of special protection areas (SPAs) (Article 4) and the establishment of information systems to report to the Commission. Full implementation of these is foreseen to be achieved soon.

Directive 92/43/EC on the conservation of natural habitats and of wild fauna and flora as amended by Directive 97/62/EC ("Habitats Directive").

The Directive, except for three definitions, is transposed by the Biodiversity Act of 2002 and the Regulation on the conditions and Order for Issuance of Permits for Introduction of Non-native or Reintroduction of Native Animal and Plant Species into the Nature of 2003.

A partial assessment at national level of the existence and location of sites hosting the natural habitat types listed in Annex I to the Directive and the species listed in Annex II, which are native to the national territory, has been undertaken by a DANCEE project (2002-2004). Initially **309 potential NATURA2000 sites** have been identified. The process continued in the period 2005-2012 till a comprehensive assessment was completed. This phase was nationally funded.

Regulation 338/97/EC on the protection of species of wild fauna and flora by regulating trade therein, as amended by Regulations 1497/2003/EC and 834/2004/EC ("Endangered Species Regulation"), also considering Regulation 1808/2001/EC laying down detailed rules concerning the implementation of Council Regulation 338/97/EC and Regulation 349/2003/EC suspending the introduction into the Community of specimens of certain wild fauna and flora

This regulation is implemented, except for the establishment of a mechanism to regularly communicate information to the Commission (Article 15).

A.3. International Cooperation/Agreements

Bulgaria is one of the most biologically diverse countries in Europe, hence the nature protection being among the major priorities of the national environment policy. Biodiversity conservation activities at national level are combined with international ones. Bulgaria has signed and ratified a large number of global, European and regional conventions, most important among them being:

- Convention on Biological Diversity, 1992;
- Convention on the Conservation of European Wildlife and Natural Habitats (Bern);
- Contention on International Trade with Endangered Species (CITES);
- Convention on Wetlands of International Importance as Habitat of Wild Birds (Ramsar);

- Convention on Protection of World Cultural Heritage;
- Convention on the Protection of the Black Sea Against Pollution and the Protocol on Biodiversity and Landscape Conservation;
- Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS), ratified, State Gazette 87/5 October 1999, in force since 1 June 2001, State Gazette 95/8 October 2002**.**

Bulgaria has long established traditions in nature conservation and well-functioning administrative system in this area. In general, Bulgaria complies with international commitments undertaken, though measures in practice are not always taken in due course because of financial constraints.

Although no **specific bilateral agreements** on nature/biodiversity conservation have been signed, the issue is among the priority areas for cooperation identified in virtually all bilateral agreements on environmental protection signed by Bulgaria in the last 20 years.

B. TURKEY

B.1.National Level

Turkish laws and by-laws which relate to conservation of biodiversity are as fallows.

- Turkish Constitution (9.11.1982)
- Environmental Law (9.8.1983)
- Harbours Law (14.4.1923)
- Coastal Law (4.4.1990 Amendment 1.7.1992)
- Fisheries Law (22.3.1971, Amendments 15.5.1986)
- National Parks Law (9.8.1983)
- Law for Protection and Cultural and Natural Wealth (21.7.1983)
- Council of Ministers Decree for Agency for Specially Protected Areas (19.10.1989)
- Bosporus law (18.11.1983)
- Coastal security force law (9.7.1982)
- Settlements law (3.5.1985)
- Tourism Incentives Law (12.3.1982), (2003)

- Forestry Law (31.8.1956; Amendments, 23.9.1983)

Additional important documents relevant to protected areas in Turkey are:

- Decree on the establishment of a special protected area agency for environmental protection
- Law on Emergency Response and Compensation for Damages in the Case of Pollution of the Marine Environment by Oil and Other Harmful Substances
- Decree on the establishment and responsibilities of the Ministry of Environment and Urbanization
- Decree on the establishment and responsibilities of the Ministry of Forestry and Water

The **National Biodiversity Strategic Action Plan** (NBSAP) is based on the five following assumptions: biodiversity is the biological foundation for sustainable development; biodiversity is in jeopardy; conserving biodiversity is a shared responsibility; biodiversity links to future prosperity; and Turkey contributes to global biodiversity conservation. Turkey's NBSAP comprises 6 goals, which relate to: conservation and sustainable use; ecological management; education and awareness; incentives and legislation; International Cooperation and implementation. The NBSAP2001 was updated in 2007 (active for 2008-2017). The Plan does not refer specifically to the Black Sea.

Draft Turkish laws, which are to be discussed in the Parliament are:

a. *Draft Code on Draft Law on Protection of Nature and Biological Diversity* includes changes or additions such as the following:
   - Slight changes in the definition of "biological diversity" and will include "genetic resources".
   - "sustainable use" of biological diversity (this provision created much opposition)
   - Changes to the definition of "waste" to be harmonized with EU *aquis communautaire*
   - Addition of integrated approach to waste management
   - Sensitive areas, defined as those with high risk for eutrophication, to be designated by the MoFW
   - Prepare a "strategic noise map"
   - Preparation of emergency response plans

- Integrated coastal management
- Landscape definition
- Climate change
- Climate change risk management
- Special protected area to include protection of landscape

b. Draft Law Amending the Environmental Law

Current situation: Due to the creation of the two new Ministries there is a significant degree of overlapping authorities which need to be resolved. This is particularly the case in regard to protected areas. Currently, marine protected areas are under the authority of the MoEU and the Directorate of Natural Resources. However, there is work underway to revise the entire Turkish environmental legislation and regulations to address the problems that have arisen from overlapping authority. For this reason, the information in this report is subject to change significantly during this Parliamentary session, which should end in June 2013.

B.2. European Level

The implementation of the Birds and Habitat Directives has been supported by the EU since 2002. Activities related to the Habitat and Bird Directives is going on under The Ministry of Forestry & Water Affairs, General Directorate of Nature Conservation and National Parks.

B.3. International Cooperation/Agreements

. Convention on biological diversity
. Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) under CBD
. CITES
. RAMSAR Convention
. EİT (Economic Cooperation Organization)
. KEİ (Black Sea Economic Cooperation)
. EU Landscape Convention
. Bern Convention on the conservation of the European Wildlife and habitats.

- Natural Habitats (Natura 2000)
- The World Heritage Convention
- The UNESCO Man and the Biosphere Programme and its work on Biosphere Reserves
- Bonn Convention on the conservation of migratory species of wild animals, marine fauna (Turkey doesn't sign)
- ACCOBAMS (Turkey doesn't sign)
- Convention on the Protection of the Black Sea Against Pollution, Bucharest, 1992
- Strategic Action Plan for the Rehabilitation and Protection of the Black Sea, 1996
- EU Habitat & Bird Directive
- European Marine Strategy Directive

1. Description of the site and its features

1.1. Regional setting: location, access

The protected area **BG0001007 Strandzha** was designated under the Habitats Directive (transposed in the Bulgarian Biodiversity Act) as a Natura 2000 SCI with the Decision of the Council of Ministers N 122 of 2nd March 2007 (State Newsletter N 21/2007). The marine extent of the site covered 2296.35 ha limited to the 20 m isobath. As a result of an initiative undertaken by the Institute of Oceanology - BAS (implementation of the project "Extension of the marine Natura 2000 in the Bulgarian Black Sea" carried out in 2011-2012 and an official proposal to the MOEW) a Decision of the Council of Ministers N 660 of 1st November 2013 (State Newsletter N 97/2013) extended significantly the marine range of SCI Strandzha to the current 37 612.52 ha and 75 m depth, which comprises 15 % of the overall national coverage of marine protected areas within Natura 2000 ecological network in Bulgaria (Fig. 1).

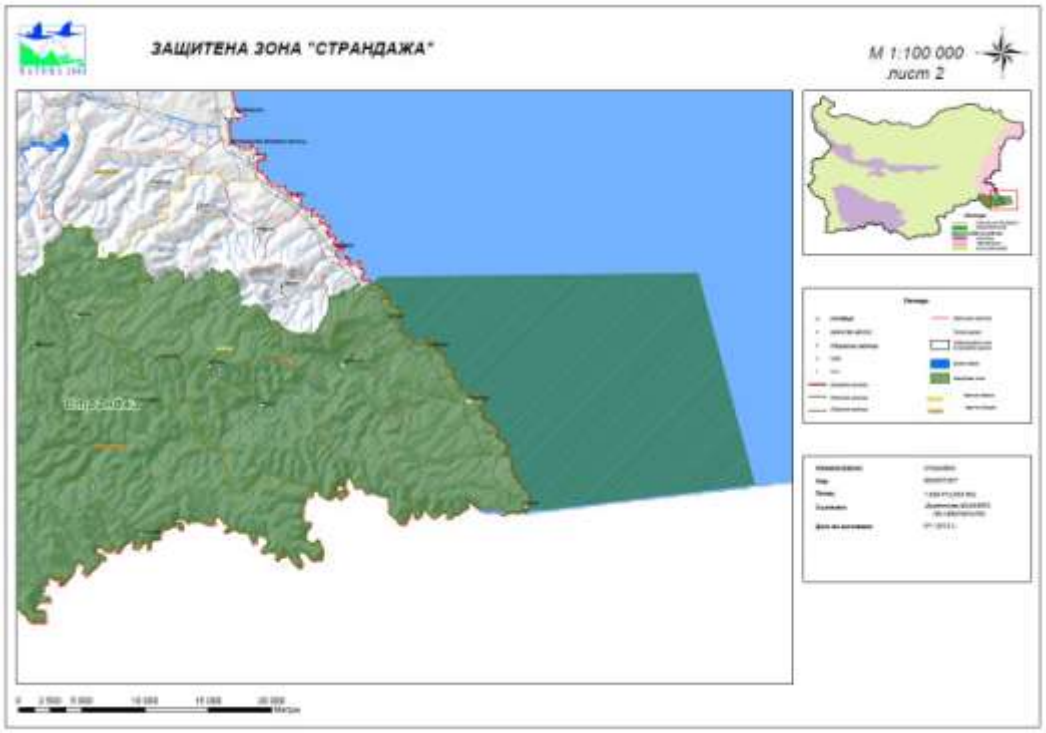

Figure 1. Map of Strandzha protected area. Source: Project "Extension of the marine Natura 2000 in the Bulgarian Black Sea", Contract № 7976/04.04.2011 between EMEPA and IO-BAS.

The area covers part of Burgas region (part of the territory of Malko Tarnovo and Tsarevo municipalities). The coastal settlemens include 1 town-Ahtopol and 3 villages - Varvara, Sinemoretz and

Rezovo. Within Strandzha's territory the town of Malko Tarnovo and a number of villages are situated, nevertheless urbanization is low on the overall. The shortest connection of the protected site with regional administrative centre Burgas town is 41km – road Burgas-Malko Tarnovo. Another main road in coastal area is Burgas-Rezovo.

The special location of Strandzha Mountain on the route between Europe and Asia makes it unique in cultural, historical and biodiversity aspects. Due to that a number of protected areas have been designated at the national level under the Bulgarian Protected Areas Act, including Nature Park Strandzha, 5 strict nature reserves, numerous protected sites and natural monuments. One internationally protected site is designated as well – the Ramsar site Uzunbodzhak.

SPA Strandzha BG0002040 is designated under the Birds Directive, the boundaries partially overlapping the Habitats directive SCI BG0001007 Strandzha

Iğneada is located in the north-western part of Turkey, being a small town within the district of Demirköy in Turkey's Kirklareli Province. It lies on the Black Sea coast and it is approximately 5 km south of the Rezovo River, which forms the border with Bulgaria. Southern and western parts of İğneada lies at the lower slopes of the Istranca (Yıldız) Mountains with its highest point at 1035 m. İğneada is only 74 km far from the city Kırklareli and the district Lüleburgaz . Its population is 2.087 as of 2012.

The İğneada region which lies on a coastal plain on the European and Turkish zones of the Black Sea is assessed to be the most appropriate location for such a transboundary protected area. The potential area proposed comprises the İğneada coastal inshore marine area and a terrestrial component, Strandja between Bulgaria and Turkey. The terrestrial portion of İğneada is already under protection due to its unique waterlogged forests, wetlands on alluvial soils and coastal sands. The area is of ultimate importance for biological diversity providing a habitat to many flora and fauna species. The human population density in this region is also very low for Turkey (as well as for Bulgaria) hence the anthropogenic stress is very limited on this coastal ecosystem

Marine boundaries. The area which is recommended as a marine protected area is the 50 m contour line of İğnaeada (Fig. 2). The surface area of the proposed marine area is 19.910 hectares and on the land side the size of the protected area is 3155 hectares.

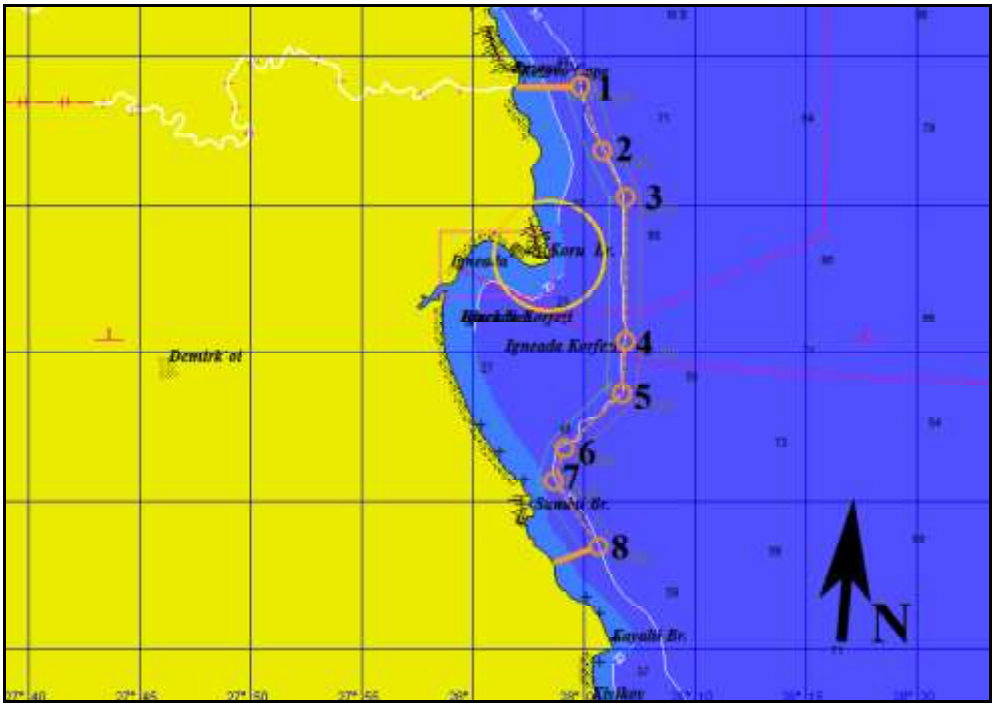

Figure 2. Boundaries of proposed marine protected area in İgneada region

1.2. Conservation values of the site

Strandzha - İğneada area is unique in Europe for its endemic and diverse flora and fauna. The special nature is a result of geolological past, climate and geographical location. The plant communities in Strandzha developed before Europe was separated from Asia by the formation of the Bosphorus strait that now connects the Black Sea and the Mediterranean Sea. Land-ice never reached Strandzha during the ice-ages of the Pleistocene and the Holocene. This lack of glaciations has created a unique window to the past. Plants that were once widespread on the European continent during the Tertiary period are now only preserved in Strandzha. It is a living museum.

Character and use of adjacent areas

Large part of **Strandzha Mountain** was designated as Nature Park in 1995 with the objective to conserve in the long-term the unique nature within the watersheds of Veleka and Resovska rivers, as well as to ensure the sustainable socio-ecological development in the region (Strandzha Nature Park Management Plan - http://www.biodiversity.bg/files/File/STRANDJA_ManagPlan.pdf).

The area has been designated as one of the five top priority sites for protection in Central and Eastern Europe, and the whole Nature Park has been included in the Natura 2000 ecological network.

On the territory of the two protected areas under the Habitats Directive (SCI) (Strandzha BG00001007) and the Birds Directive (SPA) (Strandzha BG0002040) and Nature Park there have been designated 5 strict nature reserves (Vitanovo, Sredoka, Uzunbodzhak, Silikosia, Tisovitsa), 19 protected sites (ncluding the complex of the Rezovo River mouth, Veleka River mouth and Silistar River mouth protected sites) and 17 natural monuments. The nationally protected areas aim mainly at conserving the unique forest ecosystem of Standzha Mountain characterised by endemic flora and high faunal diversity of fish, reptiles, amphibian, birds, mammals and plants. The area is important for birds: the second largest in Europe birds' migration route crosses Strandzha, while the bays and estuaries along the coast are important wintering grounds for a number of water birds. The mouth of Veleka River is designated to conserve the coastal landscape, cliffs, fjords and specific xerothermic flora. In the frames of the project CORINE Biotopes, Strandzha region (terrestrial and marine part) is defined as a priority in the ecological network of the country and one of the most important territories for conservation in Europe.

Igneada relatively lacks human-induced disturbance or degradation. But the constructions of summer houses and touristic facilities threaten the ecosytem. The area includes different ecosystems and a wide range of biodiversity, making it one of the Turkey's most important areas.

İğneada flooded forest is a unique assemblage created by various diverse ecosystems through thousands of years and it is a part of Istranca humid forest which is an independently natural richness. Lagoons, freshwater and salty lakes, coastal sand dunes, aluvial flooded forests, seasonal marshes, reedbeds and meadows generate a wild nature around İğneada which has an enviable and valuable beauty. It is an extremely diverse nature in terms of living species. Although not investigated completely, scientists have identified 180 bird, 33 mamalian, 6 amphibian, 94 tree and bush and 500 grassy plant species living in this small geographical area. It is obvious that these numbers cannot be encountered in another natural place with a similar coverage area.

Igneada hosts many threatened or endangered species and habitats. The region is used traditionally for fisheries, forestry, tourism and recreation, so it is needed to maintain these activities in this area as a way to promote the environmentally friendly activities. There is also a significant

potential in İğneada for eco-tourism. Honey, mushrooms, fruits, marine products, handcrafts, dairy products and organic fruits are the most common products of the town.

The area can be used in the educational process, first of all by children, but not only, because the entire community can learn about the marine ecosystems and how these can change under human pressure.

Naturalness, rarity, biodiversity, aesthetic values, and the degree of habitat representativeness

Coastal habitats of conservation importance

Typical of the **Strandzha** site are dune habitats occurring mainly nearby river estuaries. The site is important for the geographic coherence of the white and grey dunes including the habitats of European importance:

2110 - Embryonic shifting dunes

2120 - Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")

2130 - Fixed coastal dunes with herbaceous vegetation ("grey dunes")

The majority of the coastline is occupied by well conserved cliff habitat of the type:

1240 Vegetated sea cliffs of the Mediterranean coasts with endemic *Limonium* spp.

Among the most important habitats representative of Stranszha site are the estuaries (habitat type **1130**) of Veleka (Fig. 3), Butamiata, Silistar and Rezovska rivers. The estuaries support high biodiversity and provide shelter for endangered species such as *Emys orbicularis* (Fig. 4) and *Mauremys caspica*.

Figure 3. Veleka river estuary and sandbar. Source: project "The development of an indicative ecologically coherent network of sub-tidal Marine Protected Areas (MPAs) in Bulgaria and Romania"

Figure 4. *Emys orbicularis* in Veleka estuary. Source: project "The development of an indicative ecologically coherent network of sub-tidal Marine Protected Areas (MPAs) in Bulgaria and Romania"

In **Iğneada**, forest and sea are side by side. The cave of Dupnisa which is close to İğneada is a unique cave for the people interested in cave tourism. Dupnisa cave, which is one of the best-known caves in Turkey, has continued its construction for almost four million years. Its total length is 2720 meters. It is quite interesting that it consists of three opposite caves. It has been a tourist site since 2003.

Important habitats:

1130 Estuaries

1210 Annual vegetation of drift lines

2110 Embryonic shifting dunes

2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")

2130 Fixed coastal dunes with herbaceous vegetation ("grey dunes")

3150 Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition* - type vegetation

Coastal sand dunes with longoz forests comprise the most delicate ecosystem of İğneada. Rich and interesting plant types are found on sand dunes. The vegetation of the coast, front side and stable sand dunes are distinctly at good state. Several types of oak tree are dominant here as the pedunculate oak, which is the primary species in relatively dry regions and the mountain alder and common ash tree, abundant at marshy parts of the ash-oak-alder type forest unique to the

southeastern part of Europe. Additionally, climbing plant species are the most distinct feature of the forest. These forest assemblages are rare and important habitats that exist at southwestern coasts of the Black Sea and called as 'longoz'. The dominant plants in the upper layer are common alder, ash tree, common beech and maple tree. As it has a tropic forest character, it is also rich in climbing plants.

İğneada and its vicinity has high priority in terms of its faunal diversity. The result of the studies revealed the below species at the area: fishes (Trout, Silver Fish, Grey Mullet), birds (White tailed Eagle, Green Woodpecker, Owl, Grey Heron, Cuckoo, Kingfisher, Black Stork, Hoopoe), mammals **(**Wild Cat, Wild Boar, Deer, Hare,Tree marten, Badger, Wolf, Fox, Otter, Yellow necked Wood Moose, Weasel, large eared bat, multicolored skunk), reptiles **(**Thracian tortoise, Southern crested newt, European legless lizard, Horned viper, Ring snake).

Marine habitats of conservation importance

The **Strandzha** marine habitats are highly varied. The most representative among them encompass:

1110 Sandbanks which are slightly covered by sea water all the time. This habitat is represented by clean coarse to fine sand and shell rubble inhabited by psamophilic clams *Donax trunculus, Chamelea gallina, Gastrana fragilis, Lentidium mediterraneum, Lucinella divaricata*. The habitat area is estimated at 2835.81 ha, comprising 7.6 % of the national habitat coverage.

1140 Mudflats and sandflats not covered by seawater at low tide. The coarse sands in the mediolittoral zone, well flushed by the wave action, are inhabited by dense populations of the small wedgeclam *Donacilla cornea*. The habitat area is estimated at 7.56 ha.

1170 Reefs. The rocky seabed is luxuriously covered by the brown alga *Cystoseira barbata* (Fig. 5) and the blue mussels *Mytilus galloprovincialis* and *Mytilaster lineatus*. The unique Black Sea habitat of *Ostrea edulis* biogenic reefs occurs as well. The area of the rocky bottom within Stranzdha SCI is estimated at 1384.46 ha. Another habitat interpreted as type 1170 is the mussel beds of *Mytilus galloprovincilis* on sediments with area estimated at 33624.59 ha. Overall the habitat type 1170 in SCI Strandzha comprises 8.3 % of the national habitat coverage.

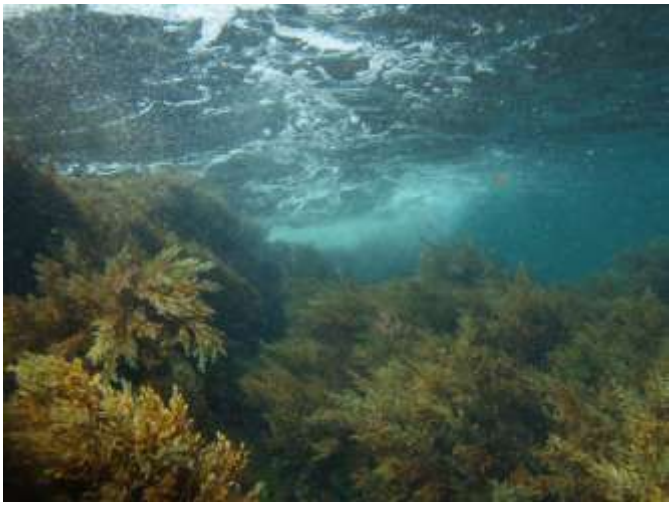

Figure 5. *Cystoseira barbata* over rocky bottom along Strandzha coast. Source: project "The development of an indicative ecologically coherent network of sub-tidal Marine Protected Areas (MPAs) in Bulgaria and Romania".

On the biogenic reefs and marvelous rocks many sponges, sciaphylic algae *Zanardinia typus, Apoglossum ruscifolium, Phillophora crispa*, crusts (*Peisonellia rubra, Hildenbrandia rubra, Phimatholiton lernormandii*) crabs (*Eriphia verrucosa*), blennies, gobbies, scorpion fishes (*Scorpaena porcus*), wrasses and mullets could be seen. The *Cystoseira* meadows are the habitat for fish species such as *Syngnathus typhle, Symphodus ocellatus*, *Salaria pavo, Atherina boyeri, Hypocampus gutulatus, Pomatomus saltator, Blenius tentacularis*, *Mulus barbatus*, *Aidablenius sphinxs,* also decapods *Polybius navigator*, *Macropodia sp, Eriphia verrucosa*, *Palaemon elegans.* High diversity of gastropods has been observed - *Tricolia pullus, Rissoa splendida, and Bittium reticulatum*. *Actinia equina* was also present on hard substrate. The blue sponge *Dysidea fragilis* is frequently seen here at almost all depths. The fish *Belone belone* was also registered in the area. *Pomatomus saltator* and *Belone belone* are listed in the Bucharest Convention Protocol, but are not included in Standard data form of Strandzha protected area. *Scomber scombrus* also is not listed, but it is critically endangered species. Turbot *Pseta maxima* is recognized as being an endangered species in Bulgarian Red Data Book and mentioned in the "Aims of conservation of species and habitats" of Strandzha protected area.

In the frame of the project "Extension of ecological network of NATURA 2000 in Bulgarian Black Sea sector to overcome deficiency of marine habitats 1100 and 1170 and species 4125 - *Alosa*

immaculata 1349 - *Tursiops truncatus* and 1350 - *Phocoena phocoena*", there was estimated besides *Cystoseira* species and Phyllophora's biomass also the distribution of the latter along the Bulgarian Black Sea coast. Based on this study, *Cystoseira* spp. and *Phyllophora* sp. were for the first time mentioned in the Natura 2000 Standard Data Form of new Strandzha protected area. *Cystoseira* spp. has the highest biomass in the south part of Bulgarian Black Sea coast, namely Sinemoretz, Varvara, Maslen nos.

Seagrasses and macroalgae compose the biological quality element "benthic vegetation" used by both the WFD and the MSFD. These species are included in Red Data Book of Black Sea as vulnerable and their habitats are defined as endangered in Bulgarian Red Data Book (http://e-ecodb.bas.bg/rdb/bg/). The sea's shallow areas, including coastal lagoons, shallow sandbanks, and both coastal and offshore reefs, serve as important spawning and nursery areas for fish as well as important feeding and wintering areas for large number of sea birds. Meadows and kelp forests are extremely valuable ecosystems because they provide many ecological services to coastal zone. They are highly productive, influence the structural complexity of habitats, enhance biodiversity, play important roles in global carbon and nutrient cycling, stabilize water flow and promote sedimentation, thereby reducing particle loads in the water as well as coastal erosion. In fact, has been estimated that *Cystoseira* meadows such as kelp forests and sea grasses meadows deliver the highest value, in terms of ecosystem services, of all natural ecosystems. Policies aiming at improving coastal waters' and ecosystem's quality are a priority in European countries as well as in other countries and regions on the Globe (e.g. USA: Clean Water Act (CWA, 2002/P.L. 107–303/USA), National Estuary Program (www.epa.gov/nep).

The **Igneada** marine habitats are highly varied. The most representative among them encompass:

1110 Sandbanks which are slightly covered by sea water all the time. This habitat is represented by clean coarse to fine sand and shell rubble inhabited by psamophilic clams *Chamelea gallina, Lucinella divaricata, Donax trunculus, Gastrana fragilis, Lentidium mediterraneum,*.

1140 Mudflats and sandflats not covered by seawater at low tide.

1150 Coastal lagoons

1170 Reefs. The rocky seabed is luxuriously covered by the brown alga *Cystoseira barbata* and the blue mussels *Mytilus galloprovincialis* and *Mytilaster lineatus*.

The shores of İgneada are generally rich in habitat diversity. Sand, gravel, rock, mud, alage and phanerogams caused formation of different types of habitats.

Species diversity and conservation importance

Nature Park Strandzha is the richest Bulgarian protected area in terms if the invertebrate fauna with 404 species encountered in the area.

The fish diversity at the protected area ranks among the highest in Europe with 41 freshwater and 70 marine species (http://www.biodiversity.bg/files/File/STRANDJA_ManagPlan.pdf).

In Strandzha Nature Park are established half of the nesting birds in the country and 28% from the nesting birds in Europe. Through the protected area passes the second largest in Europe birds migration route "Via Pontica". The globally endangered birds *Aquila heliaca*, *Aythya niroca*, *Pelecanus crispus*, *Circus macrourus* have been observed to migrate over the Park. Strandzha coast is an important wintering ground for a number of water birds.

At the national level the highest biodiversity of marine macrophytes - 102 species was established in that region (Dimitrova, 1981).

The species listed in Annex II of the Habitats Directive found in **Strandzha SCI** comprise 13 invertevrates, 7 fish, 2 amphibians, 5 reptiles and 42 mammals. Among them there are 5 marine species:

1103 *Alosa fallax* (Twaite shad)

4125 Alosa immaculata (Pontic shad)

4127 *Alosa tanaica* (Azov shad)

1349 *Tursiops truncatus* (Bottlenose dolfin)

1351 *Phocoena phocoena* (Harbour porpoise)

Other marine species of national or Black Sea conservation importance listed for the site include:

Algae: *Cystoseira barbata, Cystoseira crinite, Phyllophora crispa*.

Benthic invertebrates: *Chamelea gallina, Donacilla cornea, Donax trunculus, Lentidium mediterraneum Ostrea edulis, Mytilus galloprovincialis, Eriphia verrucosa, Pachygrapsus marmoratus, Xantho poressa*.

Fishes: *Acipenser gueldenstaedtii, Acipenser stellatus, Aidablennius sphynx, Anguilla anguilla, Atherina boyeri, Coryphoblennius galerita, Dasyatis pastinaca, Hippocampus guttulatus, Huso huso, Liza ramada, Pegusa lascaris, Mesogobiusbatrachocephalus, Neogobius melanostomus, Pomatoschistus microps, Raja clavata, Salaria pavo, Sarda sarda, Syngnathus typhle, Trachinus draco, Uranoscopus scaber*.

With its number of fish species, the protected area occupies one of the first positions among the other protected areas in the country, all of them situated along the Black Sea coast (Management plan for Strandzha Nature Park http://www.biodiversity.bg/files/File/STRANDJA_ManagPlan.pdf). Fish populations represent an important value for fisheries and also for genetic analyses and scientific investigations (Apostolou, et al., 2007; Tsekov et al., 2008; Dobrovolov et al., 2012; Kotlik et al. 2008; Atanasov et al., 2011; Panayotova, 2012).

Species from *Alosa* genus are considered endangered and sensitive to anthropogenic influence. Studies about distribution and population structure of *Alosa spp.* in Bulgarian Black Sea coast were performed in the frame of the project "Extension of ecological network of NATURA 2000 in Bulgarian Black Sea sector to overcome deficiency of marine habitats 1100 and 1170 and species 4125 - *Alosa immaculata* 1349 - *Tursiops truncatus* and 1350 - *Phocoena phocoena*".

The sea is also the home of 3 species of dolphins and of otter *Lutra lutra,* species listed in the Bern Convention http://conventions.coe.int/Treaty/en/Treaties/Html/104.htm. Models of distribution of cetaceans in the Bulgarian Black Sea are based on data obtained from accidental observations. Data for genetic structure were also collected. Recent data collected in the period 2006-2010 concerning the distribution of the three species of cetaceans were published by Raykov & Panayotova (2012). The investigations cover the area comprised between 20-100 m depth (shelf zone). The total number of dolphins observed was of 933 exemplars out of which *Tursiops truncatus* – 486, *Delphinus delphis* - 288 and *Phocoena phocoena* – 159.

In spite of insufficient studies, the three species are subject to special protection in the Bulgarian part of the Black Sea. The acts under which they are protected are: Biodiversity Act, Fisheries and Aquaculture Act, Protection of Environment Act and others. These species are subject of many international agreements and conventions: Agreement for Protection of Cetaceans in the Black

Sea, Mediterranean and Atlantic Ocean (ACCOBAMS), Convention on the protection of Black Sea against polution (Bucharest Convention), UN Convention of Wetlands with International Importance (RAMSAR), Bern Convention, Bonn Convention on the conservation of migratory species of wild animals, European Habitats Directive, Marine Strategy Framework Directive and others. The three species are included in Bulgarian Red Data Book and in the Red list of endangered species of IUCN.

Strandzha coast might still be visited occasionally by the monk-seal (*Monachus monachus*), a world threatened species included in Annex II of the Bern Convention. This is probably the last secure and tranquil area of the Bulgarian coast where exists the possibility for restoration of the monk-seal population.

In addition to the diversity of habitats and species of conservation importance at European, regional and national level other features considered as conservation values deserving the designation of Strandzha as a protected site is the uniqueness, rarity and preserved naturalness of the biota and habitats, as well as the cultural values of the area.

Uniquesness and rarity

Strandzha possesses autochthonous flora and fauna formed of species descended from different biogeographical regions (Central Europe, Mediterranean, Anatolia, Caucasus, and Balkan Peninsula) with characteristic presence in the region. Wild flora and fauna is typical for the area and at the same time, unique for Europe, which requires special measures for preservation of this characteristic.

Strandzha offers the rare chance to observe centuries - old *Fagus orientalis* and *Quercus polycarpa* forests of moderate climate, typical for the Tertiary (before 2 million years) (Strandzha Nature Park website - http://www.strandja.bg/). Unique feature of Strandzha forests is the evergreen undergrowth of relic shrubs.

The indented by fiords cliff coast represents an open museum of paleovolcanic activity of great scenic value.

Ostrea edulis biogenic reefs must be mentioned among the unique habitats of the Black Sea (Todorova et al., 2009).

Natural rivers as Veleka and Rezovska are rare phenomenon in Europe.

With reference to the unique flora 7 relic species occur only in Strandzha at the European level: *Rhododendron ponticum*, *Daphne pontica*, *Vaccinium arctostaphylo*, *Quercus hartwissiana*, *Ilex colchica*, *Hypericum calycinum* and *Hypericum androsaemum.* Two local endemics *Veronica turrilliana* and *Anthemis jordanovii* are unique of Strandzha area. Another 6 Bulgarian endemics and 40 Balkan endemics occur in the protected site.

Rare marine algae are: *Padina pavonia*, *Cladostephus sp*., *Nemalion sp., Ceramium ciliatum, Laurencia sp*.

Endemic Black Sea fish fauna in SCI Strandzha is represented by 7 species: *Rutilus frisii, Syngnathus abaster,* gobbies *Ponticola cephalargoides*, *Neogobius gymnotrachelus, N. fluviatilis*, *N. melanostomus,* and *Mesogobius batrachocephalus. Proterorchinus marmoratus* and *Stizostedion marinus are endemic for the Black Sea and the Caspian Sea.*

Naturalness

Strandzha. Overall the terrestrial and coastal habitats are characterised by preserved naturalness and vast wild areas with relatively low fragmentation due to limited urbanization, roads and other infrastructure in the site. The marine habitats of underwater sandbanks and reefs have also preserved their natural character due to relative lack of human-induced disturbance or degradation.

Igneada. Natural habitats are coastal cliffs, inlets with algae meadows, inhabited by fishes, zoobenthos. Sand banks contain also a rich diversity of zoobenthos. The area includes different ecosystems and a wide range of biodiversity, making it one of the Turkey's most important areas. İgneada has a relative lack of human-induced disturbance or degradation. The human population density in this region is also very low for Turkey (as well as for Bulgaria) hence the anthropogenic stress is very limited on this coastal ecosystem. But the constructions of summer houses and touristic facilities threatens the ecosytem.

Typicalness

Strandzha - Igneada possesses autochthonous flora and fauna formed of species and groups of species, descended from different biogeographical regions (Central Europe, Mediterranean, Anatolia, Caucasus, and Balkan Peninsula) with characteristic presence in the region. Wild flora and fauna is

typical for the area and at the same time, unique for Europe, which requires special measures for preservation of this characteristic.

Cultural values

In addition to the nature conservation values, due to being a bridge between Europe and Asia **Strandzha Mountain** area has a very rich culture and history, ancient folklore customs and traditions. Diversity of monuments of culture from all the historical epochs, supplements the specific spirit of the territory. Here complement each other almost all culture layers from Eneolit and bronze epoch, Thracian megalith culture, antiquity, Middle Ages, Bulgarian renaissance up to new history, in concentration, rarely seen in Europe. Unique phenomenon is the sunken towns in the Bulgarian part of the Black Sea. Objects established in inlets of Varvara, Ahtopol, Sinemoretz, Silistar, north of Rezovska estuary are evidence for developed Thracian culture with active navigation, shipbuilding, economic and commercial connections far away from Greece civilization. Some of the villages with their original architecture complement the uniqueness of nature in the park.

İğneada took the name Thynias, meaning the place where Thyn people live, from the tribe of Trak. Migration wave has a great impact on the area. Cultural pressure of ancient Greek has never been absent particularly from the south. İğneada was invaded by Bulgaria during Balkan War before republican period and left to Bulgaria with the determination of Midye-Enez line. As a result of the assaults and agreements after the lost of Edirne, today's Thracia border was drawn and İğneada was kept in our domain. The name of the commander who conducted the conquest of İğneada was İne Bey. The area was named after him as "İneada" and it turned into İğneada in time (http://www.milliparklar.gov.tr/).

Natural vulnerability of habitats and species

Species

Vulnerable are considered those sensitive biological and ecological species, which once that their habitats change or undergo anthropogenic pressure, the risk of their disappearance increases. Most important characteristics of these species are: adherence to substrate and/or trophic specialization, low reproductive success, late maturity, weak demographic structure of their

population, predators' competition. All endangered and rare species are considered also as vulnerable ones.

Hunting and fishing. Destruction and collecting of wild plants and animals, destruction of habitats

Object of commercial fishing are some species of mussels, crabs, fishes. Object of illegal hunting are European otter (*Lutra lutra*), the monk seal *(Monachus monachus)* (information referring to poaching date back to 1980). The Mediterranean monk seal (*Monachus monachus*) is one of the most endangered mammals in the world.

Recreational fishing affected the fish stocks that have been decreased dramatically in the last years. The invertebrates that are subject to exploitation are: snails, crustaceans, mussels. The flora diversity is also threatened because of illegal collection, the coastal sand species being the most affected, among which endemic and rare species.

In conclusion, the threat of use and illegal destroy of wild flora and fauna could have tremendous effect on hundreds of species, especially if their populations are small or their usage is considerable.

Alignment of dunes and extracting of sand for building almost destroyed one of the rarest habitats in Europe – "Westpontian white dunes". Building of hydro - constructions and corrections of rivers course and coastal area changed their natural habitat character. Damage or changing of riverbanks destination for building and agricultural needs also disturbed these habitats. Coastal zone is exposed to intensive construction and urbanization as result of development of tourism (http://www.natura.bsnn.org/pdf/Protected_Natura_3.pdf). This led to worsening and even destruction of coastal habitats. There is a risk of local pollution from waste water sewerage input into the sea. Especially dangerous for migratory birds are plans for construction of wind generator parks. Construction of mussel farms also leads to deterioration of water quality and disturbance of natural habitats.

Climatic changes are another factor which makes species and habitats vulnerable. Mussels are vulnerable to high temperatures, also fish, marine benthic organisms and algae. In result of hypoxia and anoxia, caused by warming, marine organisms could die. This leads to additional pollution, which is negatively reflected on biota.

1.3. Features

1.3.1. Physical

1.3.1.1. Geological caracterization of Strandzha - Igneada area

From geological point of view, the Strandzha - Igneada area is situated in the major tectonic unit of Sredna Gora, and more specifically in the Eastern Sredna Gora structural zone, i.e. the Bourgas basin (Cheshitev & Kanchev, 1989) (Fig. 6). The Burgas synclinorium is an extremely fractured area (Fig. 14). Its northern and southern borders are represented by deep fractures – the Back Balkan Fault and the North Strandja Flexure. Its western margin is marked by disrupted structures, while the structure is open to the east.

The basement of Sredna Gora zone is represented by Precambrian metamorphic rocks, Paleozoic granite-dominated batholiths and Triassic - Jurassic sediments. On this heterogeneous basement, volcanic successions dominated by andesites accumulated in the Late Cretaceous.

South of Burgas, the Black Sea coastal area exposes dominantly Late Cretaceous volcanic rocks, interbeded with turbidites, the latter increasing in volume to the South, in the Rezovo-Igneada area. Late Cretaceous (Santonian-Coniacian) intrusives (gabbros and granodiorites) occur locally within the volcanic successions, between Burgas and Primorsko and NW of Rezovo. The volcanic successions are overthrust from the west by earlier, Turonian-Cenomanian turbidites and volcanics. The total thickness of the volcanic successions (separated in three distinct formations – Burgas, Michurin and Grudovo groups), estimated at over 3000 m, is increasing to the east. The volcanic complexes interbedded with sediments (mainly turbidites) are considered to have formed in an island-arc geotectonic setting; rocks were subjected to compression, intense folding and thrusting in the Maastrichtian times (Zagorchev, 2001).

Locally, the volcanic deposits are overlain by small patches of Palaeogene continental molasses (coal-bearing clastics) and small basins filled with Neogene terrigenous clastics and Quaternary (alluvial drift and talus drift) sediments.

The Burgas synclinorium is divided into two distinct structural zones: a northern zone, with a blocks and folds pattern. In the northern zone, the volcanic complexes are folded and disrupted. The structure of the southern zone is monoclinal and intensely fractured, as result of Alpine deformations affecting the largest part of the Late Cretaceous successions. Faults with a general NE-SW trend

control the zones of volcanic activity and the linear pattern of volcanic structures. The Late-Alpine tectonic deformation produced a block-faulted structural pattern (Fig. 7).

Several aqueous horizons and complexes are hosted in the Bourgas synclinorium, due to its geological-structural and lithological - facial features. They include the Quaternary, Pliocene, Miocene and Paleogene aquifers and the Upper Cretaceous aqueous complex. The latter occupies the largest area as it is practically found in all parts of the synclinorium. The basin contains several major faults, which act as the main drainage system. The most important fault is connected to the hydrothermal fields Poljanovo, Aitos, Sadievo, and probably the Bourgas spas (Georgieva & Vlaskovski, 2000). The Medovo hydrothermal field is connected to a group of shorter fractures.

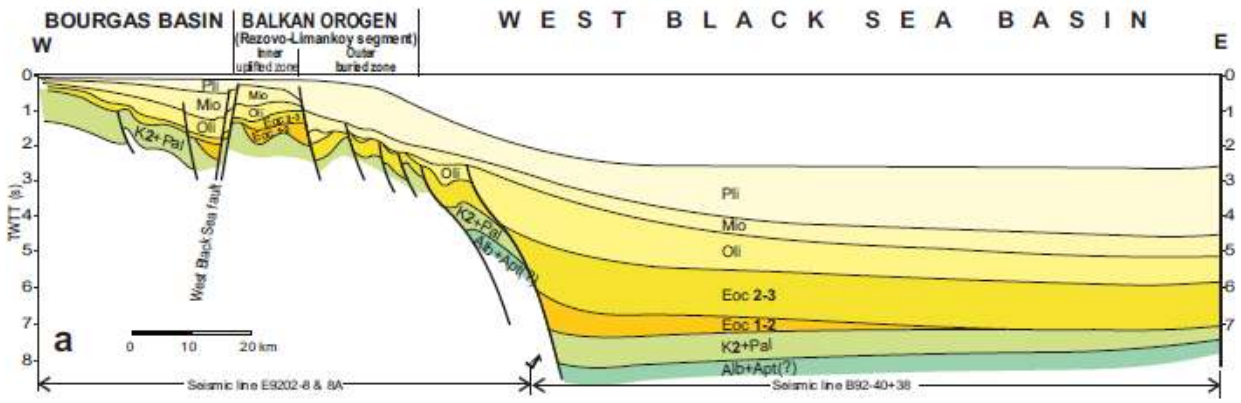

Figure 6. Geological cross-section in the Burgas basin (after Georgiev, 2012) showing the geological succession and structure of the sediments in the Black Sea offshore in Strandzha-Igneada area Abreviations: Alb+Apt – Albian-Aptian; K2+ Pal – Late Cretaceous-Paleogene; Eoc – Eocene; Ol – Oligocene; Mio – Miocene; Pli – Pliocene.

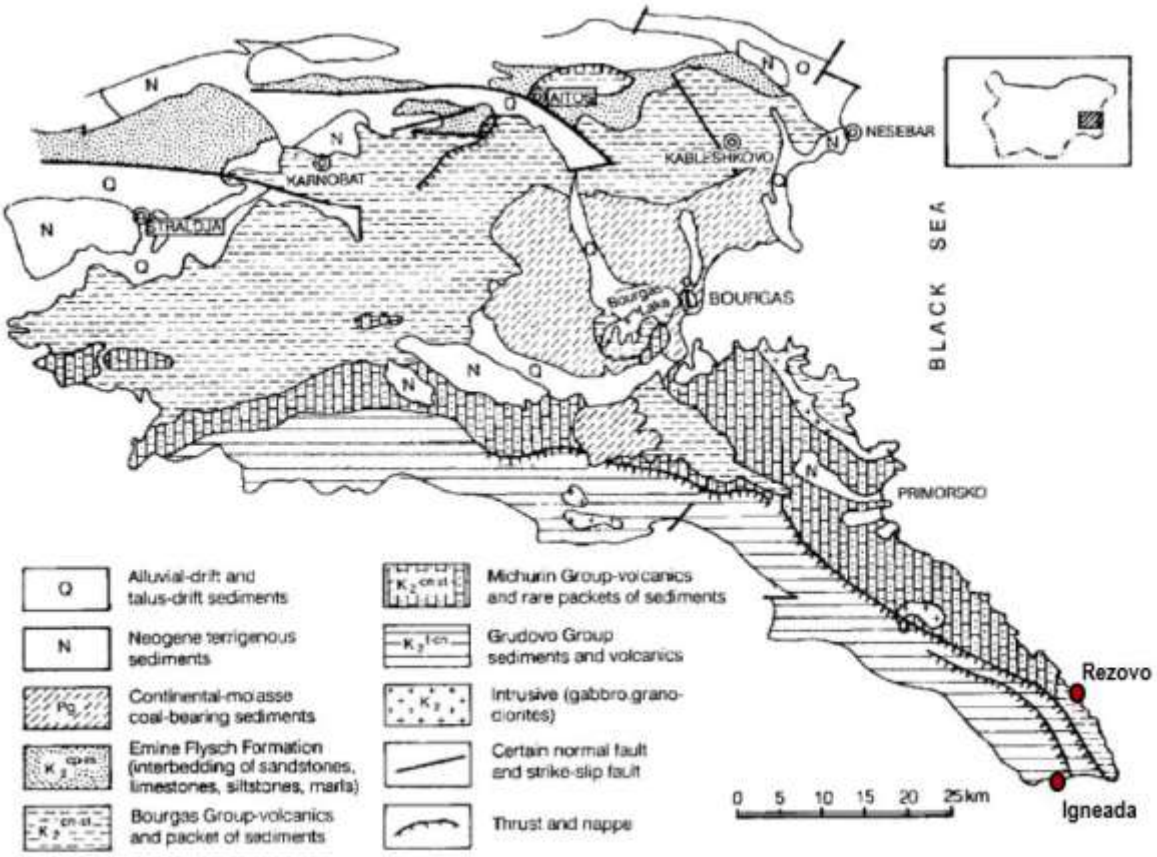

Figure 7. Geological map of the Burgas synclinorium (after Cheshitev and Kanchev, 1989).

Development of coastal cliffs within the Bulgarian coast is the action of a complex of the natural factors. From the eight types of cliffs along the Bulgarian littoral, in the southern part of the Burgas basin there are three types of cliffs (unpublished report, 2011, project MARINEGEOHAZARD):

- cliffs composed by sedimentary and low metamorphosed rocks with weaker links, intrusive and effusive rocks prevalent on the Strandja coast and on the Medni Rid coast;
- cliffs containing a more solid rock; The sliding of the cliff takes place without significant changes of the rock packages and without any mixing of materials; it can be found near the villages Tyulenovo and Kamen Bryag, near the town of Tzarevo and south of Ahtopol town.
- cliffs characteristic mostly for the southern Bulgarian coast; the pocket beaches are fed with sediments eroded from the rocks composing the cliffs; such beaches are formed at the bottom of the small bays in Tsarevo area, Varvara area and Ahtopol area.

Sand-beach strips represent one of the most widespread accumulative forms along the Southern Black Sea coast (Popov & Mishev, 1974). Their formation is related to the energy of the

blacklash of waves and of coastal currents. Trough their composition, the beach-strips are closely related with the lithological structure of the coastal area, as well as with their morphological structure, the wind and wave dynamic of the shelf water. The beach-strips of the Burgas Bay and Medni Rid coastal areas consist mainly of pyroxene-magnetite sands and heavy minerals, as well as of also younger Sarmatian, Pliocene and Pleistocene sediments. The sand-strip along the Strandja Mountain coast consists of carbonates, quartz and heavy minerals.

The abrasion-accumulative morphosystem is characterized by the following processes: accumulation and movement of sediments, underwater landslides and rockfalling, movement of suspension processes occurring under the influence of exogenous factors. The entire Bulgarian coastal zone is affected by old and recent landslides, which are in various states of slope stability and degrees of activity.

The geological-engineering zonation of Bulgaria placed the entire coastal strip and adjacent areas in the Black Sea Landslide Zone. As the Black Sea coast South of Burgas consists mainly of magmatic rocks, the conditions for development of large landslides are strongly limited. Most landslides in this area are shallow and develop in the cliff strip. Main destabilizing factors are represented by marine abrasion and fluctuations in groundwater levels. Single shallow landslides affect the shoreline up to the Bulgarian-Turkish border, so the Rezovo-Igneada area.

IGNEADA AREA

According to geological data, the base has a structure belonging to neogene period (Fig. 8). Lagoons are formed on this structure with sands brought by rivers and with the accumulation of finer material. İğneada has a remarkable richness due to the diversity of rocks and their sequence characteristics. Alluvions composed of young river deposits, and old alluvial deposits protected by beach sand dunes and terraces exist in the research area. The sandy beaches at İgneada coasts are remarkable. İğneada beaches are composed of coarse and fine sand, mollusc shells and fragments. Longoz forests and the area where other wetland ecosystems occur are under a slight or no influence of water erosion. On the other hand, the area close to the border of Bulgaria may be exposed to wave erosion.

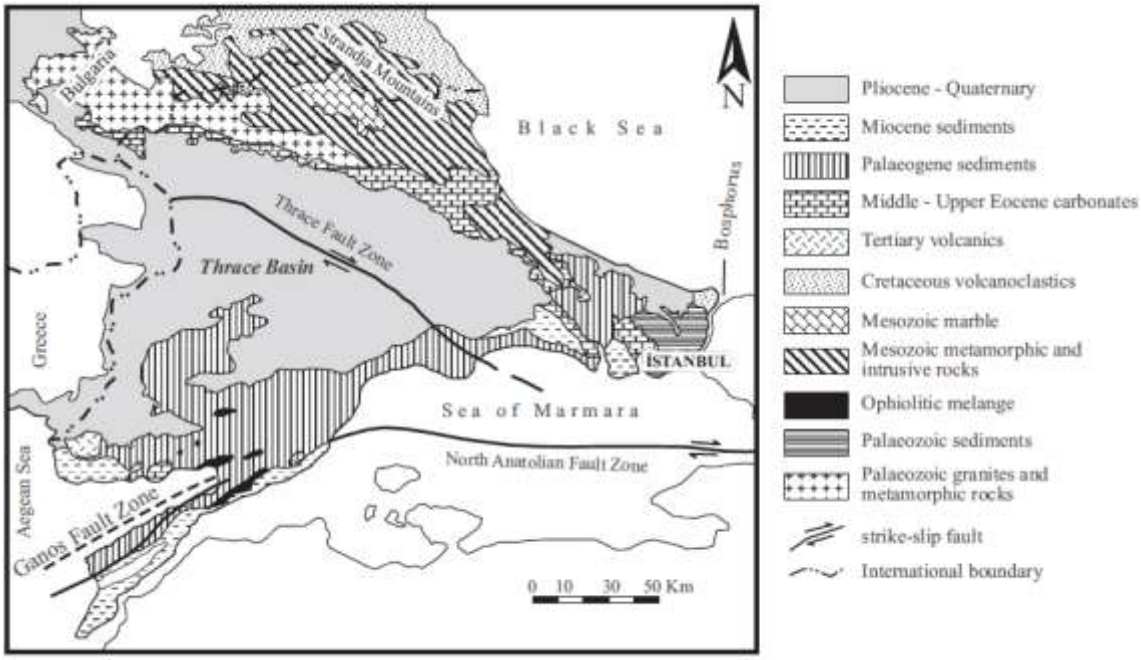

Figure 8. Geological map of Turkish Thrace (Ekmekçi, 2005)

Geomorphology: coastal and marine landscapes, sediment types

STRANDZHA AREA

The Bulgarian coastline is 378 km long with a general eastward aspect. The coastline is composed of rock cliffs along some 60 % of the entire shoreline, sand beaches (about 30%) and dunes or low-laying parts of firths and lagoons together with two large bays (Varna and Burgas). Firths (26) and lagoons (5) are typical of the Bulgarian coastal zone in particular along the south part of coast. Firths are former river valleys that have been drowned by rising sea levels in the Holocene. Today, firth configuration almost repeats the contours of old river valleys drowned during the Holocene (Dachev, 2000). Hard stabilization structures and harbour development cover some 10 % of the coast. The coefficient of coastline crenulations varies from 1.02 at the north to 3.79 on the south (Popov and Mishev, 1974; Peychev, 2004; Keremedchiev and Stancheva, 2006).

The coastline is characterized with various geological types. An erosion coast is prevalent at the northernmost part as the geology includes loess sediments and limestones. In the middle part, the geological properties are sandstones, limestones, marls and clays, aleurolites and argillaceous rocks. Large sand strips are formed here. Volcanic rocks (potassium-alkaline trachytes, latites, psammitic and psephitic tuffs, pyroclastic flysch) and volcanites, andesite-basalts, and basalts outcrop along the coast

at the southernmost part between Cape Foros and the Rezovska River. These volcanic rocks are resistant against wave erosion and the average rate of cliff retreat is low (around 0.01 m/y; Peychev and Stancheva, 2009).

Beaches and dunes are widely distributed along the Bulgarian Black Sea coast. There are over 70 sand beaches with a total length of 121 km (Stancheva, 2009). Small beaches, generally less than 3 kilometres in length, have formed in the region extending from Burgas to the border with Turkey, composed of medium- and fine-sized magnetite-titanite sands, with a high content of heavy minerals (up to 75%) due to the volcanic rocks (Sotirov, 2003; Peychev, 2004).

Sand dune systems occur behind the larger beaches or in small inlets, where their development has been favoured by the combined factors of coastline orientation, wind direction and sufficient sediment supply. Extensive dune fields are developed at the northern and middle sections and a number of dune complexes are located along the southern coastline (Stancheva, 2013).

Fourteen Bulgarian rivers enter the Black Sea, but the total coastal discharge rate is less than 2 cubic kilometres per year. River flow is highly variable and dependent on the season: it is highest during the spring snow-melt and autumn rains, whereas in summer flow rates are much lower. In majority, the rivers from the southern part of Burgas Bay to Rezovo area flowing directly into the sea form a sand bar in front of their mouth (e.g., Veleka River: annual rate discharge (km^3/y): 0.24)).

Within the Bulgarian continental shelf parallel to the coast line, there are three main geomorphological areas: Coastal, central and peripheral inner (Fig. 9). Coastal zone is located near the coast line. It covers the underwater coastal slope, submerged relict terraces and coastal depression. The central zone of the shelf occupies the largest area of with depth of about 30 m to 90-95 m. It is divided into three sub-areas - accumulative bars, slightly indented plane and indented plane. Peripheral shelf zone is differentiated into at most seaward part of the shelf as a strip width from 3-4 to 10 km.

The coast in Strandzha - Medni Rid is erosion. The coastline is straight and underwater coastal slope - steep, reaching considerable depth - 40 m in the north to 70 m in the south. Coastal depression is located along shoreline at distance about 5 km from the coast. It situated between steep underwater coastal slope to the west and accumulative bar in central part of the shelf to the east. The width of accumulative bar is about 6 km, the height - about 18 m and the water depth above its ridge vary between 34 in the northern part to 60 m in the southern. Eastward bar gradually passes into inclined

flat surface that reaches the peripheral area. Seaward depths change from 50-60 to 90-105m (ESIA Report, 2011).

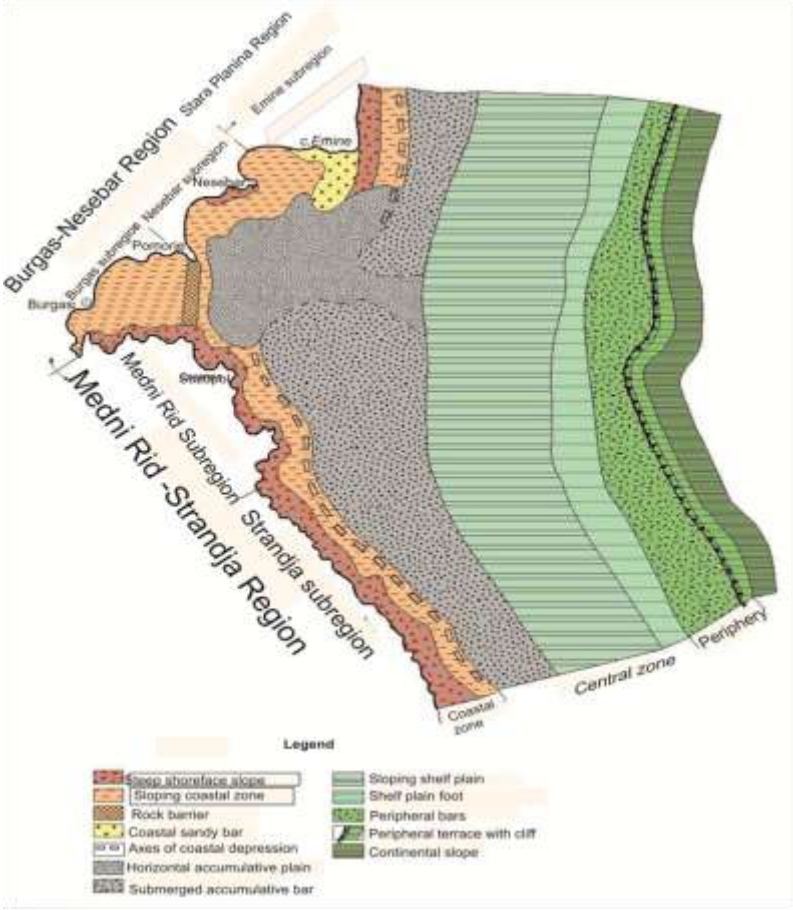

Figure 9. Geomorphological scheme of Southern Bulgarian Black Sea shelf (ESIA Report of Burgas – Alexandroupolis pipeline 2011) (After Ionin et al 1979, Parlichev et al 1972)

For the MSFD purposes Bulgarian shelf was subdivided into 3 parts from north to south (Northern, Central and Southern) and from the coast to the shells break into shallow sublittoral (below 20m depth) and deeper shelf sublittoral (from 20 m to shelf periphery, approximately 90-100m). Additionally, the coastal shallow water zone (midlittoral and shallow sublittoral) is divided into 5 basic regions from north to south. Zoning is done by several key indicators: morphographic (erosion and hydrographic segmentation of coastal landscape and lithostratigraphic characteristics of the bottom sediments, density of river-valley network, average unit runoff and average turbidity and morphometric (coastal exposure, coastal indentation, and slope of the underwater slope morpho-lithostratigraphic structure. The southernmost area is between Sozopol and Rezovo River.

Sozopol and Rezovo River Region is characterized by high erosion and hydrographic segmentation of relief as a result of tectonic block structure forming the beach Kp coefficient of indentation to 3.02 and slopes of the underwater slope to 0.025, as the horizontal segmentation is km/km2 to 22.30 and the vertical to 200 m/km^2. There is a highly developed river-valley network (km/km^2 to 1.55) with constant high annual sediment discharge to 11 l/s/m^2. Northeastern coastal exposure prevails, as the coast is open to the waves from NE and E quarter. Slopes of active hydrodynamic zone range from 0.03 to 0.06 and in less active to 0.02. Biogenic component is a major sediment forming factor, the content of $CaCO_3$ in sandy sediments ranges from 40% to 50% (Todorova et al. 2013).

The areas in Sozopol – Rezovo region in medio-sublittoral rocks and reefs and sands are included in Table 1 and depicted in Fig. 10 (Todorova et al. 2013).

Table 1. Areas in Sozopol – Rezovo region in mid-sublittoral rocks and reefs and sands

Zone	Substrate	Substrate Type	Area	Area % from the zone
Mediolittoral	Rocks		3.649	
Mediolittoral	Sediments		2.1456	
Shallow sublittoral	Rocks		20.79	20.46
Shallow sublittoral	Rocks	Calcareous rocks	0.2805	1.349
Shallow sublittoral	Rocks	Sandstone	7.1289	34.29
Shallow sublittoral	Rocks	Volcanic Rocks	13.3804	64.36
Shallow sublittoral	Sand		36.11	35.56
Shallow sublittoral	Sand	Coarse sand	6.9686	19.3*
Shallow sublittoral	Sand	Medium Sand	19.5897	54.24*
Shallow sublittoral	Sand	Fine sand	9.5563	26.46*
Shelf sublittoral	Rocks and Reefs		31.722	
Shelf sublittoral	Rocks and Reefs	Limestone	1.6792	5.29**
Shelf sublittoral	Rocks and Reefs	Sandstone	17.0553	53.76**
Shelf sublittoral	Rocks and Reefs	Volcanites	12.9875	40.94**
Shelf sublittoral	Sands		61.275	
Shelf sublittoral	Sands	Coarse sand	18.93394	30. 9***
Shelf sublittoral	Sands	Medium sand	22.9127	37.39***
Shelf sublittoral	Sands	Fine sand	7.4569	12.17***
Shelf sublittoral	Sands	Sandy mud	11.9717	19.54***

* percent from sand and sandy mud area

** percent from rocky bottom area

*** percent from mixed sublittoral sediments area

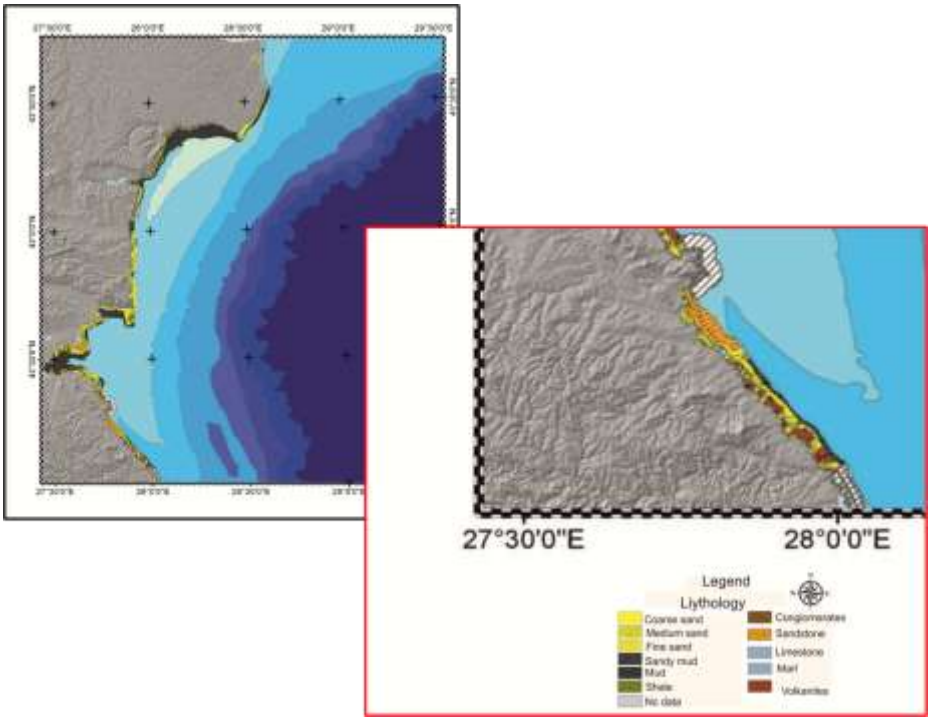

Figure 10. Substrates in shallow (0 - 20m) sublittoral in Region Sozopol – Rezovo River (after Todorova et al. 2013)

Most coarse sediments are distributed patchy in coastal area. They are attached to submarine bars or estuaries and submerged river valleys. Sandy sediments with median diameter 0.50-0.10 mm are present only in the coastal area. Seaward zone with increased values of Md, but not in excess of 0.025 mm coincides with ridge parts of accumulative bars of the central shelf under the influence of the southern current (Fig. 11).

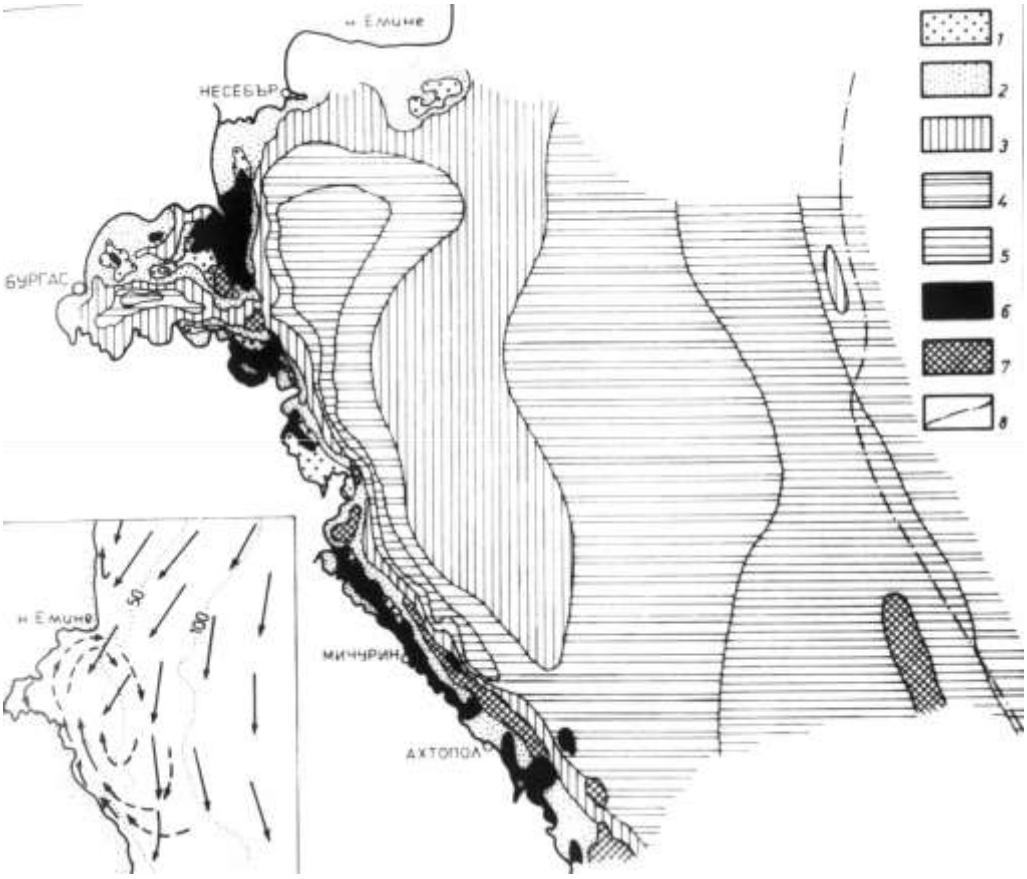

Figure 11. Distribution of the values of the median diameter (Md) in surface sediments Values of Md in mm: 1. - > 0.50; 2. – 0.50 – 0.10; 3. – 0.10 – 0.025; 4. – 0.025 – 0.010; 5. - <0.010; 6. - rocks; 7. – relict sediments; 8. – shelf edge (ESIA Report, 2011)

Distribution of sorting coefficient values in surface sediments largely follows the distribution of median diameters. Two areas with good sorting are formed. One coincides with coastal area where sandy sediments were developed. The second zone with good sorting matches with longitudinal ridge parts of accumulative bars of the central shelf region while in the adjoined accumulative plane sorting is worse (ESIA Report, 2011) (Fig. 12).

The dominating sediments in the deep littoral shelf area are:

Units A, B, C, D - greyish black, gray and greyish green soft plastic terrigenous mud with layers of shelly debris. Low to high gas-saturated

Units K and H - Olive green to greyish green medium plastic terrigenous mud with layers of shelly debris. Low to high gas-saturated (Kojuharov et al, 2008).

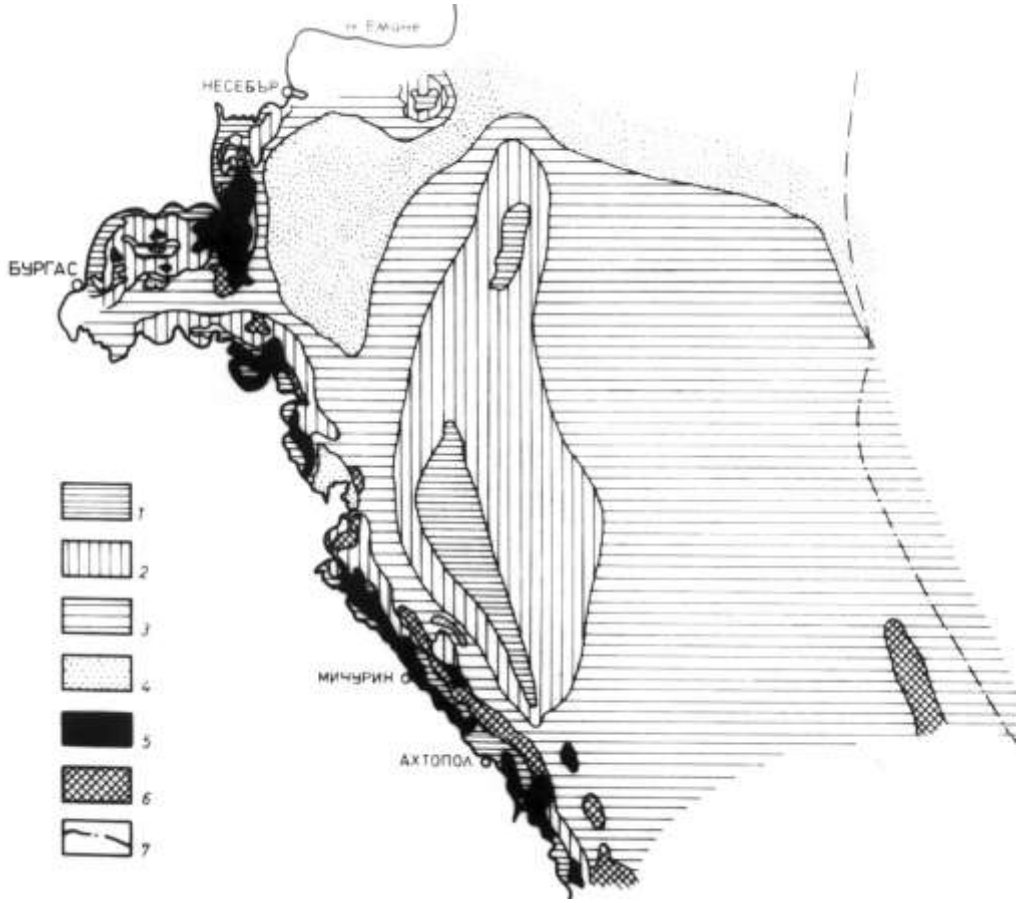

Figure 12. Distribution of sorting coefficient (So) in surface sediments
Values of So: 1. – 1.00 – 1.50; 2. – 1.50 – 2.50; 3. – 2.50 - 5.00; 4. - > 5.00; 5. - rocks; 6. - relics sediments;7. - shelf edge. (ESIA Report, 2011)

IGNEADA AREA

Coastal structures : Small bays and high lands at the mouth of valleys between Kıyıköy and İğneada are in the form of capes. The coast is flat from place to place but cliffs are also seen. Strong waves created by northern winds has caused the formation of cliffs by constantly undermining the coast. Main beaches along the coast are located on the bays of Kıyıköy, Panayır İskelesi and Selves. It is possible that the places where Longoz forests exist may have been under the sea at ancient times. It is understood that they are formed by the depostion of material carried thorugh rivers at the shallow part of the sea. Moreover, beach sand dunes disconnected the rivers and the sea resulting in the formation of lagoons behind the sand dunes. The general bathimetry of the area is presented in the Fig. 13.

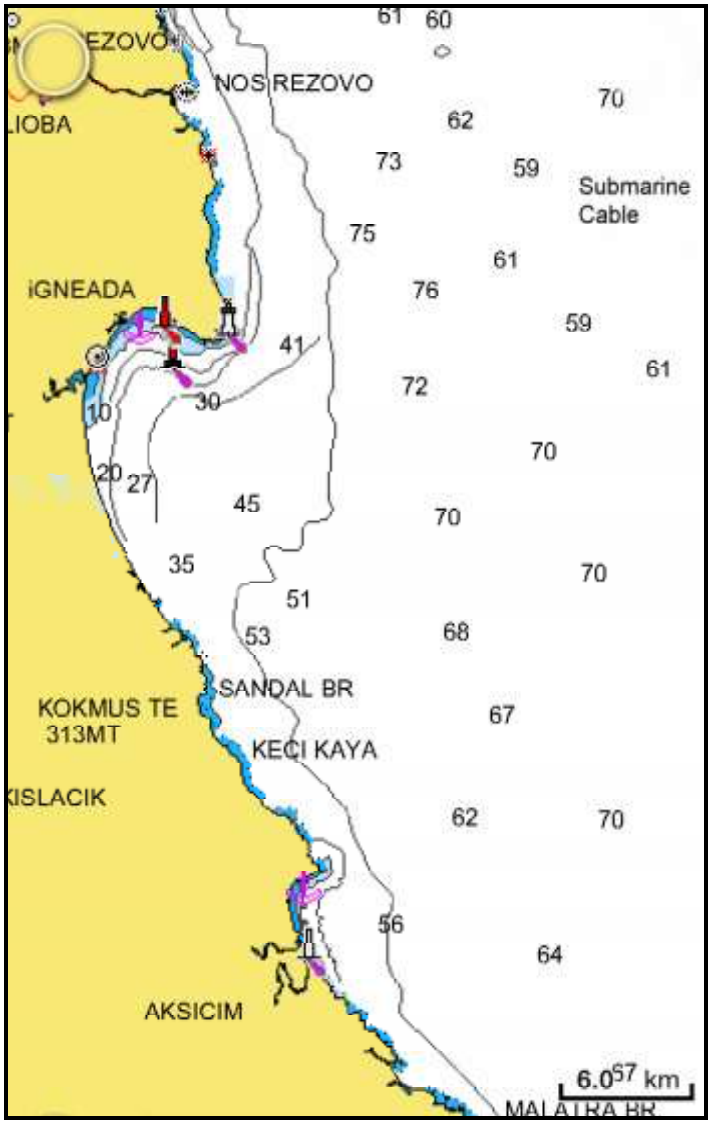

Figure 13. Bathymetric map of the İğneada region

1.3.1.2. General physico-chemical caracterization

STRANDZHA AREA

Physical - chemical characterization of water body

The Bulgarian coast is predominantly subject to northerly, north-easterly and north-westerly winds throughout the year. Occasional westerly and south-westerly also occur during the cold season (October to March). The wind strengths are lower during the warm season (April to September), when easterlies and more rarely south-easterlies also occur. Southerlies are rare throughout the year. The predominant northerlies and north-westerly of the cold season are generated by depressions over Central Europe. In autumn, the presence of a marked European north-south temperature gradient is

responsible for the north-easterlies. Summer daytime easterlies are commonly caused by onshore sea breezes with reciprocal weak westerly at night. The most stable wind flows are in the dominant northerly directions, with an average life of approximately 14-18 hours and speeds of 7- 12 meters per second.

The Rim Current separates the interior of the basin from the narrower coastal zone (out to 200 meter water depths). This zone is dominated by clockwise eddies, resulting in the shoreward drift of water along the Bulgarian coast, which is particularly marked in summer and autumn.

In the immediate vicinity of the coast, out to a depth of about 20 metres, the surface flow is dominated by southerly movement of low salinity water from rivers. In certain areas offshore winds can move surface waters away from the coast allowing the inflow of colder, deeper offshore water to replace it. This process is known as 'upwelling' and can bring fresh nutrients to the surface, thus enhancing the productivity of the coastal waters.

Surface water temperatures range from 18 to 24 ^{o}C in the summer, with the seasonal thermocline extending to depths of 15 to 25 metres. In autumn, the thermocline deepens to around 50 metres and the surface temperature drops to an average value of 11.5 °C. In winter, the surface temperature drops to as low as 6.5°C. The salinity ranges between 16.0 - 18.2 PPS while the oxygen concentrations range from 5 to 9 ml/L, with summer concentrations being 70 to 80% of the winter values. This decrease is due to biological utilisation and increased surface temperatures.

The investigated area (MPA Strandzha) belongs to the Bulgarian water body WB **BG2BS000C012** located in south part of coastal waters along Bulgarian coast. The study of Water Quality (WQ) of the body was carried out in 2012 in the frame of National monitoring programme on the base of data for nutrients, salinity, pH and oxygen from two stations (BG2BS00000MS012 - Veleka and BG2BS00000MS013 - Varvara). Further data details and chemical parameters distribution could be found in the Report on the State of Marine Environment in 2012 (IO Report, 2013) of the Institute of Oceanology (IO).

The CTD measurements were done at two stations in the most south Water Body (WB) **BG2BS000C012** along Bulgarian coast in the frame of National monitoring programme.

Vertical profiles of hydrophysical parameters presented in Fig. 14 showed typical seasonal changes in water column hydrological structure within May – November period. Thermocline formation and low salinity characterized the spring season. The maximum surface water temperature

(>26ºC) was measured in summer (July and August). Homogeneity of the upper layer was registered in November (Fig.23f), when the temperature and salinity in the first 34 m recorded 18ºC and 18.05‰, respectively. Transparency (Secchi depth) in 2012 varied from 4 – 8 m in spring to 7 – 10 m in summer-autumn period.

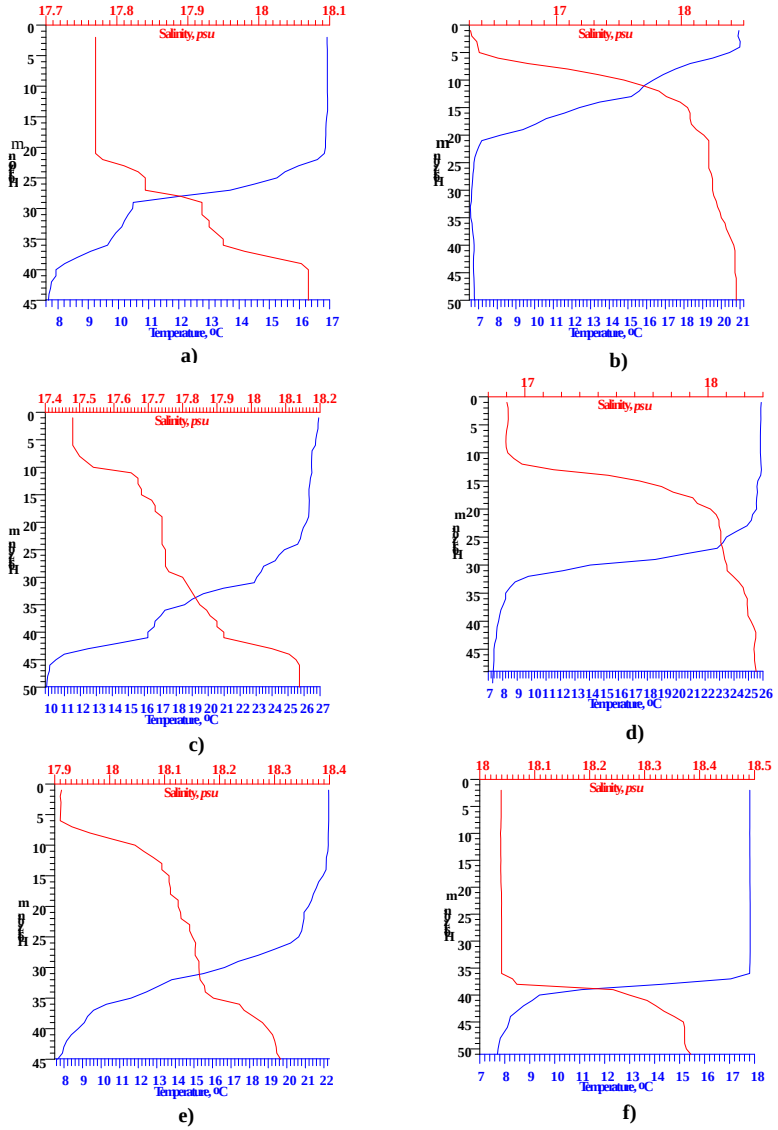

Figure 14. Vertical distribution of TºC and S‰ in May (a), June (b), July (c), August (d), September (e) and November (f).

Nutrients content during different seasons varied in the following ranges: 0 - 0.7µM NH_4-N, 0 - 0.21µM NO_2-N, 0-1.4µM NO_3-N, 0-0.3µM PO_4-P, 0.05-0.96µM TP, 31-40µM TN.

The hydrochemical parameters distribution during the period from May to November 2012 is presented in Fig. 15. Maximum dissolved oxygen content (DO) and saturation (OS) were recorded in

May-June period. Oxygen (DO and OS) in bottom layer decreased during summer-autumn period (OS < 80%) due to the summer vertical stratification.

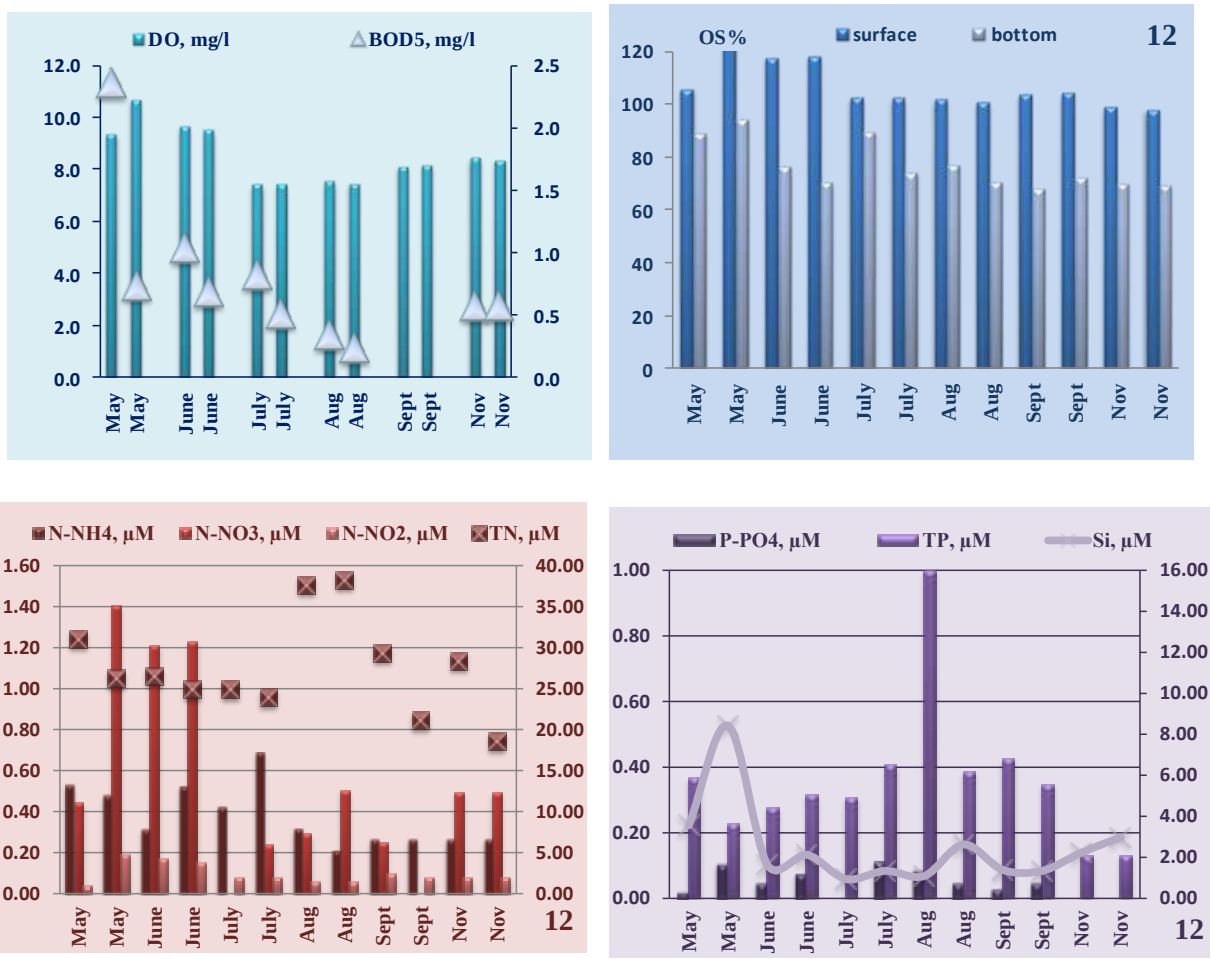

Figure 15. Chemical parameters distribution in May –November period of 2012 in the WB BG2BS000C012

Comparison between both seasons revealed higher nutrients content in July, best expressed for phosphate and ammonia (Fig. 15). OS% in bottom waters is characterized by values >100% in October, while it is lower in July, due to the different depths.

The assessment performed in 2012 revealed a ***Moderate*** status of water body. The status was high for nutrients and moderate for oxygen parameters. The low oxygen concentrations in bottom water during summer - autumn period at both sampling stations of the WB could be explained by high depth (about 50m) in this area.

The sediments study revealed 0.19-0.27% phosphorus (P) content and 0.67-1.33% organic carbon (Corg) (IO Report, 2013).

The physical-chemical parameters measurements (Table 2) carried out within the frame of MISIS Project in the protected area Rezovo in October, 2012 completed the picture about the abiotic condition of the area. Thus, the typical values of temperature of 21°C, salinity ranging from 16.7 to 17 ‰ and a transparency of 15m (Secchi disc depth) were recorded.

Table 2. Phisical-chemical parameters, measured in October, 2012

Station	Horizont, m	O_2, µM	TN µM	NO_3-N µM	NO_2-N µM	NH_4-N µM	TP µM	PO_4-P µM	S‰	TºC
Rezovo1	2	280.9	22.10	1.20	0.08	0.52	0.21	0.13	16.7	21.0
Rezovo2	2	308.6	10.00	0.15	0.04	0.33	0.22	0.11	17.0	21.0

The oxygen content ranged between 281 - 309 µM and had a saturation >105%. While phosphorus content is similar at sampling stations, ammonia N and nitrate N content was higher at St. Rezovo 1 (Fig. 16).

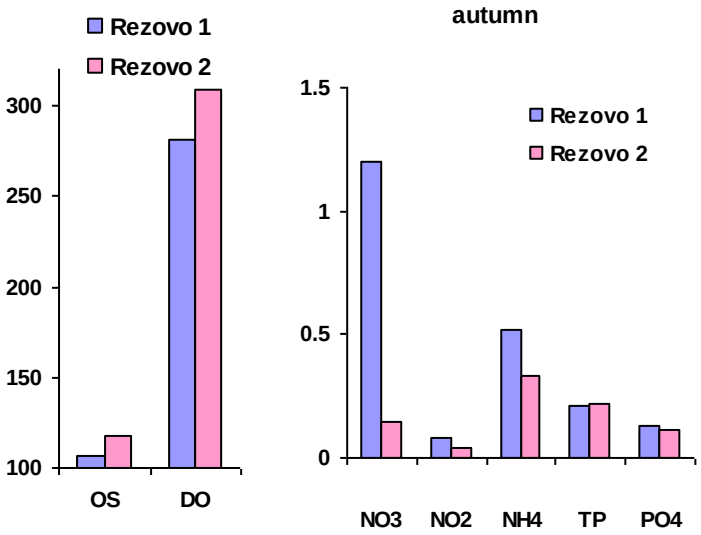

Figure 16. Oxygen and nutrients distribution (µM/l) in Bulgarian MPA Rezovo in autumn 2012

The results from autumn survey (2012) revealed that nutrients and oxygen conditions (OS%) correspond to WQ standards for ***High*** state according to classification in Bulgarian legislation.

Acording to the IO Report, (2013) the state of Rezovo site in summer 2012 was categorized as ***High*** by nutrients and as *Moderate* by oxygen conditions, due to the low oxygen saturation in bottom waters (IO Report on Assessment of marine environment state in 2012) (Table 3).

Table 3. Ecological status of investigated poligons at 2m depth, based on nutrients and oxygen saturation measurements

Poligons	Summer-nutrients	Summer-OS%
Varvara	High	Moderate
Sinemoretz	High	Moderate
Rezovo	High	Moderate

In July 2013 the main physical parameters of seawater: temperature and salinity varied between 22.5 °C and 26.2 °C and 13.61 and 16.1 PSU, respectively. In the observed area no clear thermocline or halocline existed.

Water column in summer is oversaturated with oxygen, but OS corresponds to ***Good* status**. No evidence for hypoxia in bottom waters was established. Veleka station in summer is characterized by higher oxygen and phosphorus content, while poligon Rezovo 2 – by higher nitrate N concentration (Fig. 17). The summer data reveals *High* WQ for oxygenated N forms except station Rezovo2 for NO3-N and *Good* WQ for PO4-P and NH4-N.

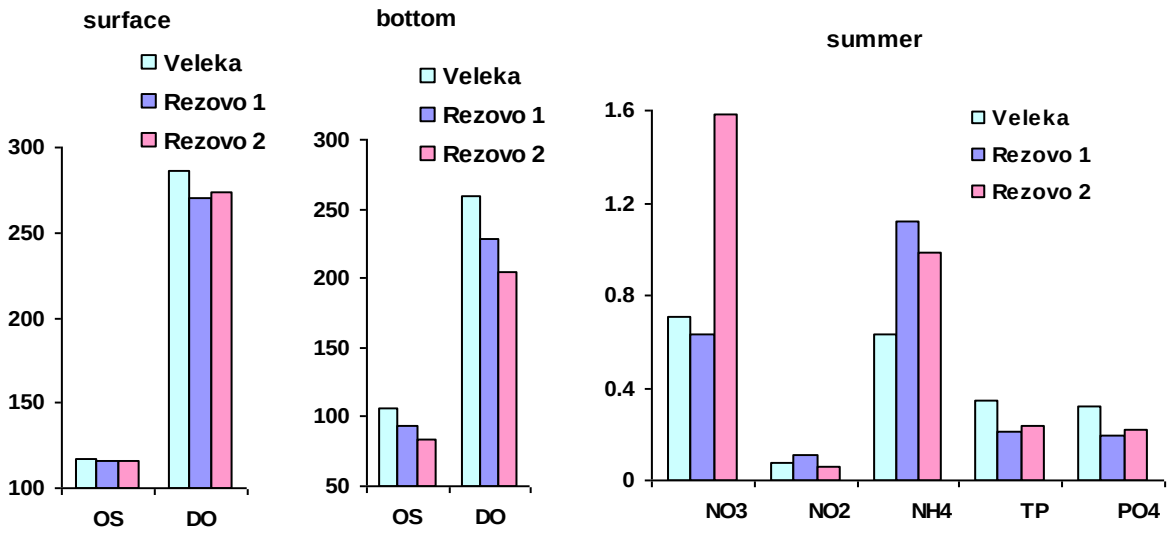

Figure 17. Oxygen and nutrients distribution (µM/l) in Bulgarian MPA Strandzha in summer 2013

In contrast with 2012 (Table 4), NO_3-N and TP content in 2013 are higher in September, while TN and Si content, in November. The oxygen condition in 2012 was better than in 2013. During summer 2013 an oxygen content <200µM/l and OS<60% in bottom waters were measured. In November a minimum for DO and OS was established (179µM/l and 55%). The WQ assessment in 2013 revealed that the water body BG2BS000C012 does not correspond to Good status according to oxygen parameters (DO and OS %) while the nutrients concentrations within WB corresponds to High status (IO Report, 2014).

Table 4. WQ of poligons by seasons

Poligons	Autumn (October2012)	Summer (July2013)
Veleka		Good
Rezovo 1	High	Good
Rezovo 2	High	Good

The information about sea water pollution in the area is poor. Monitoring of pollutants was not carried out in Bulgarian Black Sea area in correspondence to Water Framework Directive (WFD). Some data for pollutants were collected in the frame of scientific projects or contracts supporting the WFD implementation.

The results of the survey in 2011 (Annual report on state of waters in 2011, BSBD) reveal that the all pollutants concentrations in water are lower than Detection limit (<DL). Pesticides, PAHs, PCBs and some priority substances were measured at one station and heavy metals at both sampling stations in water body BG2BS000C012. The DL values for some of the pollutants are higher than values of Quality standards (Regulation, 2010) and it is impossible to assess the chemical state of waters. The sediments in the polygon Rezovo contain 0.4%P and 0.32% Corg, respectively.

The main pressure indicators near the Rezovo site are represented by anthropogenic sources represented by human agglomerations, which led to important N and P inputs via rivers into the coastal water bodies (Fig. 18 and 19). However, it is evident that in the south part, loads are with the lowest values compared with the other areas of Bulgarian Black Sea coast.

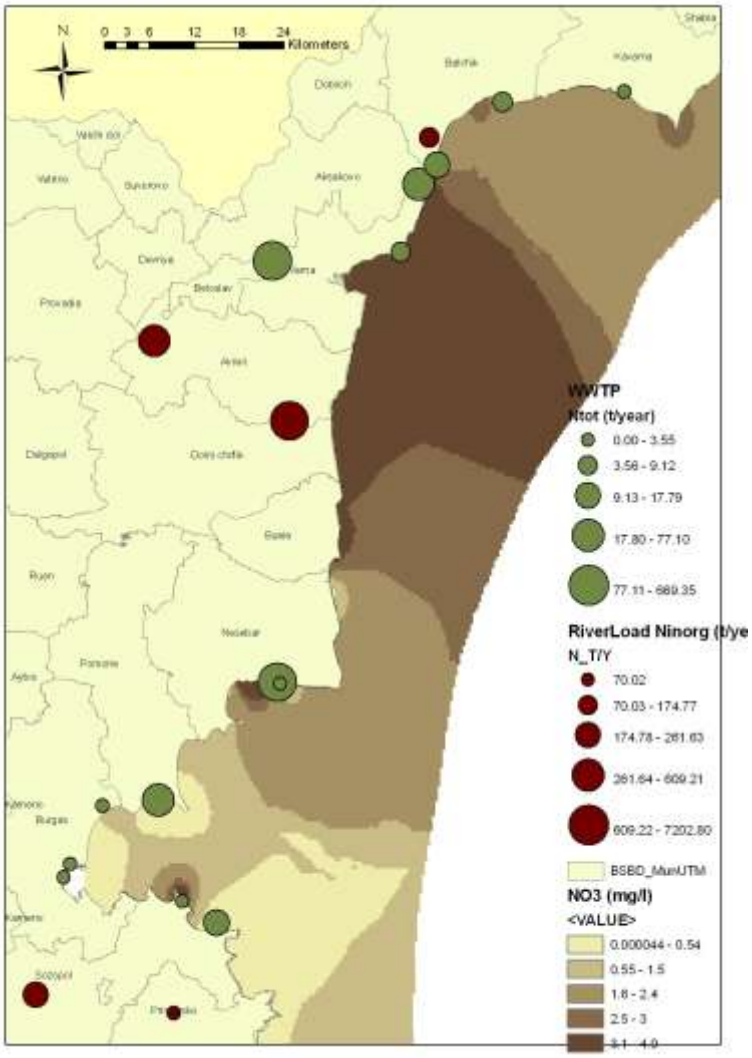

Figure 18. Maps of pressure indicators inorganic nitrogen (mg/l) by sites of investigation from bathing waters data, river load (N) tones per year and Total Nitrogen (N tot- t/year) from waste water treatment plants along Bulgarian coast - in 2007 (Maps made by Valentina Doncheva-Institute of Oceanology, Varna, Bulgaria)

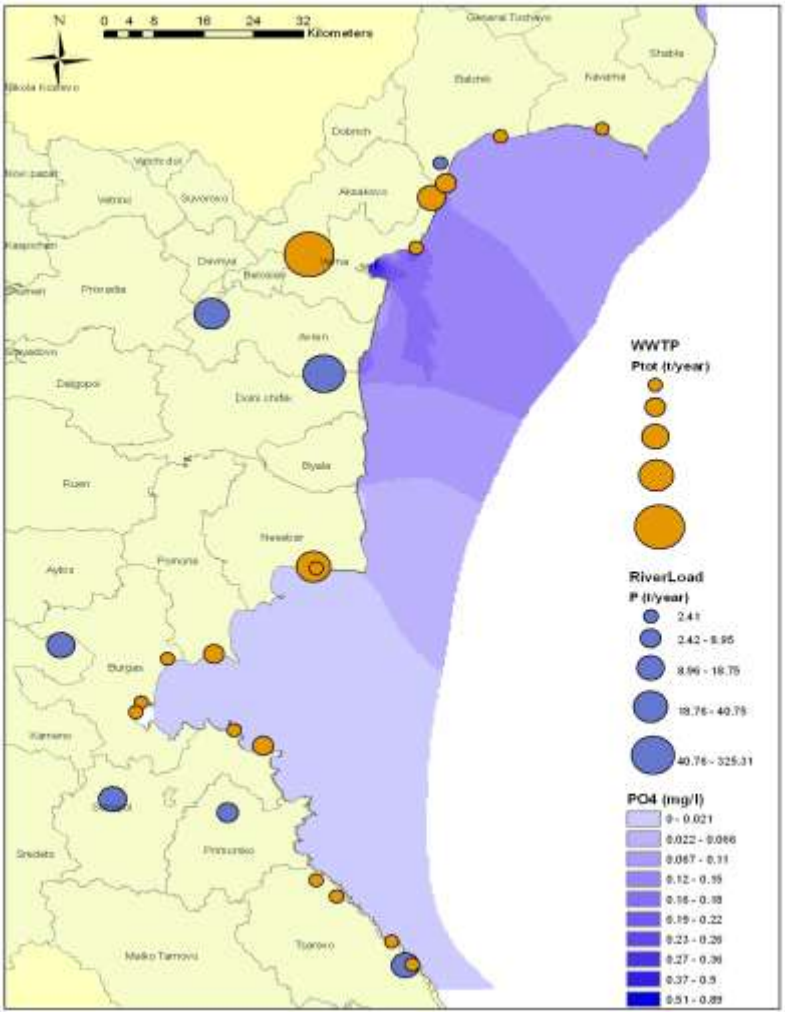

Figure 19. Maps of pressure indicators inorganic nitrogen (mg/l), phosphorus PO4 (mg/l) near by sites of investigation from bathing waters data, river load (P and N) tones per year and Total nitrogen and phosphorous (P, N tot- t/year) from waste water treatment plants along Bulgarian coast – in 2007 (Maps made by Valentina Doncheva-Institute of Oceanology, Varna, Bulgaria).

IGNEADA AREA

A general pollution status of the region with respect to Cf (Contamination factors) and CD (sediment contamination) was considered, coming from the pollution induced by heavy metals.

In the Table 5 there are shown the comparative data regarding the contamination factors (Cf) of metals and degree of sediment contamination (CD) of the Black Sea along Turkish coast. The criteria for Cf and CD are presented in the Table 6 (Hakanson, 1980) and show a moderate degree of contamination according to CD of Igneada region, much lower than the values calculated for the other stations, except Sile, while in case of Cf of different metals, a considerable degree of contamination at

Igneada station is given by Hg (mercury), and in less measure by Al (aluminium), however the biggest in the series of Cf recorded in the other stations.

Table 5. Comparative data regarding the contamination factors (Cf) of metals and degree of sediment contamination (CD) of the Black Sea along Turkish coast

Stations	C_f						C_D
	Al	Cd	Cu	Pb	Hg	V	
İğneada	1.26	0.27	0.12	0.54	4.55	0.13	6.87
Terkos	0.71	0.63	0.05	1.19	6.13	0.16	8.86
Şile	0.45	0.90	0.11	1.11	3.28	0.16	5.99
Sakarya R	0.44	1.30	0.83	1.20	4.43	1.00	9.19
Ereğli	0.34	1.67	0.23	0.13	4.55	0.08	6.99
Zonguldak	0.32	1.23	0.97	2.15	4.55	1.17	10.39
Bartın	0.36	3.47	1.28	1.28	2.83	0.98	10.19
Cide	0.29	0.63	0.38	1.27	6.23	0.56	9.36
İnebolu	0.52	0.10	1.06	1.33	4.78	0.92	8.69
Sinop-2	0.52	0.67	0.13	1.08	4.93	0.31	7.62
Sinop-1	0.48	0.67	0.39	0.87	5.30	0.57	8.28
Kızılırmak R	0.30	0.93	0.81	0.97	6.03	1.08	10.11
Samsun	0.61	0.93	1.12	1.48	5.83	1.24	11.21

Table 6. Descriptive criteria of the Cf and CD (Hakanson, 1980).

C_f	C_D	Description
$C_f < 1$	$C_D < 6$	Low degree of contamination
$1 \leq C_f < 3$	$6 \leq C_D < 12$	Moderate degree of contamination
$3 \leq C_f < 6$	$12 \leq C_D < 24$	Considerable degree of contamination
$C_f \geq 6$	$C_D \geq 24$	Very high degree of contamination

Physical - chemical characterization of water body

The physical parameters such as temperature, salinity, pH and dissolved oxygen (Table 7) have been measured with a multiparameter device (YSI- 6600V).

Table 7. Seasonal physical parameters of water column in the study area

		Temp (°C)	Salinity (ppt)	pH	DO (mg/L)
Nov-2012	**Min**	14.81	17.82	8.25	8.24
	Max	15.25	18.04	8.31	9.43
	Mean	15.05	17.95	8.29	8.47
May-2013	**Min**	9.69	15.42	8.39	9.21
	Max	18.04	17.95	8.61	10.51
	Mean	15.72	16.17	8.53	10.01
July-2013	**Min**	22.97	14.92	6.87	7.39
	Max	24.72	16.17	6.98	8.66
	Mean	23.71	15.76	6.92	8.05
Oct-2013	**Min**	18.35	18.24	6.85	7.86
	Max	18.65	18.28	6.89	8.2
	Mean	18.54	18.26	6.87	7.96

The lowest temperature value was recorded in May (9.69°C), while the highest in July 2013 (24.72°C) (Table 7). The warming period was generally accompanied by decreasing oxygen concentrations and low pH values, indicating a high input of humic matter of terrigenous origin, caused by flooding phenomenon, which affected the hydrological regime of the area at that period. This situation is confirmed also by low salinities measured in May (16.17‰) and July 2013 (15.76‰). In October 2013, the physical characteristics within the water column have slightly changed comparative with the summer period in terms of salinity (18.26‰) and temperature (18.54°C), while the pH (6.87) and oxygen (7.96 mg/L) parameters have maintaned the same tendency (Fig. 20). According to these parameters, the water quality was high during November 2012 and May 2013 and low in the July and October 2013.

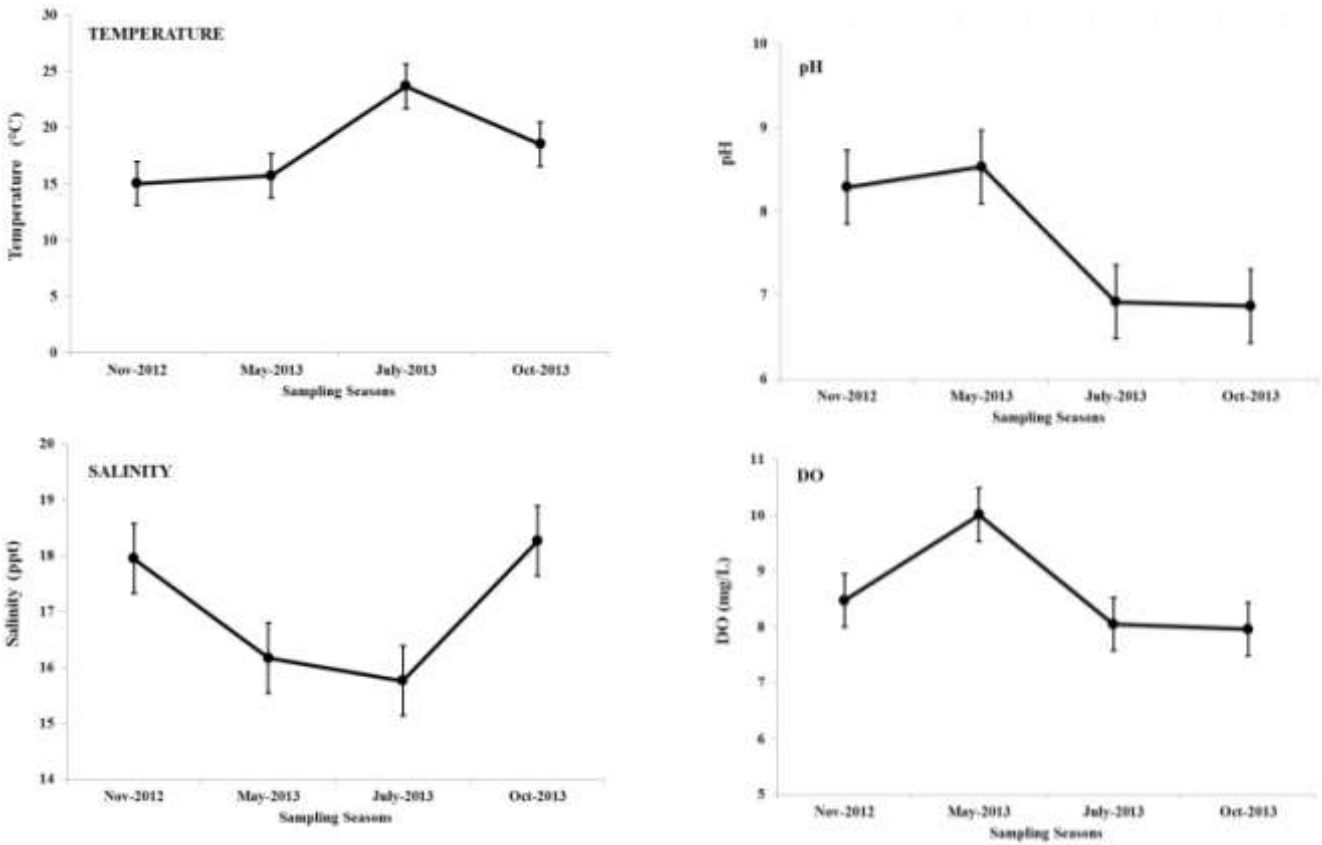

Figure 20. Physical parameters of water column during the sampling months

These observations are supported also by the values of transparency given by the measurements done using Secchi Disc. Thus, the highest SD depth was recorded as 6.5 m in station I-

1-3 in November 2012, while the lowest SD depth (2.6 m) was found in station I-2-1 (5 m bottom depth) in October 2013. However, the deeper and further of coast the sample point was the higher the transparency (May 2013). The local wind regime influenced also the water transparency, situation that can be observed in large variation of transparency recorded in autumn months (October and November) (Fig. 21).

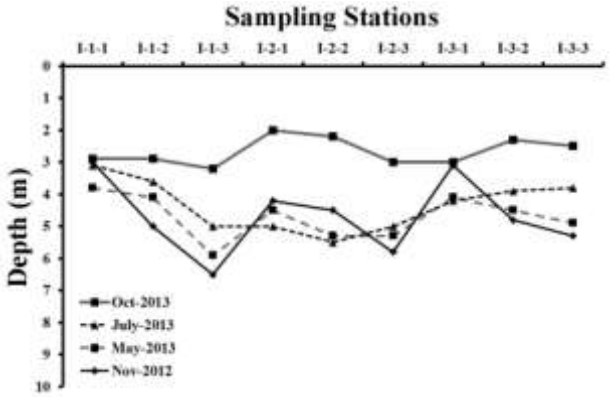

Figure 21. Secchi Disc Depths (m) at the sampling stations in the sampling seasons.

1.3.2. Biological

1.3.2.1. Ecological status of phytoplankton community

STRANDZHA AREA

Phytoplankton community taxonomic composition

The phytoplankton assembly in the area in July was represented by a high variety and species richness, a total of 98 species belonging to 12 classes (Fig. 22). Class Dinophycea was the most diverse – 58 species, representing more than 60% of the species pool, followed by Bacillariophycea (14 species) the other classess composed of 1-5 species and a high variety of microflagellates. In 2012-2013 (May-November) in the stations Varvara and Veleka more than 128 species were recorded and the species number per sample varied between 23 - 44 and between 44 - 64 in 2013 with similar pattern of distribution among the different taxonomic classes (Moncheva et al., 2012, 2013). In general the species composition in the Rezovo area was similar to the community composition of the other water bodies along the Bulgarian coast. High diversity and species richness emerged as a recurrent feature of phytoplankton community along the Bulgarian Black Sea coast, in line with the recent trends documented for other areas of the Black Sea (Nesterova et al, 2008).

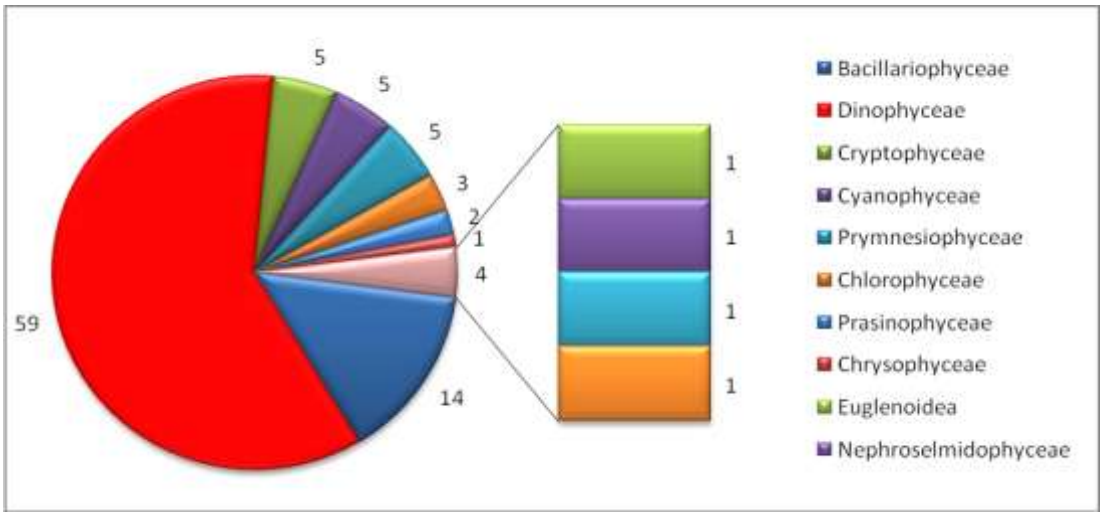

Figure 22. Proportion of phytoplankton species richness by taxonomic classes

Phytoplankton taxonomic structure and dominant species

The taxonomic structure of phytoplankton community, unlike the species diversity, in July 2013 was dominated by diatoms both in the abundance (55%, 39%, 55%) and biomass (64%, 52%, 70%) respectively in Rezovo1, Rezovo 2 and Veleka1, which in this particular case could be related to the intensive mixing during the period of sampling and associated nutrients enrichment of water column, as evident from the almost homogenous vertical distribution of nutrients (Fig 23 and Fig. 24). The coccolithophorid *Emiliania huxley* represented a high proportion in the total abundance (36%, 47% and 33%), which is a common feature of the recent period for the entire Black Sea (Mykaelyan et al, 2011, 2013).

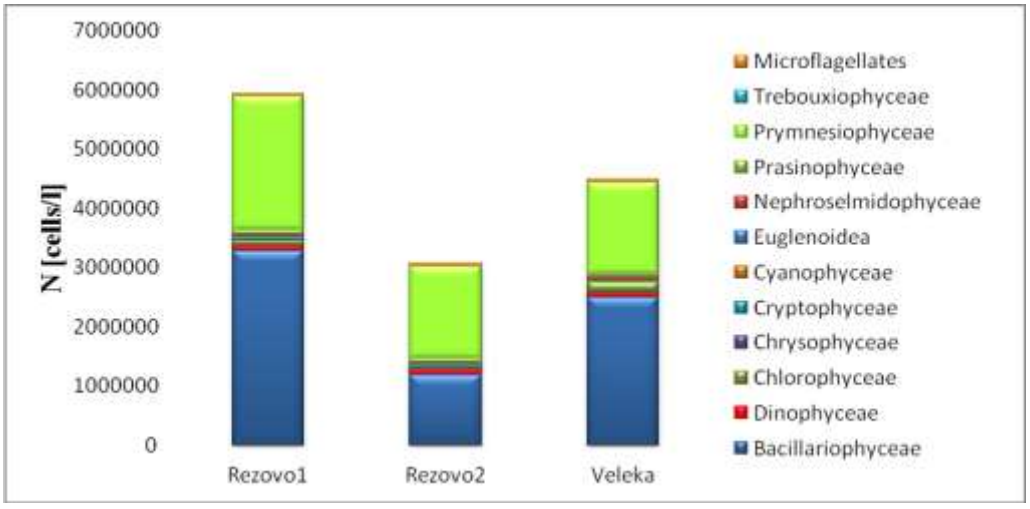

Figure 23. Phytoplankton community taxonomic structure in July 2013: proportion of taxonomic classes in the total abundance [cells/l]

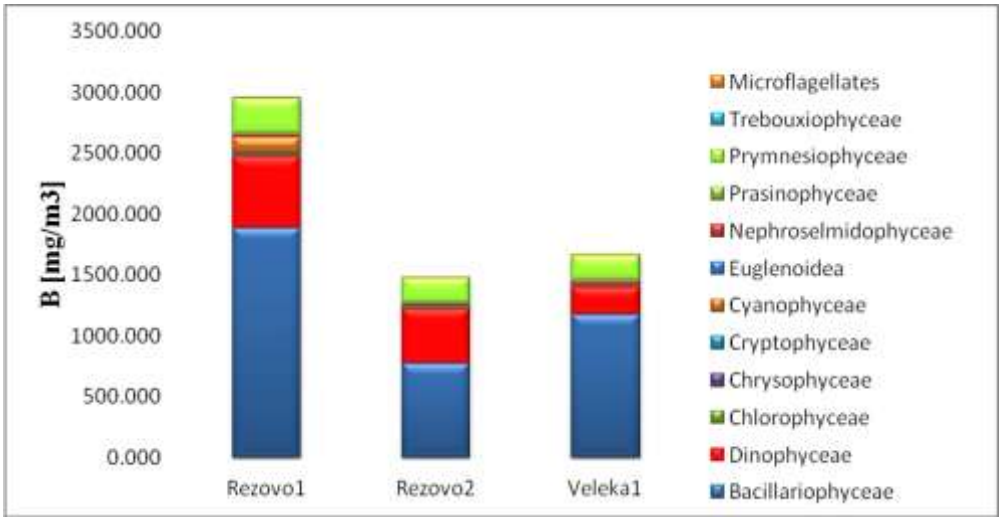

Figure 24. Phytoplankton community taxonomic structure in July 2013: proportion of taxonomic classes in the total biomass [mg/m^3]

Dominant species among diatoms were *Thalassionema nitzschioides* (in Resovo and Veleka in abundance >1x10^6 cells/l), *Pseudo-nitzschia delicatissima, Pseudo-nitzschia seriata, and Emiliania huxleyi* (abundance between 1 and 2x10^6 cells/l). Among dinoflagellates albeit the high diversity the contribution of a single species to the total abundance/biomass was very low even for the most common *Prorocentrum micans, Protoperidinium granii, Scrippsiella trochoidea*, the share of the class in the biomass varying between 13-19%.

The total abundance and biomass were high and varied between 3 - 6x10^6 cells/l and 1.4 - 2.9 g/m^3 exceeding the summer threshold for good ecological status (800 000 cells/l and 950 mg/m^3] several times. According to the IBI index in July 2013 the area is classified in "poor" ecological status – Table 8.

Table 8. Ecological status assessment based on WFD phytoplankton metrics (colors correspond to the WFD classification color codes)

Station	S	Nx10^3 [cells/l]	B [mg/m^3]	Menhinik	Sheldon	MEC%	DE%	IBI
Rezovo1	74	5935	2948.777	0.03	0.09	0.91	80.4	0.28
Rezovo2	67	3077	1473.245	0.04	0.1	1.84	76.5	0.37
Veleka1	57	4484	1659.153	0.03	0.12	1.32	86.1	0.31

In the context of phytoplankton characteristic in spring, summer and autumn 2010-2013, July 2013 is an exception in terms of the high numerical abundance and biomass, which could be related to the intensity of hydrodynamics in the area, mentioned above, and also to the shallower location of the stations than the traditional monitoring stations in the area, where the land-based effects could be stronger. The average seasonal values of phytoplankton abundance and biomass and their variability were lower than the reference for good ecological status over the entire period – Table 9.

Table 9. Average seasonal, stdev and threshold for good ecological status of phytoplankton abundance and biomass (2010-2013)

Parameter	spring	summer	autumn
average N [cells/l]	812606 ± 342136	506462 ± 544126	514152 ± 50765
category good		<800000	
average B[mg/m3]	324 ± 156	317 ± 246	152 ± 131
category good	<3000	<950	<1700

The main features of phytoplankton seasonal taxonomic structure were the disproportion of diatoms in the spring total biomass (almost inverse Bac : Din biomass ratio to the reference), a high contribution of coccolithophorid *E. huxleyi* in spring and autumn, increased diversity and share of small-sized species from "other" classes than diatoms and dinoflagellates along with a high proportion of microflagellates in the total abundance, indicating a misbalance in phytoplankton seasonal succession – Fig. 25 and 26.

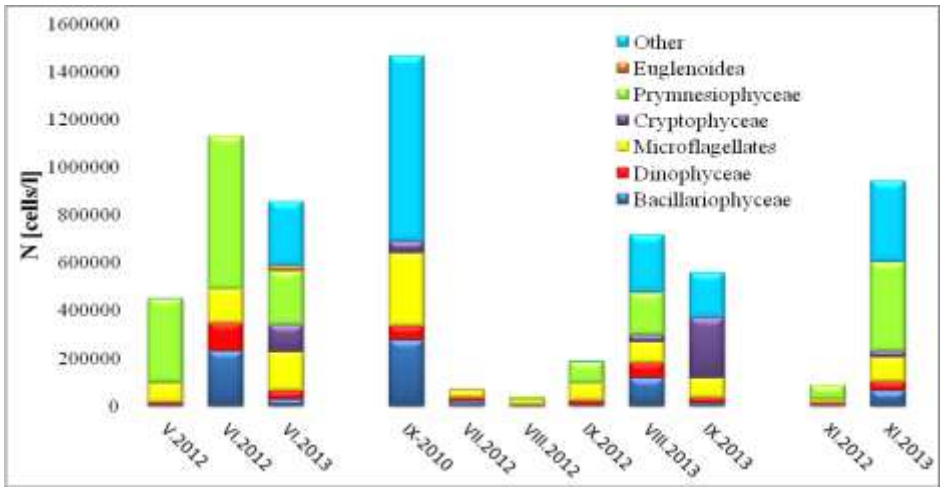

Figure 25. Phytoplankton taxonomic structure by sampling months (2010-2013) and phytoplankton abundance

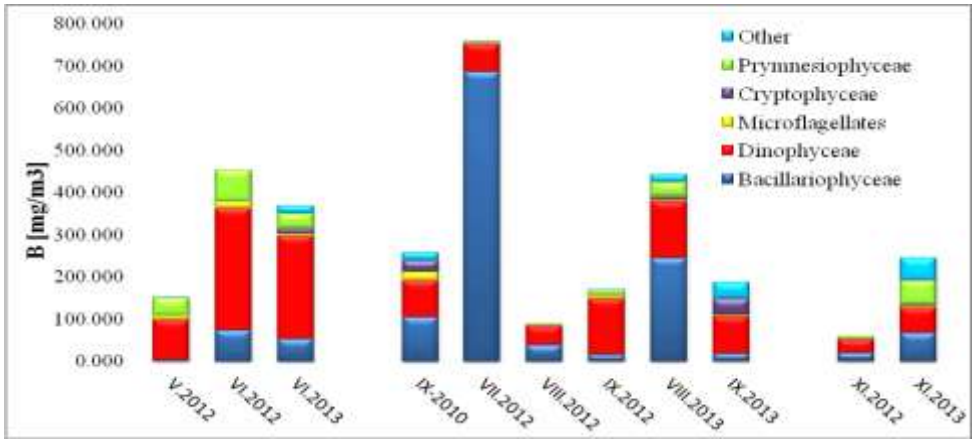

Figure 26. Phytoplankton taxonomic structure by sampling months (2010-2013) and phytoplankton biomass

The dominant species assembly during 2010-2012 was composed of the diatoms *Pseudo-nitzschia delicatissima, Pseudo-nitzschia seriata, Pseudosolenia calcar-avis, Thalassionema nitzschioides*, dinoflagellates *Prorocentrum cordatum, Prorocentrum micans, Scrippsiella trochoidea* and representatives of genus Gymnodinium, the prymnesiophyte *Emiliania huxleyi*, cryptophytes *Hemiselmis sp., Hillea fusiformis*, prasinophyte *Pyramomonas sp.* and a number of microflagellates.

The ecological status of the Rezovo area (WB BG2BS000C012) during 2006-2013 assessed by the **Phytoplankton Integrated Index** varied predominantly between the categories moderate-good with two cases in category "poor" in spring 2012 – Fig. 27.

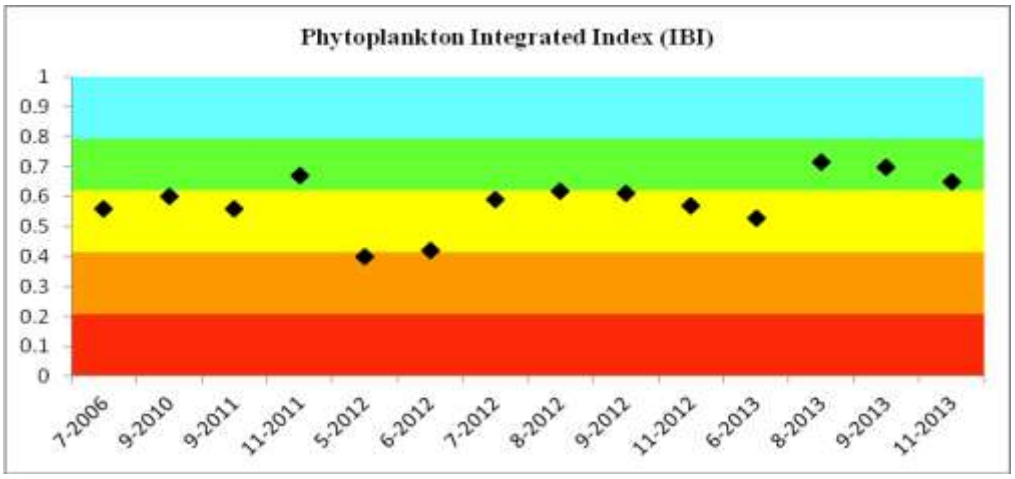

Figure 27. Ecological status assessed based on Phytoplankton Integrated Biological Index in WB BG2BS000C012 (colors correspond to the WFD classification codes)

IGNEADA AREA

Phytoplankton community taxonomic composition

Species belonging to 7 classes of algae (Bacillariophyceae, Coscinodiscophyceae, Fragilariophyceae, Dinophyceae, Prymnesiophyceae, Ebriophyceae and Dictyochophyceae) have been recorded. A total of 88 species (Annex 1) was determined out of which Bacillariophyceae was represented by 9 species belonging to 7 genera, Coscinodiscophyceae by 14 genera and 30 species, Fragilariophyceae by 3 genera and 5 species, Dinophycaeae by 17 genera and 39 species, Dictyochophyceae by 3 genera and 3 species, Ebriophyceae by 1 genus and 1 species and Prymnesiophyceae by 1 genus and 1 species (Table 10). Among these classes, Dinophycaeae dominated in terms of number of species. From the total number of species, 44% was represented by Dinophyceae, 34% by Coscinodiscophyceae and the remaining 22% by the other classes (Fig. 28).

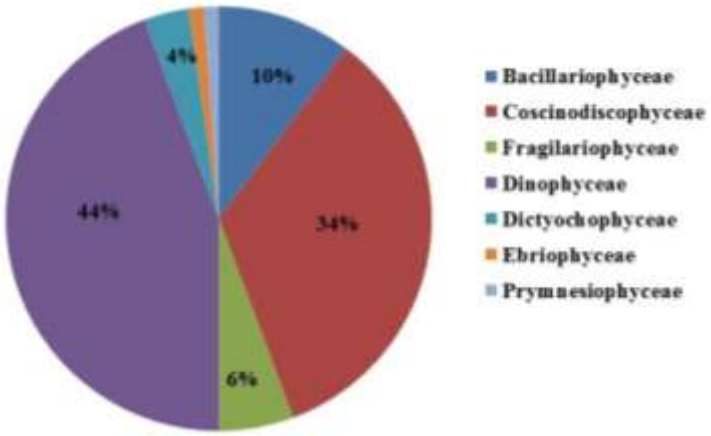

Figure 28. Percentage distribution of phytoplankton classes sampled in 2012 – 2013 period

Table 10. Taxonomic results of phytoplankton classes recorded in 2012 – 2013 period

		SAMPLING PERIODS			
CLASS	**GENUS**	**Nov-12**	**May-13**	**Jul-13**	**Oct-13**
Bacillariophyceae	*Achnanthes*	1	-	-	-
	Cylindrotheca	1	-	-	1
	Gyrosigma	1	-	-	1
	Navicula	1	-	-	-
	Nitzschia	-	-	-	2
	Pleurosigma	1	1	1	1
	Pseudo-nitzschia	1	1	1	2
Coscinodiscophyceae	*Biddulphia*	1	-	-	-

		SAMPLING PERIODS			
CLASS	**GENUS**	**Nov-12**	**May-13**	**Jul-13**	**Oct-13**
	Cerataulina	-	-	1	1
	Chaetoceros	4	4	4	8
	Coscinodiscus	2	-	1	3
	Dactyliosolen	-	1	1	-
	Ditylum	1	-	-	1
	Hemiaulus	1	-	-	-
	Leptocylindrus	1	1	1	1
	Melosira	-	-	-	2
	Proboscia	1	1	1	1
	Pseudosolenia	1	1	1	1
	Rhizosolenia	-	-	-	2
	Skeletonema	1	-	1	1
	Thalassiosira	1	1	1	2
Fragilariophyceae	*Licmophora*	2	-	2	1
	Striatella	1	-	1	-
	Thalassionema	1	1	1	1
Dinophyceae	*Akashiwo*	-	-	1	-
	Alexandrium	-	-	-	1
	Biceratium	1	1	1	1
	Dinophysis	3	-	1	4
	Glenodinium	-	-	-	1
	Gonyaulax	-	-	2	3
	Gymnodinium	-	-	1	1
	Gyrodinium	2	1	1	3
	Lingulodinium	1	1	1	1
	Neoceratium	2	2	2	2
	Phalacroma	1	-	1	1
	Podolampas	1	-	-	-
	Polykrikos	-	-	1	-
	Prorocentrum	2	2	3	3
	Protoceratium	-	-	-	1
	Protoperidinium	10	2	6	9
	Scrippsiella	1	1	1	1
Dictyochophyceae	*Dictyocha*	-	-	-	1
	Distephanus	1	-	-	1
	Octactis	1	-	-	1
Ebriophyceae	*Ebria*	1	-		1
Prymnesiophyceae	*Emiliania*	1	1	1	1

		SAMPLING PERIODS			
CLASS	GENUS	Nov-12	May-13	Jul-13	Oct-13
	TOTAL SP NO	52	23	41	70

Seasonal Analysis of Phytoplankton

According to the frequency of the species belonging to the class of Dinophyceae, 38% of the species were found to be as frequent, 21% of the species were found to be as common and 41% as constant.

56% of the species in Bacillariophyceae were determined to be frequent, 22% to be common and 22% to be constant in the community.

53% of the species in Coscinodiscophyceae were determined to be frequent, 17% to be common and 30% to be constant in the community.

40% of the species in Fragilariophyceae were determined to be frequent, 20% to be common and 40% to be constant in the community (Fig. 29).

Pleurosigma elongatum, *Pseudo-nitzschia delicatissima*, *Chaetoceros affinis*, *Leptocylindrus danicus*, *Proboscia alata*, *Pseudosolenia calcar-avis*, *Thalassiosira eccentrica*, *Thalassionema nitzschioides*, *Biceratium furca*, *Gyrodinium fusiforme*, *Lingulodinium polyedra*, *Neoceratium fusus*, *Prorocentrum compressum*, *Prorocentrum micans*, *Protoperidinium depressum*, *Protoperidinium granii*, *Scrippsiella trochoidea* and *Emiliana huxleyi* species were the constant (F=100) species at sampling stations in the sampling seasons.

The results of the cluster analysis performed on a presence-absence matrix of the species found in all sampling season are given in Fig. 30a and the results of MDS analysis performed on qualitative data are given in Fig. 30b. As can be seen from the figure, two significant clusters (A and B) are formed among the stations at a similarity level of 0.60 (Fig. 30).

Phytoplankton reached its highest abundance and biomass values in July 2013 followed by October 2013. The lowest abundance and biomass values were calculated for May 2013 throughout the sampling period (Fig. 31). The results of the cluster analysis of the species abundance found in all stations and seasons are given in Fig. 32a and the results of MDS analysis performed on quantitative data are given in Fig. 32b. Discrimination was prominent with a significant stress factor of 0.01. As

can be seen from the figure, four significant clusters (A, B, C and D) are formed among the stations at a similarity level of 0.60 (Fig. 32). As a result of this analysis, each season formed its own clusters.

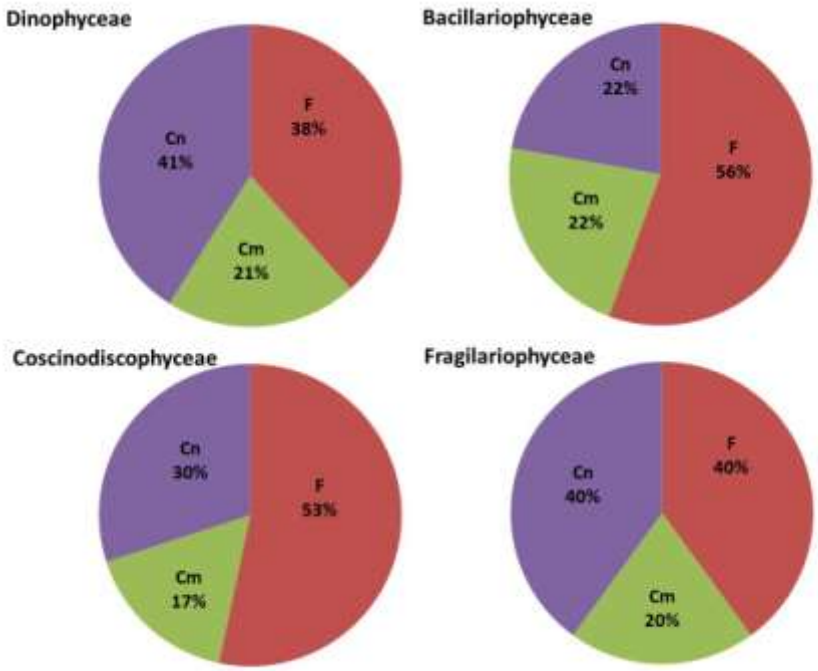

Figure 29. The frequency percentages of the species belonging to the important phytoplankton classes (%) in the sampling seasons.

In order to support the results of MDS and Cluster analyzes, AnoSIM (Analyses of Similarity) was performed. As a result of this analysis, the phytoplankton community of the area was observed to show a seasonal change. A statistically significant difference was found among seasons. (Sample statistic-Global R: 0.92, Significance level of sample statistic: 0.001). However, no statistically significant difference was found among depths (Sample statistic-Global R: -0.126, Significance level of sample statistic: 0.986).

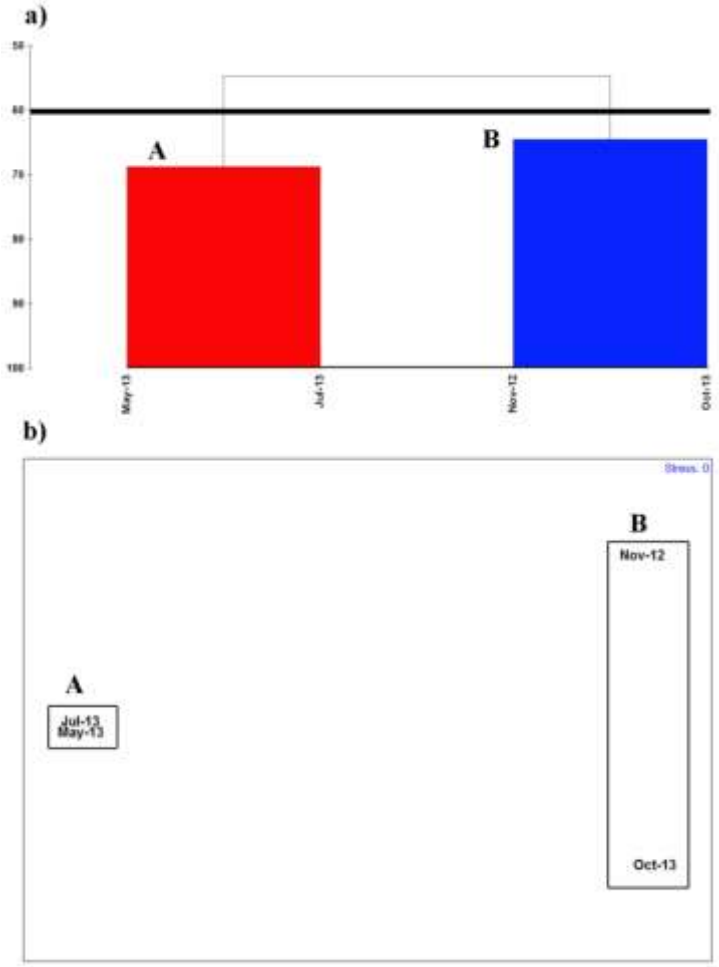

Figure 30. The dendogram (a) and MDS diagram (b) of qualitative clustering analysis of phytoplankton in sampling seasons

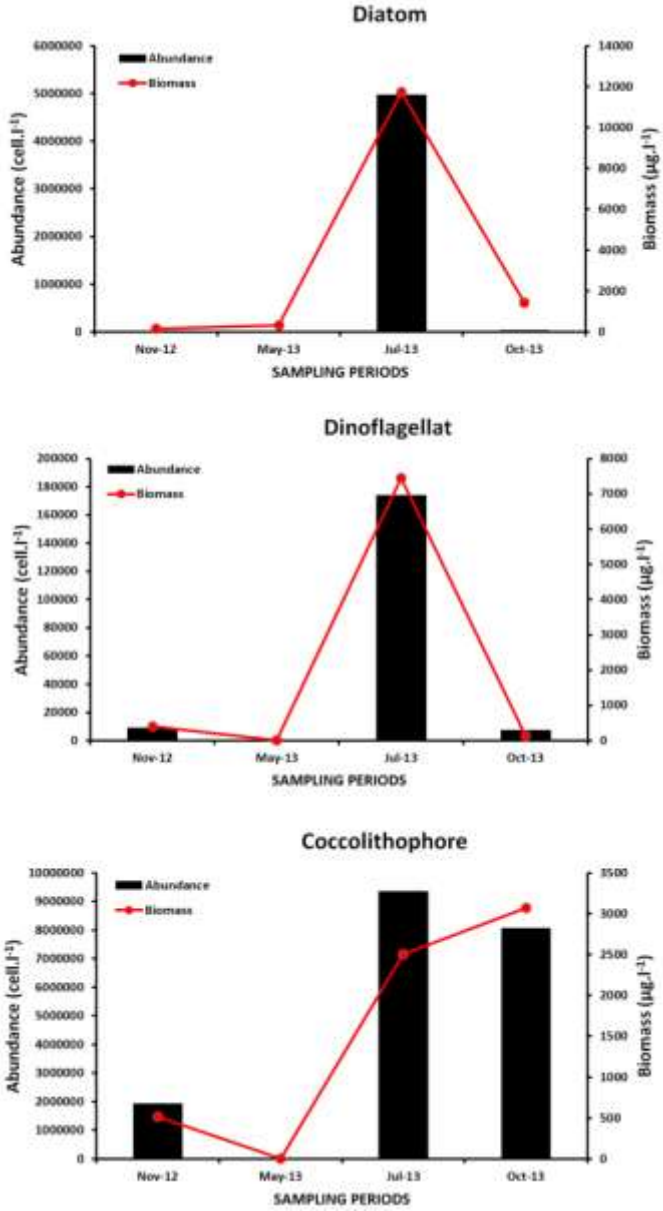

Figure 31. Distribution of abundance (cell.l^{-1}) and biomass (µg.l^{-1}) of the main phytoplankton groups in the sampling season.

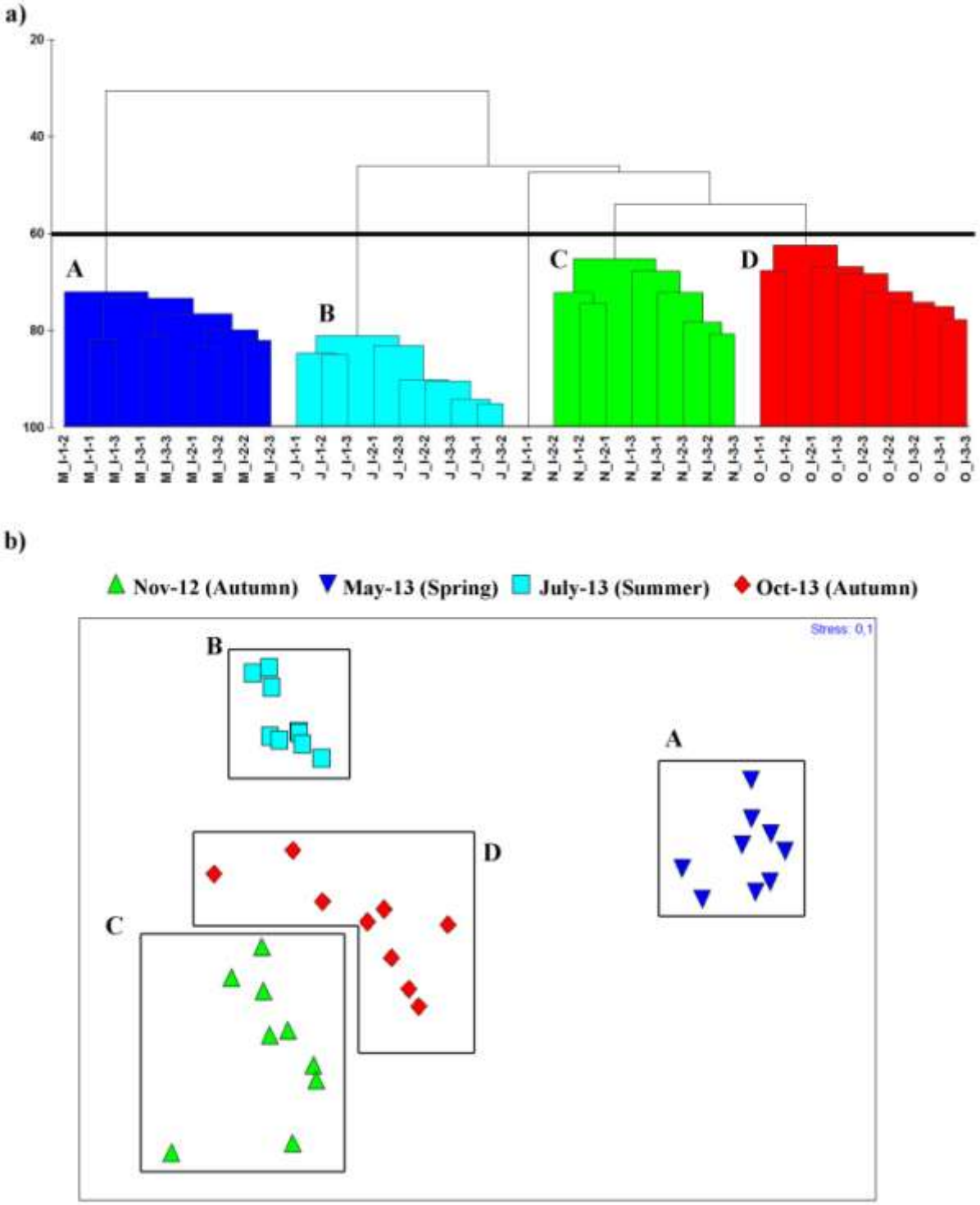

Figure 32. The dendogram (a) and MDS diagram (b) of quantitative clustering analysis of phytoplankton in sampling seasons.

1.3.2.2. Ecological status of macrophytobenthos community

Macrophytes community taxonomic composition in October 2012

During the study period, based on the qualitative analysis, 32 taxa assigned to the following phyla were identified: 7 species of Chlorophyta, 21 species of Rhodophyta, 4 species of Ochrophyta (Table 11). Out of them 13 species were categorized as sensitive (ecological state group – ESGI) and 29 – tolerant (ecological state group - ESGII). In the group ESGI, 3 species were ESGIA, 2 species - ESGIB, 8 - ESGIC and from ESGII, 5 were ESGIIA, 4 - ESGIIB, 3 - ESGIICa, 7- ESGIICb.

Table 11. Species list of macrophytes in sampling seasons and ecological state groups (ESG).

SPECIES LIST	SAMPLING PERIOD			ESG
	August 2012	October 2012	July 2013	
Chlorophyta				
Chaetomorpha linum (O.F.Müller) Kützing	-	-	+	ESGIIA
Cladophora albida (Nees) Kützing	-	+	+	ESGIICb
Cladophora coelothrix Kützing	-	+	-	ESGIIB
Cladophora vagabunda (Linnaeus) Hoek	+	-	-	ESGIICb
Cladophora vadorum (Areschoug) Kützing	+	-	-	ESGIICb
Ulva intestinalis L.	+	+	+	ESGIICb
Ulva rigida C. Agardh	+	+	+	ESGIICa
Ochrophyta				
Cladostephus spongiosus (Hudson) C.Agardh	-	+	+	ESGIC
Cystoseira barbata C. Agardh	+	+	+	ESGIA
Cystoseira crinita Duby	+	+	+	ESGIA
Sphacelaria cirrosa (Roth) C.Agardh	-	+	+	ESGIIB
Zanardinia typus (Nardo) G. Furnari	-	+	+	ESGIC
Rhodophyta				
Acrochaetium virgatulum J. Ag.	+	+	+	ESGIICb
Antithamnion cruciatum (J. Agardh) Nägeli	-	+	+	ESGIICb
Ceramium ciliatum (J.Ellis) Ducluzeau	+	+	+	ESGIIB
Ceramium circinatum J. Agardh	+	+	+	ESGIIB
Ceramium diaphanum (Lightfoot) Roth	+	+	+	ESGIICa
Ceramium virgatum Roth	+	-	-	ESGIICa
Corallina officinallis Linnaeus	+	+	+	ESGIC
Ellisolandia elongata (J.Ellis & Solander) K.R.Hind & G.W.Saunders		+	+	ESGIC
Gelidium crinale (Turner) Lamour.	+	+	+	ESGIIA
Gelidium spinosum (Gmelin) Silva	+	+	+	ESGIC

SPECIES LIST	SAMPLING PERIOD			ESG
	August 2012	October 2012	July 2013	
Hildenbrandia rubra (Sommerfelt) Meneghini	+	+	+	ESGIC
Laurencia coronopus J.Agardh	-	+	+	ESGIB
Palisada thuyoides (Kützing) Cassano, Sentíes, Gil-Rodríguez & M.T.Fujii in Cassano et al	+			ESGIB
Hydrolithon farinosum (J.V.Lamouroux) D.Penrose & Y. M.Chamberlain	+	+	-	ESGIC
Phyllophora crispa *Polysiphonia elongata (Huds.)* Harv. in Hooker	- -	+ +	+ +	ESGIA ESGIIA
Polysiphonia fibrillosa (Dillwyn) Sprengel	-	+	+	ESGIIA
Polysiphonia fucoides (Hudson) Greville	+	-	-	ESGIIA
Polysiphonia subulifera (C. Agardh) Harv.	+	+	+	ESGIIA
Stylonema alsidii (Zanardini) K.M.Drew	+	+	+	ESGIICb
Phymatholiton lenormandii (Areschoug) Adey	+	+	+	ESGIC

In Rezovo near the border and Rezovo 2 at 0-3m depth there were found 9 macrophyte species while on the Before Ahtopol, Varvara and Sinemoretz profiles, there were 11 taxons registered (Fig. 33).

On Rezovo 2 transect there were found 17 species comparative with 18 species on Rezovo 1 and 16 on "Before Ahtopol" transect at 0-15 m depth (Fig. 34).

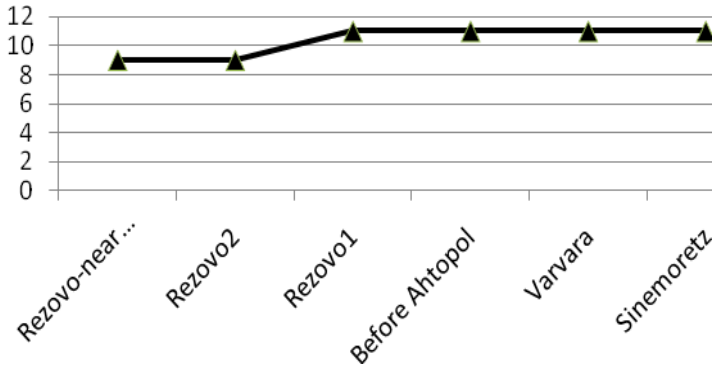

Figure 33. Number of species on each transect between 0 – 3 m depth in October 2012

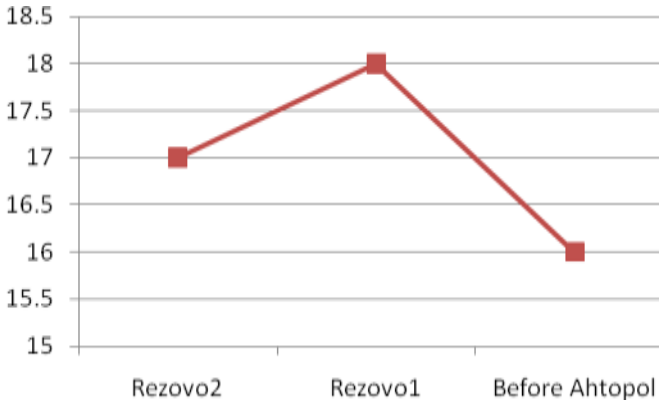

Figure 34. Number of species registered between 0-15 m depth, in October 2012

Biomass of macrophytobenthic communities (0 -15m)

Cystoseira plays an important role in the diversification of existing habitats, acting as a second substrate for the epibionthic vagile species such as gastropod *Rissoa* splendida, *Bitium reticulatum*, *Tricolia pulus* or cryptic decapode *Macropodia sp.*, shells *Mytilaster lineatus* and *Mytilus galloprovinciallis*, barnacle *Balanus improvisus*, some hydrozoans and bryozoans, fish, crabs, marine sponges, actinias.

On all transects (Rezovo1, Rezovo2 and Before Ahtopol) between 0 and 3m dominated *Cystoseira crinita* community which gave the place to *Cystoseira barbata* community as the depth increased to 5 and 10 m, recording very high biomass at 5 m but low at 10 m. The highest biomass was estimated on Before Ahtopol (7,128.67 g*m^{-2}*)* at 5 m depth and the lowest one (283.39 g*m^{-2}) at 10 m depth. At 15 m *Gelidium spinosum* formed a well developed community. In "Before Ahtopol"at 0-3m depth the next after *Cystoseira crinita* with high biomasses were situated *Cladophora albida, Ceramium diaphanum, Laurencia coronopus* (252.56 g*m^{-2}). In Rezovo 1- at 5m depth except *Cystoseira Cladophora albida, Sphacelaria cirrhosa,* and *Gelidium spinosum* were present with high biomasses; in Rezovo 2-*Polysiphonia subulifera, Cladostephus spongiosus*; in Before Ahtopol - *Laurencia coronopus, Ceramium diaphanum, Polysiphonia subulifera*. Besides *Cystoseira* important contributions to biomass at 10m depth had *Sphacelaria cirrhosa* in Rezovo 1, *Gelidium spinosum, Gelidium crinale*. At 15 m depth important contribution had *Gelidium spinosum, Gelidium crinale*.

When compare biomass values at different depths in the studied area, it is evident that highest biomass was found at 5m depth (7917.97 g.m^{-2}) on "Before Ahtopol" transect. Biomasses at 0-3m depth were lower than at 5m depth, followed by biomass values at 10 and 15 m depth. The lowest biomass (309.25 g.m-^{2}) is estimated in Rezovo 1 transect at 15m depth (Fig. 35).

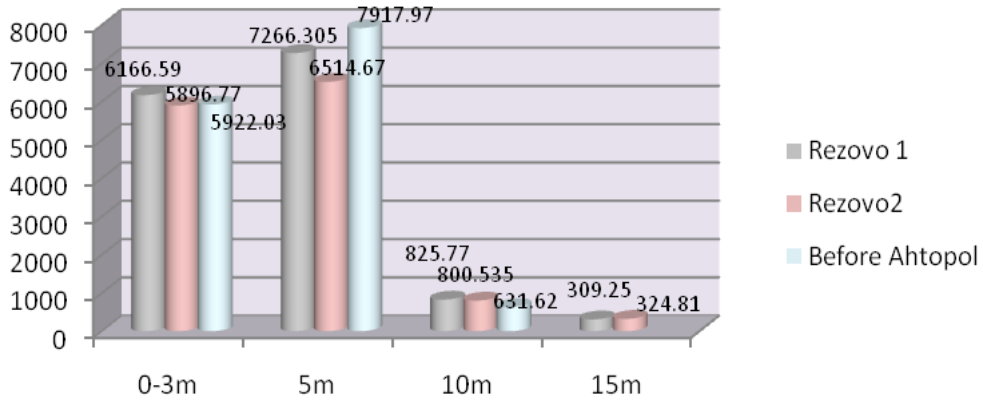

Figure 35. Biomass values of macrophytes at different transects at different depths (2012-2013).

Highest biomass was calculated for Before Ahtopol transect (5060 g.m^{-2} ± 3250.88), followed by that of Rezovo 1(4140.95 g.m^{-2} ± 3289.57) and Rezovo 2 (Fig. 36).

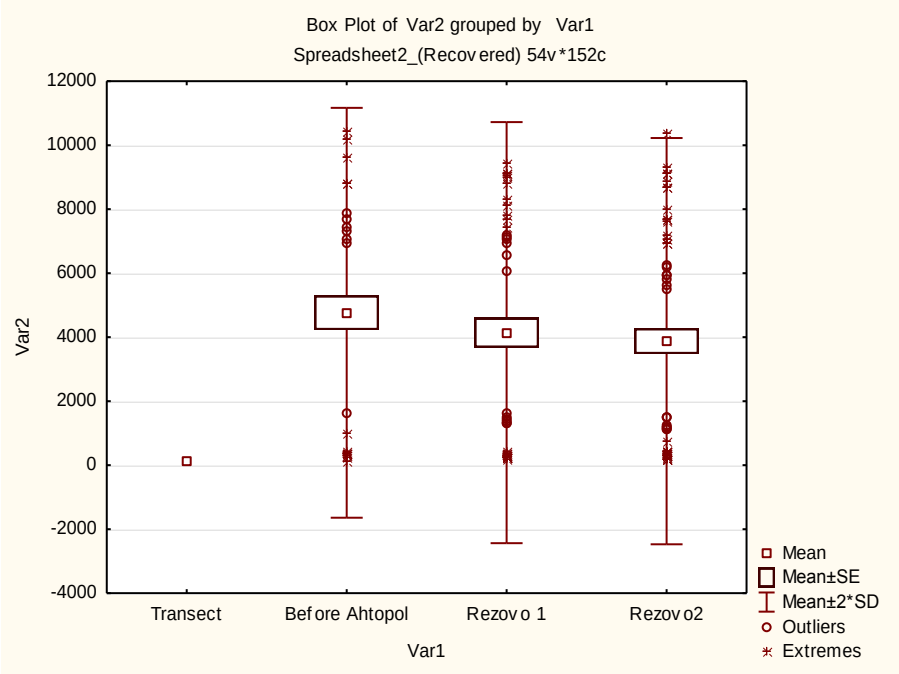

Figure 36. Total biomass of macrophytes from investigated transects (2012-2013).

Highest biomass proportion is that of Ochrophyta phylum and ranges from 89.27 in "Before Ahtopol" to 91.34% in Rezovo2. Chlorophyta and Rhodophyta were represented by low biomasses.

Sensitive species biomass percent is very high ranging from 94.5% to 91.77%, which is in agreement with high condition of marine water. Tolerant species biomass percent varies from 5.5% (Before Ahtopol) to 8.1 % - Rezovo1 (Fig. 37).

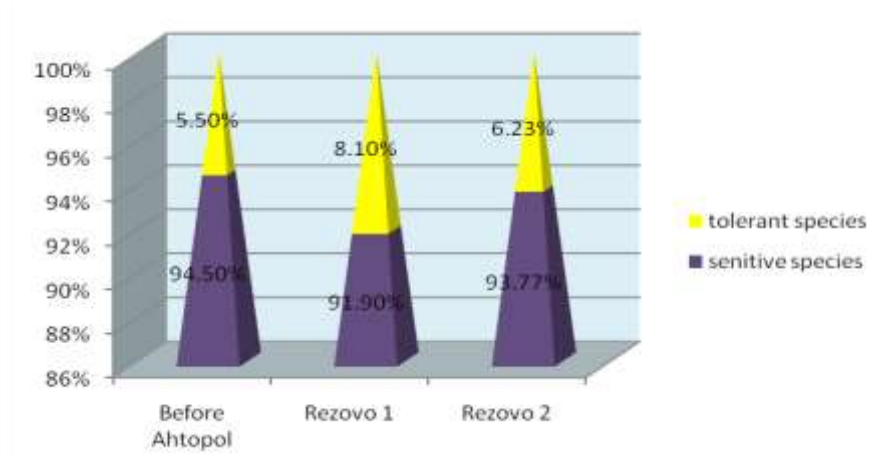

Figure 37. Proportion of sensitive and tolerant species biomass in investigated transects (2012-2013).

Highest diversity index value among the transects is found to be at transect "Before Ahtopol" (H'=1.68), and the lowest at transect "Rezovo 1" (H'=1.45) (Fig. 38)

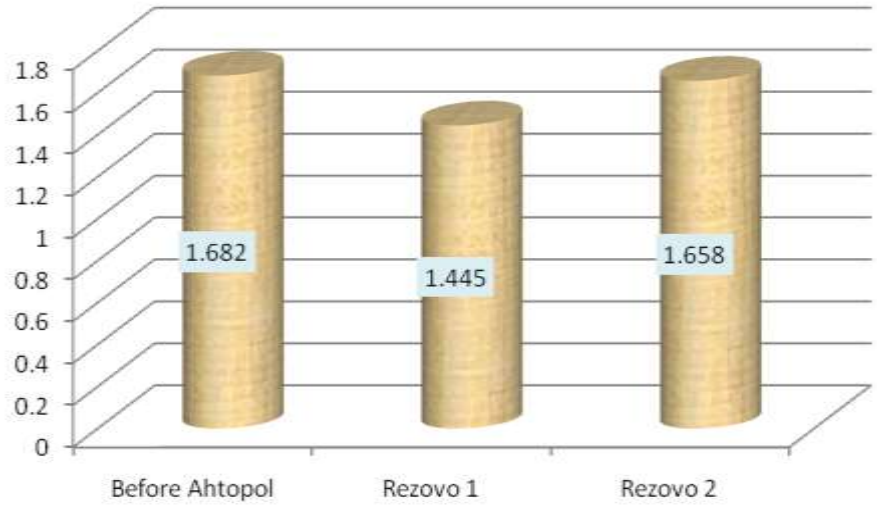

Figure 38. Diversity index values at sampling transects in 2012-2013 years.

Highest diversity index value among the stations was found to be at station I-2-3 (H'=3,30), and the lowest at station I-2-2 (H'=1.92). Evenness index (J') values ranged between 0.41 (Before Ahtopol) and 0.36 (Rezovo 1) (Fig. 39). There have been observed an even distribution of the identified species at sampling stations.

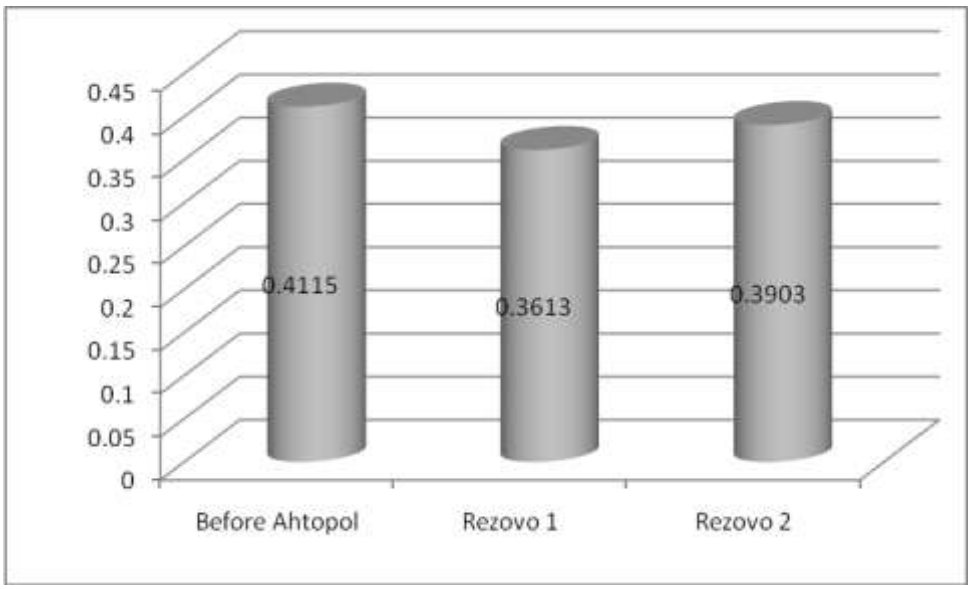

Figure 39. Eveness index (J') values at sampling transects - 2012-2013 years

When the results of Bray-Curtis Similarity Index analyze are taken into consideration, two separate species clusters are observed. The similarity between "Before Ahtopol" transect and Rezovo 1, Rezovo 2 transects was of 85 %. Between Rezovo 1 and Rezovo 2, the similarity was 95 % (Fig. 40).

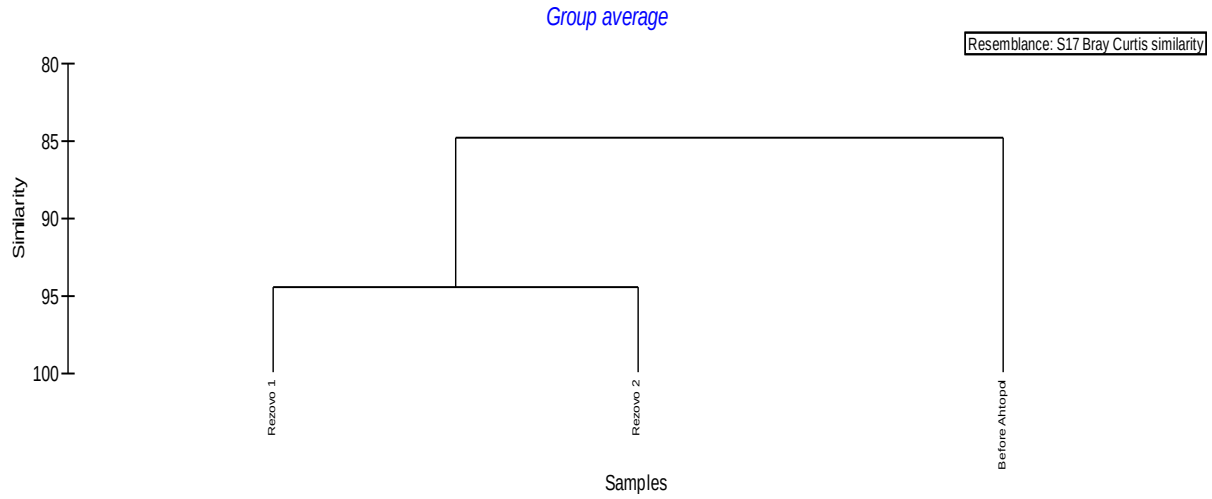

Figure 40. Dendogram graph Bray- Curtis similarity analisys for MISIS monitoring transects

In Table 12 could be seen the average biomass distribution of some invertebrates in meadows of *Cystoseira* community.

Table 12. Biomass distribution of *Cystoseira* foulings *(Mytilus galloprovincialis, Mytilaster lineatus, Tricolia pullus, Rissoa splendida, Bitium reticulatum, Amphibalanus improvisus*) - 0-10m depth.

Transect	Biomass ($g.m^{-2}$)	stdev
Before Ahtopol	208.27	272.85
Rezovo 1	295.43	295.05
Rezovo2	401.77	413.63

Ecological status

The ecological status assessed with ecological index-ecological quality ratio (EI-EQR) from 0 - 5m depth for 2012 (Table 13) and 2013 (Table 14) year is high. The ecological status in all the investigated transects in 2012 at 0-3m depth is high (Fig. 41).

Table 13. Ecological status and ecological quality ratio of ecological index in 2012 year from 0-5m depth

year 2012						
Depth/Transect	Rezovo1	Rezovo2	Before Ahtopol	Rezovo	Sinemoretz	Varvara
0-3m	0.94	0.95	0.97	0.85	0.9	0.93
5m	0.95	0.97	0.93	0.9		

Table 14. Ecological status and ecological quality ratio of ecological index in 2013 year at 5m depth

2013 year		
Rezovo1	Rezovo1	Rezovo2
0-3m		
5m	0.94	0.95

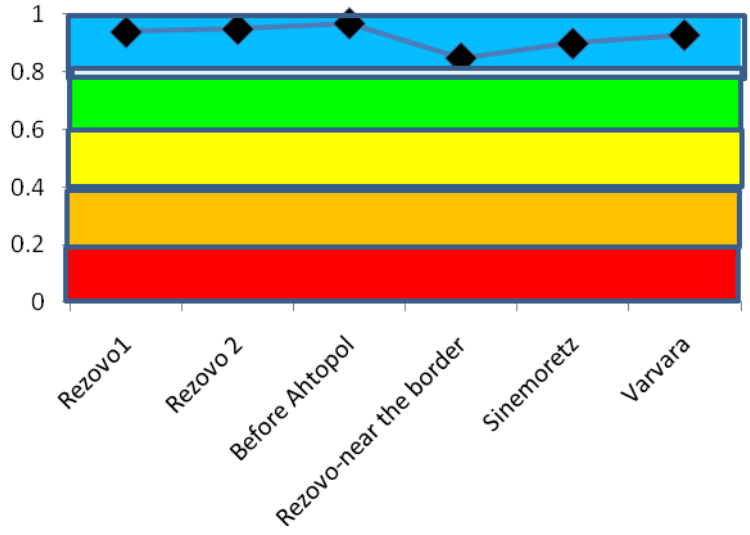

Figure 41. Ecological status of all the investigated transects in 2012 at 0-3m depth (Blue-high status; green-good status; yellow- moderate status; orange-poor status; red-bad status)

In Table 15 is presented ecological status at 0-1m depth, established with ecological index-ecological quality ratio (EI_EQR) for Bulgarian part of protected area and compared with ecological status established for Turkish side (0.2 m) (Table 16). For Bulgarian part ecological status is high and in Turkish side it is good. The good status is due to lower biomass of *Cystoseira* and *Zostera* at 0-2m depth, which is normal for this depth in comparison with 0.5-1m depth.

Table 15. Ecological status, ecological quality ratio of ecological index in Bulgarian part of protected area at 0-1m depth (blue-high ecological status)

depth	Rezovo1	Rezovo 2	Before Ahtopol
0-1m	0.92	0.92	0.92

Table 16. Ecological status, ecological quality ratio of ecological index in Turkish part at 0-0.2 m depth (yellow-moderate ecological status, green- good ecological status)

B3-j13	B3-n12	B3-n12	EI-EQR (aver)
0	0	0	0.64

For comparison is given the ecological status of macrophytobenthic communities in Sinemorets and Varvara which are part of the Strandzha protected area estimated too with Ecological index in 2006-2008 years. For these years, final ecological status in Sinemoretz was high (0.85) and for Varvara it was on the border of high/good (0.8). In 2012 improvement is noticed in ecological status (see Table 17).

Table 17. Ecological index-Ecological Quality Ratio, estimamed for macrophytobenthic communities, 2006 - 2008)

Transect/year	2006	2007	2008	EI-EQR average
Sinemoretz	0.82	0.89	0.85	0.85
Varvara	0.75	0.82	0.81	0.8

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Species Composition of macrophyta

Based on the qualitative analysis, 13 taxa were identified, assigned to the following phyla: 6 species of Chlorophyta, 5 species of Rhodophyta, 1 species of Heterokontophyta and 1 species of Tracheophyta (marine phanerogams) (Table 18).

Table 18. Species list of the Macrophyta in the sampling seasons.

PHYLUM	CLASS	SPECIES
Chlorophyta	Ulvophyceae	*Cladophora laetevirens* (Dillwyn) Kützing, 1843
		Cladophora fracta (O.F. Müller ex Vahl) Kützing, 1843
		Cladophora glomerata (Linnaeus) Kützing, 1843
		Cladophora sericea (Hudson) Kützing, 1843
		Rhizoclonium tortuosum (Dillwyn) Kützing, 1845
		Ulva intestinalis L. 1753
Rhodophyta	Florideophyceae	*Ceramium virgatum* Roth, 1797
		Laurencia obtusa (Hudson) J.V. Lamouroux, 1813
		Lomentaria clavellosa (Lightfoot ex Turner) Gaillon, 1828
		Parviphycus antipai (Celan) B. Santelices, 2004
		Polysiphonia fucoides (Hudson) Greville, 1824
Tracheophyta	Monocots	*Zostera* (Zosterella) *noltei* Hornemann
Heterokontophyta	Phaeophyceae	*Cystoseira crinita* Duby, 1830

Among macrophytes, the perenial algae *Cystoseira crinita* dominated, forming a well delimited belt in the exposed midlittoral and infralittoral at 10 m depth. Other macrophytes species, such as *Cladophora* spp. in shallow waters, *Ceramium virgatum* and *Laurencia obtusa* at 0.2 - 5 m depth, were also found in sampled stations. *Cystoseira* plays an important role in the diversification of existing habitats, acting as a second substrate for the epibionthic vagile species such as the gastropods or the cryptic decapode *Pilumnus minutus*. Generally phytobenthic vegatation is dominated by *Cystoseira crinita*, while *Zostera noltei* forms patchy meadows on fine sand infralittoral.

Biomass of macrophytes species

The biomass values of macrophytes sampled in the region were given in Table 19. *Cystoseira, Ceramium virgatum* and *Cladophora* spp. were the dominant species in the region from this point of view.

Table 19. Biomass (wet weight. g.m^{-2}) of the macrophytes during the sampling seasons

Sampling Period	Stations	Species	Biomass
Nov-2012	B-1_HB	*Cladophora laetevirens*	51,05
		Cladophora sericea	26,6
		Rhizoclonium tortuosum	24,625
		Ceramium virgatum	130,625
		Laurencia obtusa	191,575
		Lomentaria clavellosa	27,1
		Parviphycus antipai	4,675
		Polysiphonia fucoides	161,125
		Cystoseira crinita	1432,25
	B-2_HB	*Cladophora glomerata*	9,4
		Cladophora laetevirens	68,75
		Ulva intestinalis	239,2
		Ceramium virgatum	104,375
		Parviphycus antipai	6,025
		Zostera (Zosterella) *noltei*	1029
May-2013	B-1_HB	*Ceramium virgatum*	180,35
	B-2_HB	*Cladophora fracta*	21,025
		Cladophora laetevirens	81,5
		Ulva intestinalis	504,55
		Ceramium virgatum	110,875
		Parviphycus antipai	2,325

July-2013	**B-1_HB**	*Cladophora laetevirens*	196,575
		Ulva intestinalis	813,65
		Parviphycus antipai	11,375
		Polysiphonia fucoides	228,425
		Cystoseira crinita	1594,55

1.3.2.3. Ecological state of the zooplankton populations

Species composition and taxonomic structure

Results studies indicated the occurrence of maximum 23 taxa (Veleka) (Table 20) ranked by the main taxonomic divisions belonging to phyla Protozoa, Cnidaria, Ctenophora, Annelida, Arthropoda, Mollusca, Chaetognatha, Chordata. The phylum Arthropoda was the most diverse (8 species and 4 taxa). Diversity richness was due to the presence of copepoda species *Acartia clausi, A. tonsa, Paracalanus parvus, Centropages ponticus, Oithona davisae* and cladoceras *Pleopis polyphemoides, Penilia avirostris* and *Pseudevadne tergestina* and benthic larvae (meroplankton). Obviously, the key groups of Copepods, Cladocera, and Meroplankton constituted a major component of plankton fauna together with *Noctiluca scitntillans*, Appendicularia and Chaetognatha (Fig. 42).

Table 20. Zooplankton species composition in Strandzha area

Station	Veleka	Rezovo1	Rezovo2
Layer	**10-0**	**18-0**	**18-0**
Species /Taxa			
Acartia (Acantacartia) tonsa Dana, 1849	*	*	*
Acartia (Acartiura) clausi Giesbrecht, 1889	*		*
Paracalanus parvus parvus (Claus, 1863)	*		
Centropages ponticus Karavaev, 1895	*	*	*
Oithona davisae Ferrari F.D. &Orsi, 1984	*	*	*
Harpacticoida sp.	*		
COPEPODA			
Pleopis poliphemoides (Leuckart, 1859)	*	*	*
Penilia avirostris Dana, 1849	*	*	*
Pseudevadne tergestina (Claus, 1877)	*		
CLADOCERA			
Polychaeta larvae	*	*	*
Bivalvia veliger	*	*	*
Gastropoda veliger	*	*	*
Cirripedia nauplii +cypris	*	*	*
Decapoda zoea	*	*	*

Station	Veleka	Rezovo1	Rezovo2
Layer	**10-0**	**18-0**	**18-0**
Species /Taxa			
Decapoda mysis		*	*
Larvae Bryozoa	*	*	*
Ascidacea larvae	*		
MEROPLANKTON			
Oikopleura (Vexillaria) dioica Fol, 1872	*	*	*
APPENDICULARIA			
Parasagitta setosa (Müller, 1847)	*	*	*
CHAETOGNATHA			
Engraulis encrasicolus (Linnaeus, 1758) ova+larvae	*	*	*
Pisces ova	*	*	
PISCES			
Noctiluca scintillans (Macartney) Kofoid & Swezy, 1921	*	*	*
DINOFLAGELLATA			
Aurelia aurita (Linnaeus, 1758)	*		
SCYPHOZOA			
Mnemiopsis leidyi A. Agassiz, 1865	*	*	
Beroe ovata Bruguière, 1789	*	*	*
Pleurobrachia pileus (O. F. Müller, 1776)		*	
CTENOPHORA			
TOTAL	**23**	**20**	**18**

Copepoda formed 40 % of the abundance community taxonomic structure in Veleka station followed by meroplankton (26 %) and *N. scintillans* (13%). Veleka station has differentated of the Rezovo 1 and 2, very similar in the taxonomic structure, by the benthic larvae domination (53 % and 59 % respectively) (Fig. 42 left panel). Biomass evenness among key groups in Veleka is obvious (figure 3.2-1 right panel) and resulted in higher Pielou index (J= 0.75). In Rezovo 2 *Beroe ovata* occurence leaded to its domination in the community structure (figure 3.2-1 right panel) while in Veleka and Rezovo 2 zooplankton community was shifted to *Noctiluca* (about 36 %) and meroplankton (19% and 32 %).

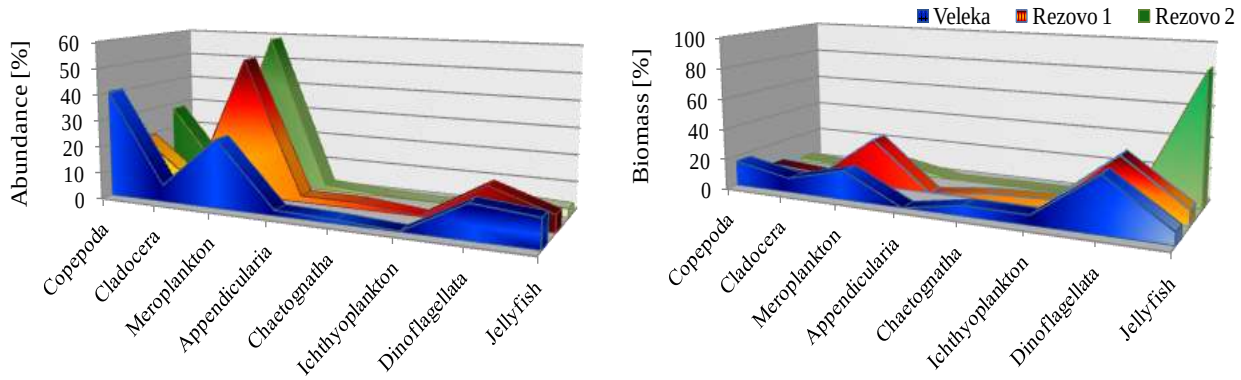


Figure 42. Percentage composition of different groups of zooplankton abundance (left panel) and biomass (right panel)

Zooplankton abundance and biomass

The obtained results for zooplankton abundance revealed a slight variation, only 1.5 fold (from 4063 ind.m^{-3} in Rezovo 1 to 6111 ind.m^{-3} – Rezovo 2), while the respective figures for the total biomass were from 119.856 mg.m^{-3} to 813.428 mg.m^{-3} (the range about 7 times) (Fig. 43). The numerically dominant copepods were *Acartia tonsa, Oithona davisae, A. clausi* and *Centropages ponticus*. Meroplankton, including the larvae of cirripedia, large crustaceans, various worms, bivalve and gastropod molluscs, represented a large fraction (average 2043 ind.m^{-3}±1074) of total zooplankton abundance. A number of other zooplankton taxa were also present, including harpacticoid, cladocerans, the larvacean *Oikopleura dioica*, chaetognaths and gelatinous medusa (Fig. 44A). Copepods and meroplankton were the most important groups in zooplankton community with large fluctuations (figure 3.2-3A). According to biomass presence of eggs and larvae of *B.ovata* (ctenophors) shifted the plankton community fauna (Fig. 44B).

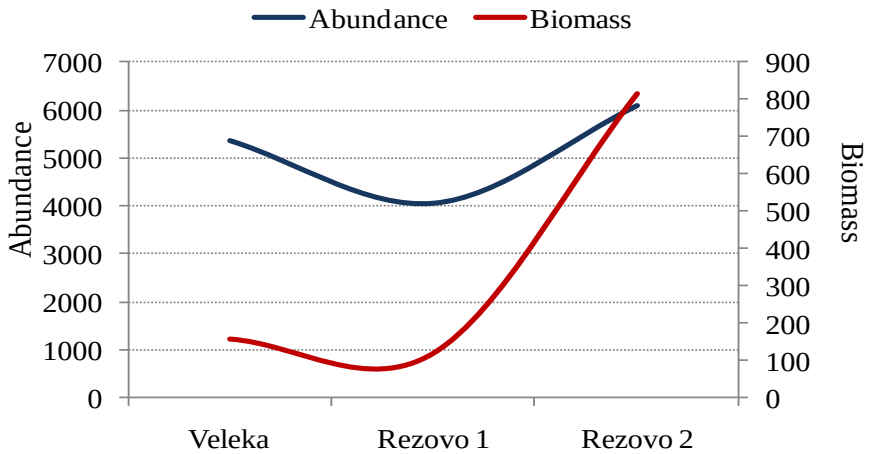
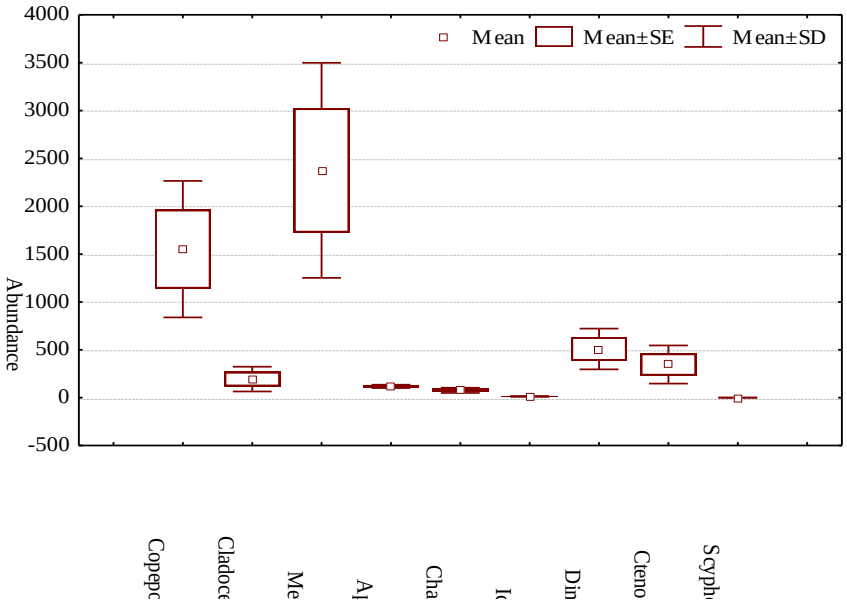
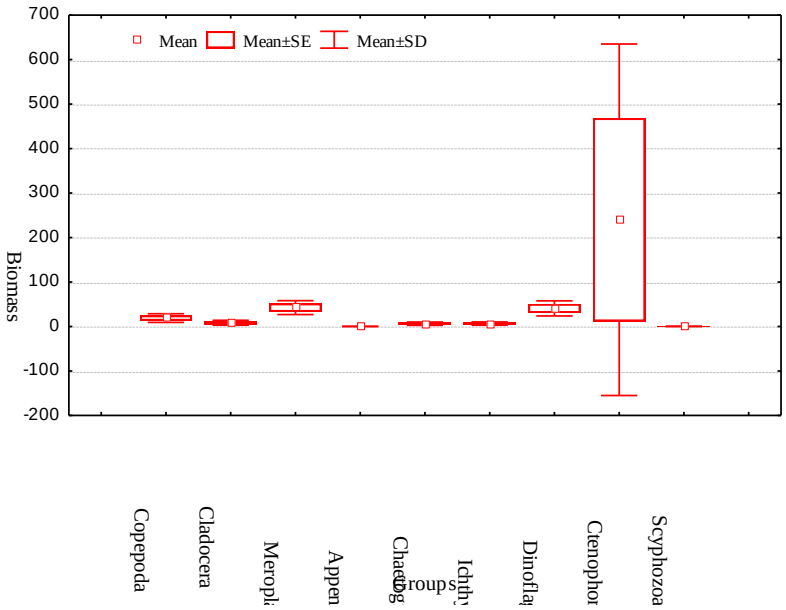


Figure 43. Variability of the total zooplankton abundance [ind.m^{-3}] and biomass [mg.m^{-3}] by sampling stations



A)

Figure 44. Box-whiskers plots of zooplankton abundance



B)

Figure 44. Box-whiskers plots of zooplankton abundance and biomass by key groups in the study area.

Ecological quality status

Zooplankton constitutes a diverse group of organisms with respect to size, life cycle and behaviour. Plankton fauna is an important link between the phytoplankton and higher trophic levels such as fish. Despite the importance of zooplankton as consumers of primary production and as

agents of energy transfer and nutrient cycling they have not been widely used as indicators of environmental condition and zooplankton is not included as a relevant quality element for the assessment of ecological status within Water Framework Directive. One of the methods for classification of ecological state of coastal ecosystems is the determination of the conditions under (near-) pristine period, namely reference conditions which were deduced from historic records. Based on the available long term zooplankton data (1967 – 2009) reference values of proposed indicators and the extent of deviation from these reference conditions were determined to classify the water quality to five status classes: high, good, moderate, poor and bad. To establish baselines and acceptable variability for specific indicators percentile approach was applied. 5 percentile (lower quartile) of a long term data set for definition of reference values based on the best available data and the 95 percentile (upper) for the selection of "bad values" (from the period of intensive eutrophication). Ecological Quality Ratio was evaluated as equal intervals between "high" and "bad" values and where it was appropriate expert judgment was applied.

Interannual variations in zooplankton density and biomass were very broad in space and time and not normally distributed ($p<0.05$). Long-term data analysis showed that zooplankton community with related metrics passed through positive (1966-1973) to negative phase (1980-1993) (Stefanova et al, 2008)

- ***Mesozooplankton biomass***

Proposed classification thresholds are presented in the Table 21 A in seasonal aspect. According to the classification limits for the summer season the state of three stations is poor due to very low biomass index (Table 21 B). Development of *N.scintillans* and *M.leidyi* in summer reflected on mesozooplankton biomass, since both negatively correlated with the biomass of plankton fauna. From other hand the period of investigation coincided with storm conditions which also lead to lower biomass values.

Table 21. Classification scheme and EQR based on mesozooplakton biomass [mg/m^3] A) by seasons and B) mesozooplankton biomass in July 2013

A)

Season/State	High	Good	Moderate	Poor	Bad
Spring	400-270	269-140	139-70	69-11	10
EQR	1	0.7	0.3	0.2	
Summer	1300-900	900-500	500-200	200-30	30

EQR	1	0.8	0.5	0.3	
Autumn	500-350	350-200	200-50	50-10	10
EQR	1	0.6	0.4	0.1	

B)

Index	Veleka	Rezovo I	Rezovo 2
Mesozooplankton biomass	76.5	62.5	95.4

- ***N. scintillans biomass***

The wide feeding spectrum (phytoplankton, zooplankton and detritus) of the species, development in high bloom concentrations especially in spring, usually after the mass development of phytoplankton, determines its ecological importance for the pelagic ecosystem (Kiørboe, Titelman 1998, Kiørboe et al. 1998, Dela-Cruz et al. 2003). *N.scintillans* density is usually higher in coastal areas where maximum phyto- and zooplankton were registered. For detection of classification limits the period of intensive eutrophictaion (1980-1993) was selected as "low" ecological state. Classification scheme is presented in table 3.2-4. According to the index, ecological status was defined as high with range from 21.84 to 54.96 mg.m^{-3} (Table 22).

Table 22. Classification and EQR based on *N. scintillans* biomass [mg/m^3] index (A) and *N. scintillans* biomass in July 2013 (B)

A)

	High	Good	Moderate	Poor	Bad
N.scintillans	< 60	60-250	250-500	500-4000	> 4000
EQR	1	0.95	0.9	0.2	

B)

State	Veleka	Rezovo 1	Rezovo 2
N.scintillans	54.960	45.28	21.84

- ***Shannon Wiener index***

Classification scheme was based on the maximum number of species found in the reference period, without taking into account the seasons. Initial separation to 5 environmental classes (according to WFD) is presented in Table 23. According to the proposed classification limits of Shannon Wiener index the ecological state varied between moderate (Rezovo1) and good (Veleka)

with exception of Rezovo 2 (less than 2 bit/ind) where *B.ovata* occurrence in the sample decreases the ecological status.

Table 23. Classification and EQR based on *Shannon Wiener* index (A) and diversity index in July 2013 (B)

A)

	High	Good	Moderate	Poor	Bad
H '	> 4	4 -3	3 - 2	2 -1	<1
EQR	1	0.78	0.56	0.33	

B)

	Veleka	Rezovo 1	Rezovo 2
H (A)	3.78	2.87	2.81
H (B)	3.41	2.97	1.05

- ***M. leidyi biomass index***

Assessment of populations of non-native species in the Black Sea could be used as a biological indicator for stability and health of the ecosystem (Moncheva, Kamburska, 2003). As a key factor for the mesozooplankton development, *M. leidyi* became a reliable indicator for the pelagic ecosystem dynamic and functioning of other trophic levels in the Black Sea food web. As threshold 4 gr/m^3 was taken under consideration (Vinogradov et al. 2005) (Table 24). Like most plankton metrics, changes in biomass of *M. leidyi* in the last 10 years widely ranged from 0.1 to 136 gr.m^{-3} ± 34. The National monitoring observations (2012-2013) also confirmed the large fluctuations of the species (average 12 g.m^{-3} ± 34.5, maximum – 209 g/m^3).

According to the *M. leidyi* biomass index ecological state varied from high to good (Table 24)

Table 24. Classification and EQR based on *M.leidyi* biomass [mg/m^3] index

A)

	High	Good	Moderate	Poor	Bad
***M. leidyi* biomass**	0	1-4	4-20	20-50	>50
EQR	1	0.96	0.75	0.38	

B)

State	Veleka	Rezovo 1	Rezovo 2
M. leidyi biomass	2.35	1.04	0.0

Comparison with 2012 and 2013 state

Prevalence in determining ecological state in the monitoring reports 2012, 2013 was the mezozooplankton biomass index. Nevertheless, we are considering hypothesis of lower mesozooplankton biomass values in southern part of the Black Sea coast (Kamburska &Valcheva, 2003, Kamburska, 2004) and the fact that according to various indices cases of high status were 35%, good and moderate (20%) and poor condition were only 25% (Table 25).

Table 25. Classification of ecological state of MPA area according to zooplankton indicators, comparison with monitoring data (2012-2013) in summer.

Indicators	Veleka		Veleka	Rezovo 1	Rezovo 2
	2012	2013	2014		
Mesozooplankton biomass	poor	poor	poor	poor	poor
Noctiluca scintillans biomass	high	high	high	high	high
Mnemiopsis leidyi biomass	high	good	good	good	high
Shannon-Wiener index	moderate	moderate	good	moderate	moderate

Analyzing zooplankton data used for determination of the classification could be conclude that status of the MPA coastal areas in July 2013 was defined from good to moderate. Differences in zooplankton taxonomic structure among areas were not insignificant. According to applied indicators and on the base of expert judgment (south area of Bulgarian coast close to MPA demonstrated lower biomass values but relatively higher biodiversity indices) the status of zooplankton community in Veleka station was evaluated as good, in Rezovo 1 and Rezovo 2 – moderate.

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Species Composition of Zooplankton

The overall results evinced a composition made of 7 holoplankton and 12 meroplankton groups. Holoplanktonic copepods and cladocerans were identified to genus and species level. Totally, there were 12 species of copepods and 4 species of cladocers found (Table 26).

Table 26. The species list of zooplankton in cruise periods.

SPECIES LIST	SAMPLING PERIOD			
	Nov-12	May-13	Jul-13	Oct-13
APPENDICULARIA				
Oikopleura (Vexillaria) dioica Fol, 1872	+	+	+	+
CLADOCERA				
Penilia avirostris Dana, 1849	+	-	+	+
Pleopis polyphaemoides (Leuckart, 1859)	-	+	+	+
Pseudevadne tergestina (Claus, 1877)	-	-	+	+
Evadne spinifera P.E. Müller, 1867	-	-	-	+
CHAETOGNATHA				
Parasagitta setosa (Müller, 1847)	+	+	+	+
COPEPODA				
Acartia (Acartiura) clausi Giesbrecht, 1889	+	+	+	+
Acartia (Acantacartia) tonsa Dana, 1849	+	-	+	-
Acartia sp.	+	+	+	-
Calanus euxinus Hulsemann, 1991	+	-	-	+
Centropages ponticus Karavaev, 1895	+	+	+	+
Oithona davisae Ferrari F.D. &Orsi, 1984	+	+	+	+
Oithona similis Claus, 1866	-	-	-	+
Oncaea sp.	+	-	-	-
Paracalanus parvus (Claus, 1863)	+	+	-	+
Semiparasitic Copepoda	-	-	+	+
Pseudocalanus elongatus (Boeck, 1865)	-	-	+	+
Harpacticoida	+	+	-	-
Copepoda nauplii	+	+	+	+
Copepoda egg	-	-	+	+
DINOFLAGELLATA				
Noctiluca scintillans (Macartney) Kofoid&Swezy, 1921	+	+	+	+
FORAMINIFERA	+	-	+	+
TINTINNIDA	+	+	-	+
MEROPLANKTON				
Actinotrocha larvae	+	-	+	+
Ascidacea larvae	-	-	+	-
Bivalvia larvae	+	+	+	+
Bryozoa larvae	-	-	+	+

SPECIES LIST	SAMPLING PERIOD			
	Nov-12	May-13	Jul-13	Oct-13
Cirripedia larvae	+	+	+	+
Decapoda larvae	+	+	+	+
Fish larva	+	+	+	-
Fish egg	+	+	+	-
Gastropoda larvae	+	+	+	+
Medusae planula	-	-	+	-
Micronisicus sp.	+	-	-	+
Polychaeta larvae	+	+	+	+

Seasonal Analysis of Zooplankton

The results of the cluster analysis of total species abundance and of MDS analysis performed on quantitative data are given in Figure 45a and 45b. Discrimination was prominent with a significant stress factor of 0.01. As figure suggests, four significant clusters (A, B, C and D) are formed among the stations at a similarity level of 0.60 (Fig. 45). The cluster analysis of seasonal results rendered two groups, explained by seasonal change of zooplankton community of the region. In order to support the results of MDS and Cluster analyzes, AnoSIM (Analyses of Similarity) analysis was performed. A statistically significant difference was found among seasons (Sample statistic-Global R: 0.947, Significance level of sample statistic: 0.001). No statistically significant difference was found among depths (Sample statistic-Global R: -0.033, Significance level of sample statistic: 0.744).

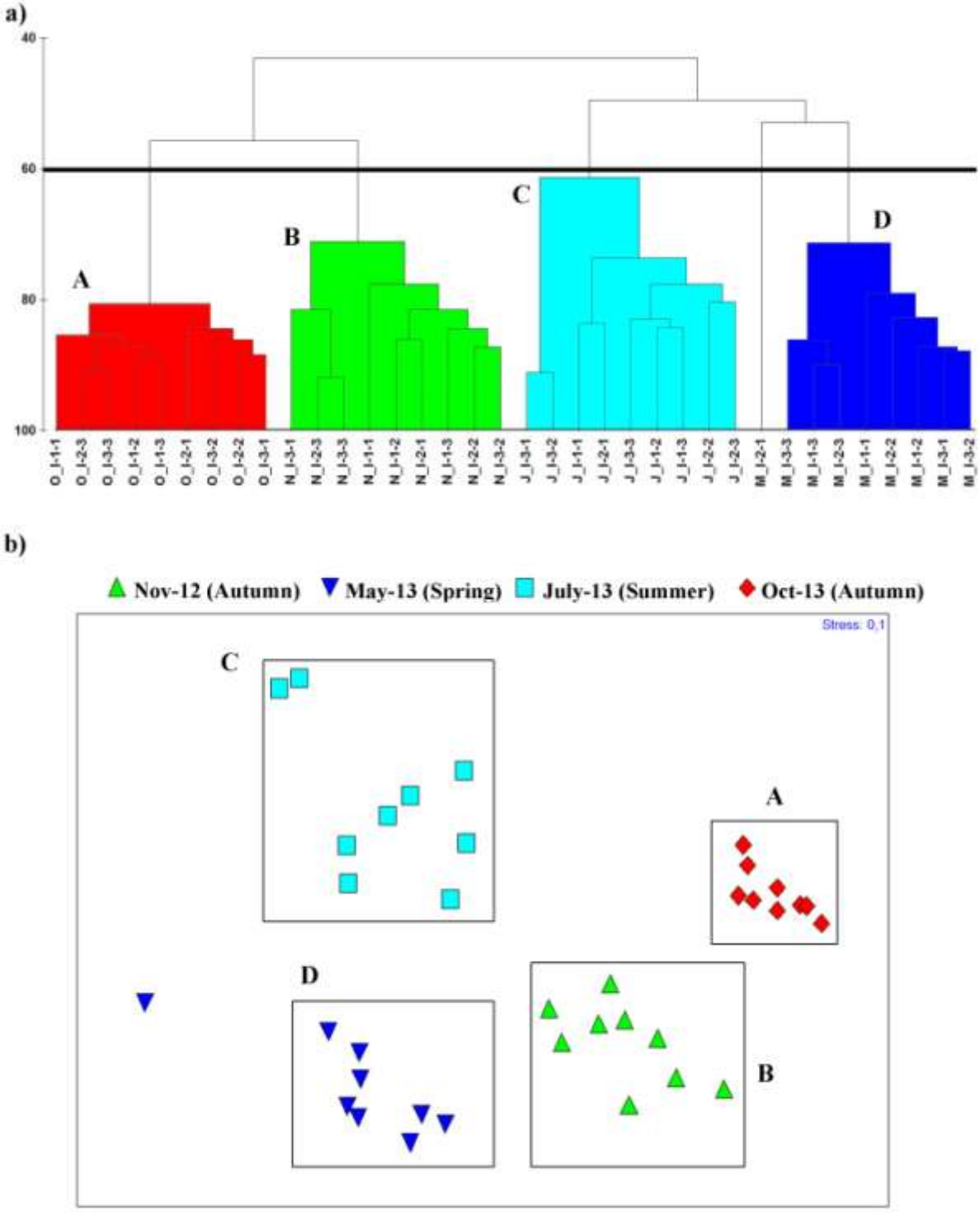

Figure 45. The dendogram (a) and MDS diagram (b) of quantitative clustering analysis of zooplankton in sampling seasons.

1.3.2.4. Marine habitats and fauna

STRANDZHA AREA

Marine habitats of European conservation importance, national subtypes and the associated benthic invertebrate fauna

The marine area of SCI Strandzha covers seven types of natural habitats listed in Annex I of the Habitats Directive as follows (MOEW):

1110 Sandbanks which are slightly covered by seawater all the time

1130 Estuaries

1140 Mudflats and sandflats not covered by seawater at low tide

1160 Large shallow inlets and bays

1170 Reefs

8330 Submerged or partially submerged sea caves

8330 Submerged or partially submerged sea caves

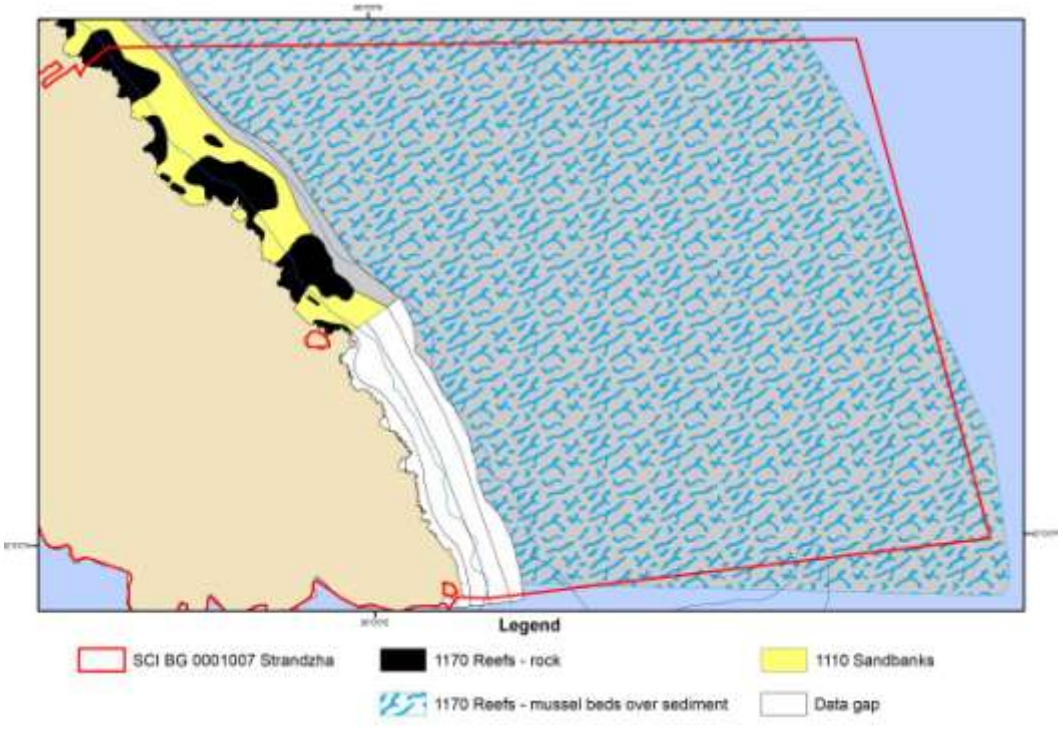

Figure 46. Map of the habitats of European importance 1110 Sanbanks and 1170 Reefs distribution in SCI Strandzha. Source: Todorova et al., 2012. Project "Extension of the marine Natura 2000 in the Bulgarian Black Sea", Contract № 7976/04.04.2011 between EMEPA and IO-BAS.

The predominant marine habitats in the area are the types 1110 Sandbanks and 1170 Reefs with two main subtypes – rocky reefs and mussel beds over sediments, as shown on the map of Fig. 46. The mussel beds distribution is reconstructed from pictures available in the grey literature (Kaneva-Abadzhieva, Marinov 1960, 1967). This information is already outdated, therefore the distribution and coverage of mussel beds is currently uncertain. The distribution of the sandbanks and rocky reefs is mapped based on recent and historical surveys of IO-BAS on the seabed substrates (Todorova et al., 2012).

1110 Sandbanks which are slightly covered by sea water all the time.

The habitat area is estimated at 2835.81 ha, comprising 7.6 % of the national habitat coverage (MOEW, Todorova et al., 2012, Todorova, Panayotova, 2011-D).

A range of national habitat subtypes/biotopes have been observed at the site encompassing coarse to fine sand and shell rubble as follows (Todorova et al., 2008, 2012):

- 1110-2. Coarse and medium shallow sand with *Donax trunculus*
- 1110-3. Fine and medium sand with *Lentidium mediterraneum*
- 1110-5. Sand and muddy sand with *Chamelea gallina*
- 1110-7. Organogenic sand and shelly gravel with *Modiolus adriaticus u Gouldia minima*

MISIS data on the invertebrate fauna from the characteristic habitat were collected in front of Rezovo and Silistar river mouths. The similarity analysis of the abundance and biomass data separated the coarse shelly sediments at Resovo from the fine sand at Silistar (Fig. 47). There are 4 communities differentiated:

- Community of the shelly gravelly fine sand at 5-10 m depth. The community is composed of typical psammophilous polychaetes *Protodorvillea kefersteini, Microphthalmus fragilis, Shistomeringos rudolfi* and turbellarians of the genus *Leptoplana*. Due to widely spread rocky bottom with interspersed patches of sand a number of species typical of the algal communities overgrowing the reefs were found too, such as the gastropods *Gibbula divaricata* and *Rissoa splendida,* the nereid worm *Perinereis cultrifera* and the clam *Irus irus.*

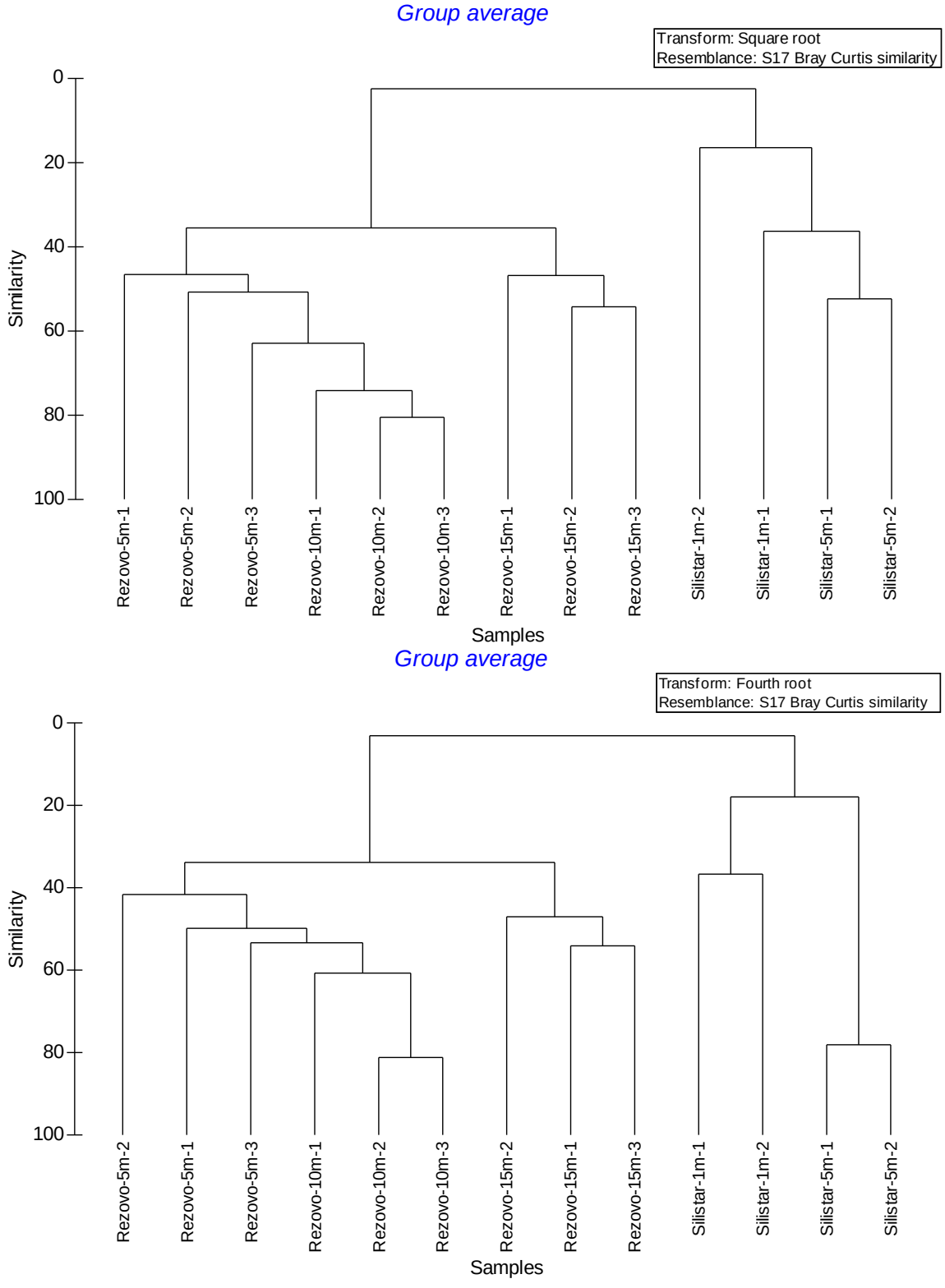

Figure 47. Dendrograms of the community similarity based on the abundance and biomass data of zoobenthos.

- Community of the shelly gravelly fine sand at 15 m depth. The community is distinguished by the gastropod *Cyclope neritea,* the lancelet *Branchiostoma lanceolatum,* the polychaetes *Lagis koreni* and *Glycera tridactyla* in addition to the above mentioned psammophilous polychaetes *Protodorvillea kefersteini, Microphthalmus fragilis*, and *Shistomeringos rudolfi*.
- Community of the fine sand at 1 m depth. The community is poor due to being disturbed by high wave energy in the mediolittoral zone, distinguished by the good swimmer isopod *Eurydice dollfusi*.
- Community of the fine-medium sand at 5 m depth. This is a typical example of *Donax trunculus* dominated community in shallow clean sand well flushed by wave action.

The complete list of the encountered zoobenthos species is given in Annex 3 to the Report. The overall zoobenthos diversity established by MISIS survey is high – 65 species recorded in 13 samples. The polychaetes are the richest taxonomic group with 30 species. Community indices (Table 27) indicate the highest zoobenthos diversity in the shelly gravelly fine sand at 5-10 m depth, while the lowest is observed in heavily wave disturbed, very shallow fine sands.

Table 27. Community indices of macrozoobenthos at the sampling stations in the sandy habitats at SCI Strandzha: S-species richness, N-abundance, d-Margaleff richness, J' – Pielou's evenness, H' Shannon diversity

Station-depth-replicate	S	N	d	J'	H'(log2)
Community of the shelly gravelly fine sand at 5-10 m depth					
Rezovo-5m-1	26	658	3.85	0.67	3.17
Rezovo-5m-2	15	142	2.82	0.75	2.94
Rezovo-5m-3	17	453	2.62	0.65	2.64
Rezovo-10m-1	25	1117	3.42	0.47	2.18
Rezovo-10m-2	26	670	3.84	0.52	2.44
Rezovo-10m-3	24	752	3.47	0.50	2.28
Community of the shelly gravelly fine sand at 15 m depth					
Rezovo-15m-1	22	121	4.38	0.76	3.41
Rezovo-15m-2	19	630	2.79	0.24	1.01
Rezovo-15m-3	30	270	5.18	0.43	2.11

Station-depth-replicate	S	N	d	J'	H'(log2)
Community of the fine sand at 1 m depth					
Silistar-1m-1	4	8	1.44	0.95	1.91
Silistar-1m-2	3	3	1.82	1.00	1.58
Community of the fine-medium sand at 5 m depth					
Silistar-5m-1	6	31	1.46	0.80	2.06
Silistar-5m-2	4	11	1.25	0.81	1.62

Ecological state according to the biological quality element (BQE) zoobenthos

The ecological state of the coastal marine waters of SCI Strandzha is assessed within the national marine monitoring under the WFD carried out by IO-BAS. As shown on the map of Fig. 48 the results for the BQE zoobenthos in the sediments at the monitoring stations situated in front of the river mouths of Varvara and Veleka Rivers the ecological status of the coastal water body BG2BS000C012 was good in 2013 (Todorova, 2014).

According to Todorova (2014) during the period 2006-2013 the benthic macrofauna in the coastal waters of SCI Strandzha suggests good ecological status maintained on the overall at Varvara station, however, a decreasing trend evident in the values of the biotic index M-AMBI and a drop to bad status in 2012 signal ecological degradation (Table 28). At Veleka station the status decreased from high to good, a trend that is warning of environmental risk.

Table 28. Ecological state of the coastal marine waters at Varvara and Veleka monitoring stations during 2006-2013 according to the multivariate biotic index M-AMBI, BQE macrozoobenthos; Blue-high state, green – good state, orange – poor state

Water body	Monitoring station	2006	2007	2008	2012	2013
BG2BS000C012	Varvara	0.84	0.83	0.74	0.28	0.56
	Veleka	0.91	0.82	0.92	0.65	0.62

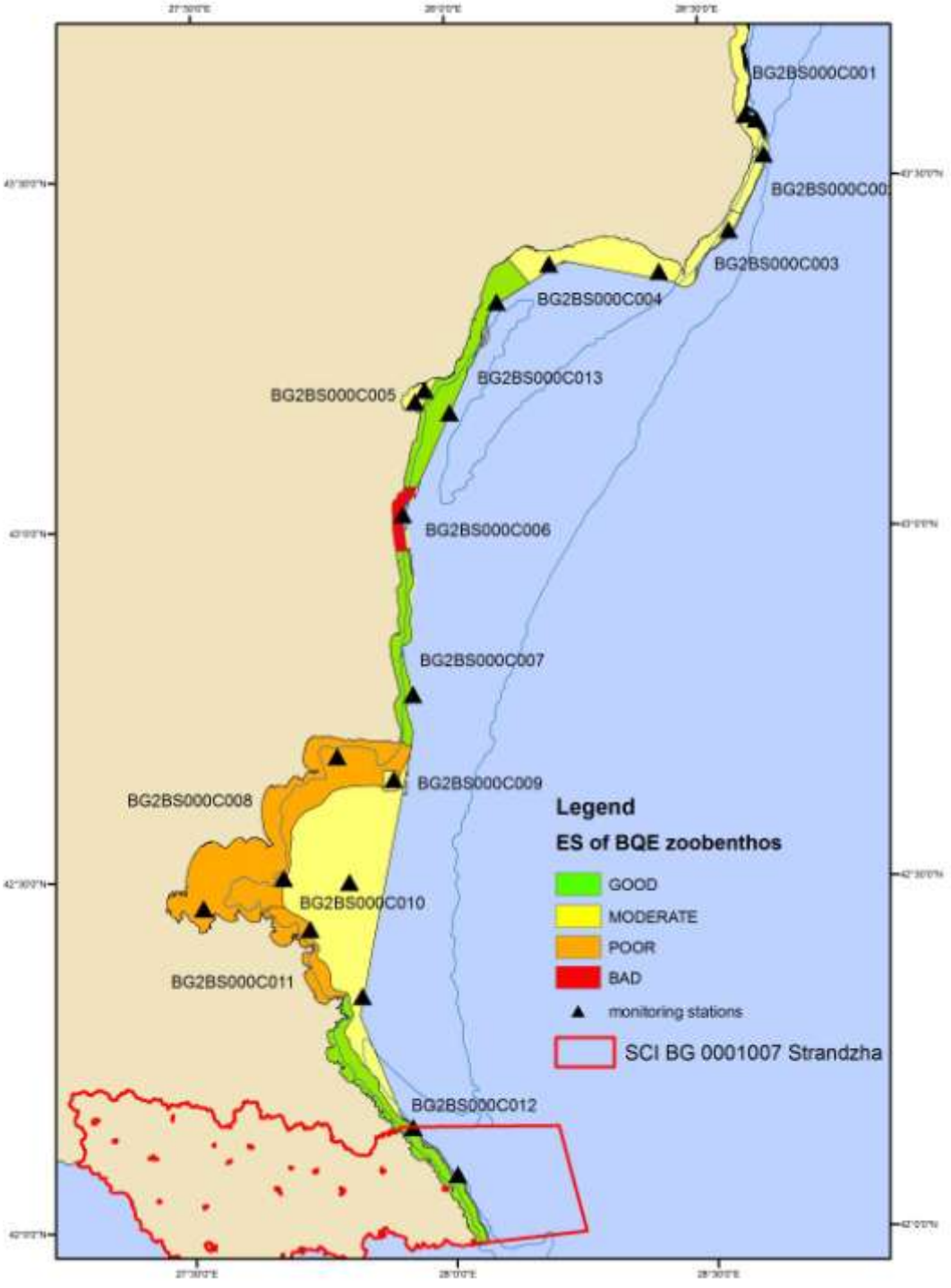

Figure 48. Map of the ecological state of the coastal marine waters according to the BQE macrozoobenthos in 2013.

1130 Estuaries

There are two large estuaries of Veleka and Resovska rivers and two smaller estuaries of Silistar and Butamiata rivers in SCI Strandzha.

The habitat area is estimated at 20.33 ha (MOEW).

The typical of the estuaries higher plants are *Phragmites australis, Typha latifolia, T. angustifolia, Sparganum erectum, Equisetum maximum, Ceratophillum spp., Zostera marina, Lemna* spp.

The estuaries provide shelter for a number of species of European importance: 1032 *Unio crassus*, 1171 *Triturus karelinii*, 1188 *Bombina bombina*, 1130 *Aspius aspius*, 1134 *Rhodeus amarus*, 1137 *Barbus plebejus*, 1141 *Chalcalburnus chalcoides*, 1220 *Emys orbicularis* and 1222 *Mauremys caspica*.

1140 Mudflats and sandflats not covered by seawater at low tide

The habitat area is estimated at 7.56 ha (MOEW).

The mediolittoral sands, well flushed by the wave action, are inhabited by dense populations of the small wedgeclam *Donacilla cornea* (Fig. 49, Todorova et al., 2008, 2012). The habitat is included in the Red Book of Bulgaria as vulnerable (Todorova, 2011).

Figure 49. Mediolittoral sand with *Donacilla cornea.* (Todorova et al., 2008)

1170 Reefs

SCI Strandzha contains almost the complete complex of the habitat 1170 national subtypes with high conservation importance listed as follows (Todorova et al., 2008, 2012,):

- 1170-1. Mediolittoral rock with barnacles *Chthamalus stellatus* and mussels *Mytilaster lineatus, Mytilus galloprovincialis*
- 1170-2. Mediolittoral rock with Corallina, Nemalion, Scytosiphon
- 1170-3. Infralittoral rock with perennial brown algae of the genus Cystoseira
- 1170-5. Lower Infralittoral rock with sciophilous association of *Phyllophora crispa*
- 1170-6. Infra- and circalittoral rock with mussels *Mytilus galloprovincialis* and *Mytilaster lineatus*
- 1170-8. Animal (sponge, hydroid) cover on rock
- 1170-9. Biogenic reefs of *Ostrea edulis*
- 1170-10. *Mytilus gallorpovinvialis* beds on sublittoral sediment

The majority of the above listed biotopes are also included in the Red Book of Bulgaria as nationally vulnerable or endangered (Todorova, Panayotova, 2011-A, B, C).

According to the historical information available in grey literature (Kaneva-Abadzhieva, Matrinov, 1960, 1967) the biotope of mussel beds 1170-10 covers vast area of the seabed, comprising 8 % of the national habitat area.

A remarkable unknown habitat - huge biogenic reefs built by the native flat oyster *Ostrea edulis* were found in 2007. This newly discovered marine habitat is deemed unique for European seas and probably the world, therefore a habitat of high conservation interest too (Micu and Todorova, 2007; Todorova et al. 2009).

The rocky reefs are characterized by an outstanding biodiversity of macrophytes, invertebrates and fish some of the representative species listed as follows:

Algae: *Ceramium strictum, C. diaphanum, Polysiphonia subulifera, Acrochaetium secundatum, Porphyra leucostica*, *Sphacelaria cirrhosa, Myriactula rivulariae, Corynophlaea umbellate*, *Gelidium spinosum, G. crinale, C. rubrum*, *Cladostephus spongiosus, Apoglosium ruscifolium, Polysiphonia elongata, Lomentaria clavellosa, Antithamnion cruciatum*, *Zanardinia typus.*

Invertebrates: Hydrozoa: *Aglaophenia pluma*, *Coryne* sp. *Lucernaria* sp.; Bryozoa: *Electra pilosa*; Mollusca: *Bittium reticulatum, Mytilaster lineatus, Rissoa splendida, Tricolia pulus*; Crustacea:

Athanas nitescens, *Clibanarius erythropus, Eriphia verrucosa, Hippolyte leptocerus, Palaemon adspersus, P. elegans, Pilumnus hirtellus;*

Fishes: *Gaidropsarus mediterraneus, Aidablennius sphinx, Chelon labrosus, Coryphoblennius galerita, Dicentrarchus labrax, Diplodus annularis, D. puntazzo, D. sargus, D. vulgaris, Gobius cobitis, G. niger, G. paganellus, Hippocampus guttulatus, Lisa aurata, L. saliens, Mesogobius batrachocephalus, Mugil cephalus, Neogobius cephalargoides, N. melanostomus, N. platyrostris, N. ratan, Nerophis ophidion, Parablennius sanguinolentus, P. tentacularis, P. zvonimiri, Pomatoschistus marmoratus, P. minutus, Salaria pavo, Scorpaena porcus, Symphodus cinereus, S. ocellatus, S. roissali, S. tinca, Syngnathus abaster, S. tenuirostris, S. typhle, S. variegates*.

Species of European importance

Fish

The Standard data form for SCI Strandzha inventories three resident marine fish species listed in Annex II of the Habitats Directive (MOEW):

1103 *Alosa falax*

4125 *Alosa immaculata*

4127 *Alosa tanaica*

Alosa falax is deemed vagrant to the Bulgarian Black Sea.

The review of the available data on *Alosa spp.* occurrence in the frame of the project "Extension of ecological network of NATURA 2000 in Bulgarian Black Sea" (Todorova et al., 2012) indicates significant population of *A. immaculata* and *A. tanaica* present in the marine area of SCI Strandzha. The fresh water inflow from the relatively large and very clean rivers Veleka and Resovska along the Strandzha coast is a prerequisite for Alosa spp to be attracted and kept in front of the estuaries being an anadromous species. The marine area is deemed important feeding grounds for Alosa spp, as well as a migration route towards the Danube River. The site covers the complete habitat complex for the shad including marine and estuarine habitats of high ecological status, good trophic conditions and relatively low fishing pressure.

The marine area included in the SCI is estimated to encompass 3 % of the national marine habitat for shad, based on the potentially suitable area to 200 m depth.

Mammals

Two small cetaceans listed in Annex II of the Habitats Directive are resident in the marine area of SCI Strandzha (MOEW):

1349 *Tursiops truncatus*

1351 *Phocoena phocoena*

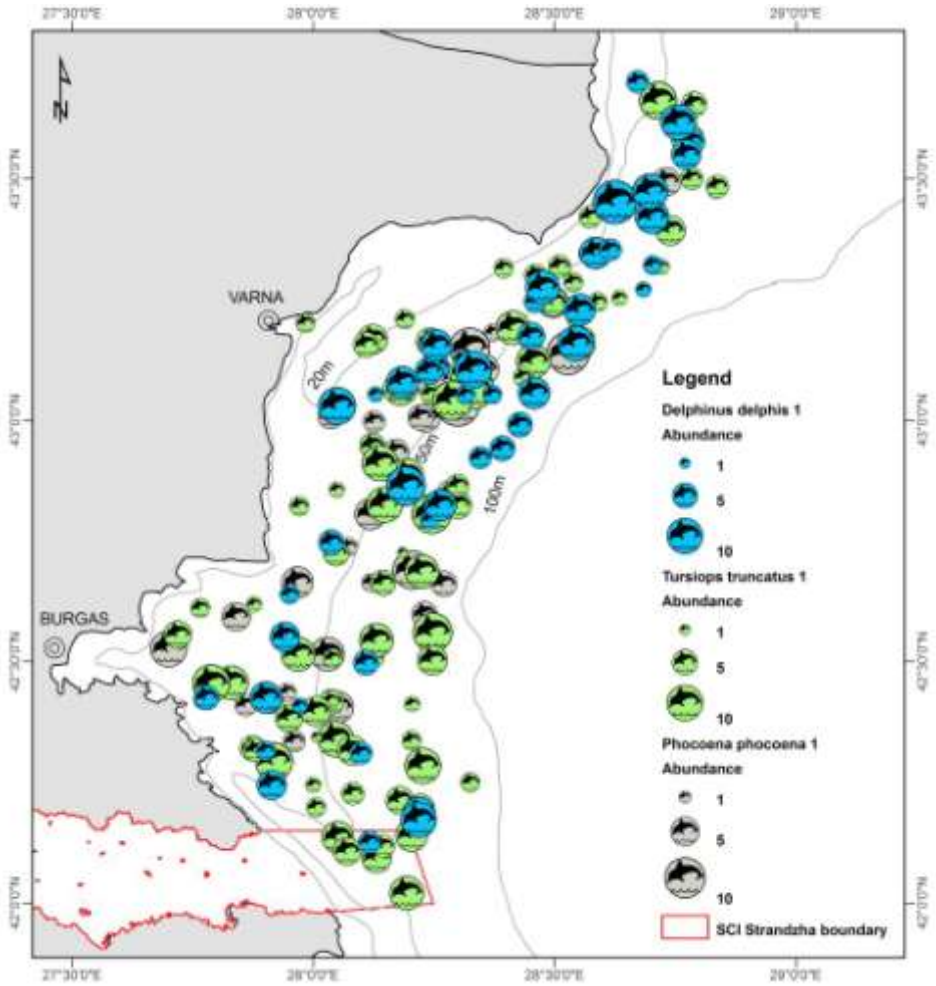

Figure 50. Opportunistic sightings of marine cetaceans in the Bulgarian Black Sea during the period 2006 – 2010 (Raykov, Panayotova, 2012)

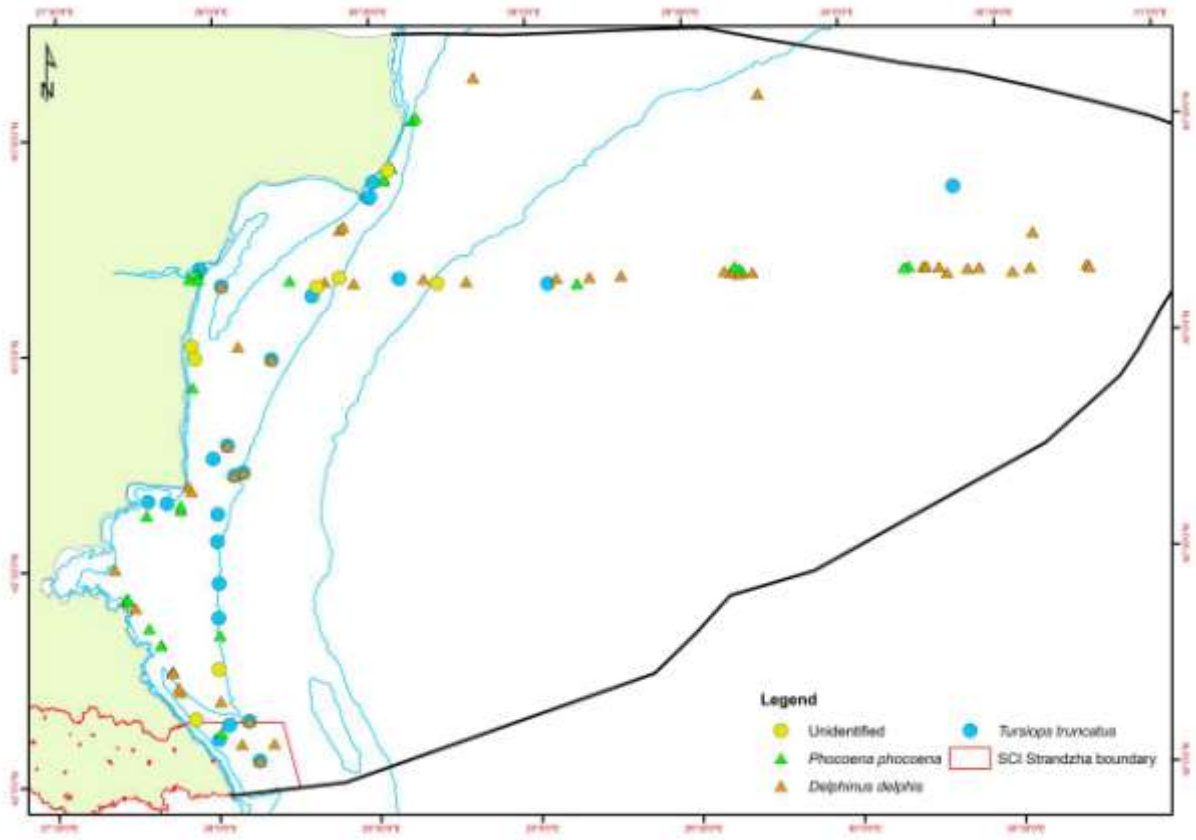

Figure 51. Opportunistic sightings of marine cetaceans in the Bulgarian Black Sea during the period 2006 – 2010 (Panayotova, Raykov, 2013)

The area is deemed an excellent habitat for the cetaceans (Todorva et al., 2012). There are significant stocks of demersal fishes that are the main food for the bottlenose dolphin and the harbour porpoise. The main pelagic fish stocks migrate through the area providing food for the cetaceans during the reproduction and nursery period. Relatively low disturbance from human pressure also contribute to the conservation importance of the site for the cetaceans.

It is estimated that SCI Strandzha covers 3.4 % and 4.7 % of the potential national habitats of *T. truncatus* and *Ph. phocoena* respectively (Todorva et al., 2012).

Recent reviews by Panayotova (2013) and Raykov, Panayotova (2012) on opportunistic sightings of the cetacean species in the Bulgarian Black Sea validate the residence of all three species (including *Delphinus delphis*) in the Strandzha marine area (Fig. 50, Fig. 51).

The three cetacean species have high conservation priority. They are object of special protection at the national level being listed in the Biodiversity act, the Fisheries and Aquaculture Act,

the Protection of the Environment Act and the Bulgarian Red Data Book. The cetaceans are also protected by a number of international agreements and conventions to which Bulgaria is a signatory country: Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and contiguous Atlantic area (ACCOBAMS); Convention on the protection of the Black Sea against pollution (Bucharest convention), Convention on the Conservation of European Wildlife and Natural Habitats (Berne convention), Convention on the Conservation of Migratory Species of Wild Animals (Bonn convention).

Other important species of flora and fauna

The Standard data form for SCI Strandzha inventories other species of conservation importance being listed in the national Red Data Book and/or International Conventions and/or Endemics.

The list accounts for 1 marine mammal, 22 marine fish species, 9 marine invertebrates and 3 algae (Table 29).

Table 29. Other important species of marine flora and fauna listed in the Standard Data Form for SCI Strandzha and motivation for their listing.

	Bulgarian Red Data Book	Endemic	Bucharest Convention	International conventions	Other reason
MAMMALS					
Delphinus delphis			**	Berne, Bonn	
FISH					
Acipenser gueldenstaedtii	CR		**		
Acipenser stellatus	CR		**		
Aidablennius sphynx			**		
Anguilla anguilla	EN				
Atherina boyeri					
Coryphoblennius galerita					
Dasyatis pastinaca					
Hippocampus guttulatus			**	Berne	
Huso huso	CR		**	Berne	
Liza ramada			*		
Mesogobius batrachocephalus		x	*		
Neogobius melanostomus		x			
Pegusa lascaris					
Pomatoschistus microps		x			
Raja clavata					
Lypophris (Salaria) pavo			**		
Sarda sarda			**		

	Bulgarian Red Data Book	Endemic	Bucharest Convention	International conventions	Other reason
Squalus acantias					
Symphodus ocellatus					
Syngnathus typhle			*		
Trachinus draco					
Uranoscopus scaber					
INVERTEBRATES					
Eriphia verrucosa			**		
Pachigrapsus marmoratus			*		
Chamelea galina					Habitat defining
Ostrea edulis			**		Ediphicator
Donacilla cornea			**		Habitat defining
Lentidium mediterraneum					Habitat defining
Mythilus galloprovinciallis					Ediphicator
Xantho poressa			**		
Donax trunculus					Habitat defining
ALGAE					
Cystoseira barbata			**		Ediphicator
Cystoseira crinita			**		Ediphicator
Phyllophora crispa			**		Ediphicator

Notes:
* Rare species according to Black Sea Biodiversity and Landscape Conservation Protocol
** Endangered species according to Black Sea Biodiversity and Landscape Conservation Protocol

IGNEADA AREA

Habitats Description of the Region

The habitat types determined in the region are as follows.

1. Boulders and blocks: This habitat is host for many microhabitats. Big sized rock and boulder piles appear on the midlittoral of rocky shores, at the base of rocky cliffs (Fig. 30).

Figure 30. Boulders and blocks from İgneada coast.

2. Supralittoral rocks: The upper-littoral rock is situated above the sea level and becomes wet to due wave foam or during storms (Fig. 31). This type of habitat is populated by the lichens, isopod crustaceans *Halophiloscia couchii* and *Ligia italica* and the *Pachygrapsus marmoratus* crab.

Figure 31. Supralittoral rocks from İgneada coast.

3. Lower Midlittoral rocks: The lower midlittoral rock is located in the lower part of the wave breaking area and it is covered by water most of the time. *Cystoseira*, calcified *Corallina officinalis* and *Ulva*, *Cladophora* and *Ceramium* algae occur (Fig. 32).

The fauna is characterized by *Balanus*, *Mytilus* and *Mytilaster*, bryozoa, amphipod and isopod crustaceans, *Pachygrapsus marmoratus* and *Eriphia verrucosa* crabs.

Figure 32. Lower Midlittoral rocks from İgneada coast.

4. Infralittoral rock with photophilic algae: This habitat type is situated immediately under the lower midlittoral level and stretches down to the inferior limit of the spreading of the photophilic algae. It include *Cystoseira* and other algae (Fig. 33).

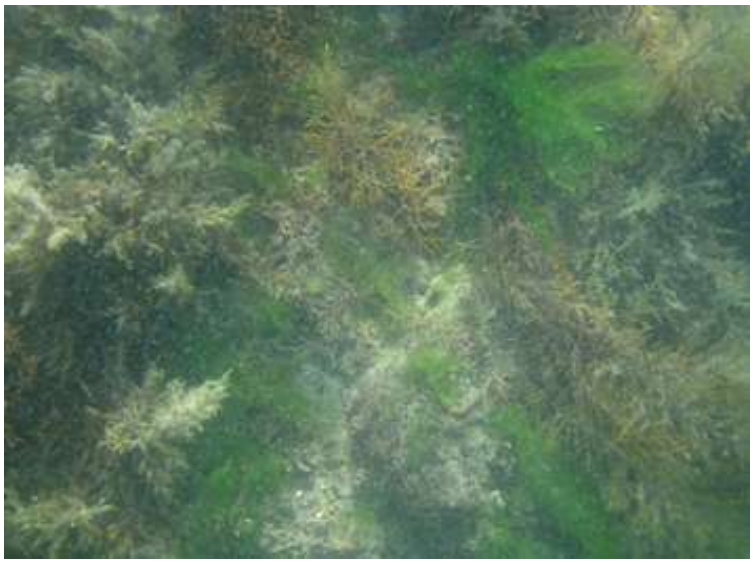

Figure 33. Infralittoral rock with photophilic algae from İgneada coast.

5. Infralittoral rock with Mytilus: This habitat type is down to 20 m deep (Fig. 34). The fauna is diverse, including some sponge, hydrozoas, bryozoans, polychaets, mollusk, crustacean and tunicats.

Figure 34. Infralittoral rock with *Mytilus* from İgneada coast.

6. Supralittoral algal deposit areas: This habitat type occupies the beach part that is covered by water only during storms (Fig. 35). The deposits are made of the materials brought by the sea (algae, died phanerogam leaves, wood pieces, organism corpses). This habitat host talitrid amphipods and isopods.

Figure 35. Supralittoral algal deposit zone from İgneada coast.

7. Zostera meadows on fine sand: *Zostera* (*Zosterella*) *noltei* and *Z. marina* forms vegetation in sheltered areas 7 meters deep (Fig. 36).

Figure 36. *Zostera* meadows from İgneada coast.

8. Muddy sands inhabited by *Upogebia* (Fig. 37): They are encountered in many places at 10-20 m muddy and sandy areas.

Figure 37. *Upogebia pusilla* from İgneada coast.

The shores of İgneada are generally rich in habitat diversity. Sand, gravel, rock, mud, alage and phanerogams caused formation of different types of habitats.

Soft Bottom Macrozoobenthos community

As a result of the samplings conducted in the survey area the highest number of species was recorded in May - 111 species, followed by July with 97 species, October with 82 species and November with 67 species (Annex 2 and Fig. 38).

The highest number of species in all four periods was determined at station I-2-2 in May with 53 species, while the lowest one was recorded at station I-3-1 in November with 3 species (Fig. 59).

Distribution of the number of individuals among stations revealed that the highest number of individuals was found at station I-2-2 with 105,280 ind.m^{-2} in July, while the lowest one was at station I-3-1 with 80 ind.m^{-2} in November (Fig. 38).

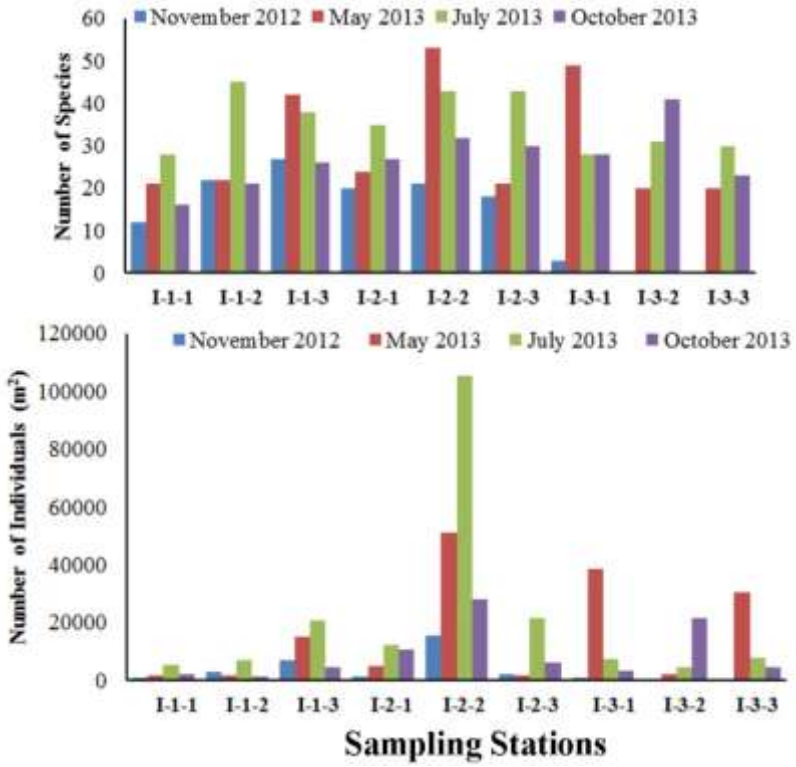

Figure 38. Distribution of number of species and individuals among stations

Hard-Bottom Macrozoobenthos

As a result of the evaluation of the obtained material, the identified taxa from the three different periods are given in the Annex 3.

The areas of İğneada close to the Bulgaria borderline are charactarized by steep rocks streched on relatively short distance along the coastal line. These rocks are observed to be densely covered by the algae *Cystoseira.* These algae provide shelter to many invertebrates against strong wave actions. Extensive sandy shores lies between İğneada Harbour and Lake Mert.

The taxonomic assessment of hard bottom communities of the area carried out in November 2012 revealed a number of 20 main taxa inhabiting here. The dominant species were *Polyophthalmus pictus* from Polychaeta and *Mytilaster lineatus* from Mollusca. In May 2013, an increase number of species (30 taxa) was recorded. *Mytilaster lineatus* and *Mytilus galloprovincialis*

from Mollusca were found to be the dominant species along with *Idotea baltica* from Crustacea. *Pilumnus minutus* which is an exotic species was also encountered at rocky shores covered by algae. A total of 22 taxa were identified in July 2013. *Polyophthalmus pictus* from polychaetes was found to be the dominant species.

In addition to the quadrate sampling, observations showed that the sponge *Dysidea fragilis* frequently occurs on rocks at 2-5 meters. These rocks were found to locally extend to a depth of 10 meters. *Eriphia verrucosa* and *Pachygrapsus marmoratus* from Decapoda were frequently seen on rocks.

Benthic Ecological Quality of the Region

The ecological quality of the region was tried to be estimated using AMBI (Borja et al., 2000) and M-AMBI (Muxika et al., 2007) indices depending on the zoobenthic taxa obtained from samplings. Accordingly, the general ecological quality of the research area was found to be good (Fig. 39 and 40).

According to the AMBI index, the results were found to range between 0 and 1.3 among all the stations and replicates showing that the general health of the benthic community is normal in the research area (Fig. 39).

AMBI	Dominating Ecological Group	Benthic Community Health	Site Disturbance Classification
0.0 < AMBI ≤ 0.2	I	Normal	Undisturbed
0.2 < AMBI ≤ 1.2		Impoverished	
1.2 < AMBI ≤ 3.3	III	Unbalanced	Slightly disturbed
3.3 < AMBI ≤ 4.3		Transitional to pollution	Meanly disturbed
4.3 < AMBI ≤ 5.0	IV-V	Polluted	
5.0 < AMBI ≤ 5.5		Transitional to heavy pollution	Heavily disturbed
5.5 < AMBI ≤ 6.0	V	Heavy polluted	
Azoic	Azoic	Azoic	Extremely disturbed

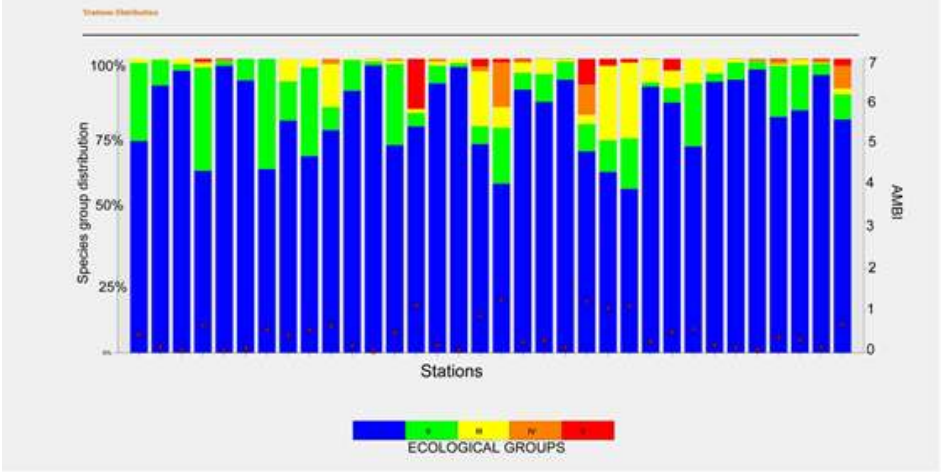

Figure 39. AMBI results of studied area.

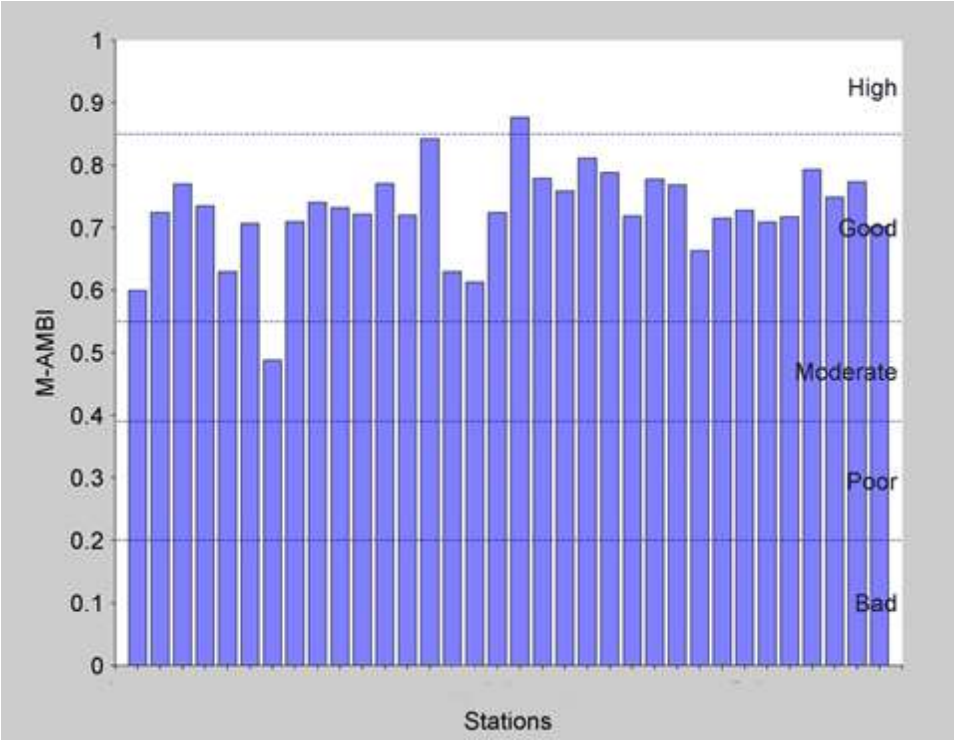

Figure 40. M-AMBI results of studied area.

1.3.3 Cultural

Strandzha. In addition to the nature conservation values, due to being a bridge between Europe and Asia Strandzha Mountain area has a very rich culture and history, ancient folklore customs and traditions.

Diversity of monuments of culture from all the historical epochs, supplements the specific spirit of the territory. Here complement each other almost all culture layers from Eneolit and bronze epoch, Thracian megalith culture, antiquity, Middle Ages, Bulgarian renaissance up to new history, in concentration, rarely seen in Europe. Unique phenomenon is the sunken towns in the Bulgarian part of the Black Sea. Objects established in inlets of Varvara, Ahtopol, Sinemoretz, Silistar, north of Rezovska estuary are evidence for developed Thracian culture with active navigation, shipbuilding, economic and commercial connections far away from Greece civilization. Some of the villages with their original architecture complement the uniqueness of nature in the park.

İğneada shed light on the history of the region around the many historical buildings are located. In Sivriler Çatalarmut village there are destroyed castles belonging to the Genoese. Also in the village houses belonging to the Thracians are reminiscent of old houses made of reeds. Again Sivriler Thracian graves in the village of Plum is said to be. Trak homes sited on poles at a height from the floor and the roof covered with reeds, and the environment is in a building. Fuzzy baths with lake where the creek flows into the sea, and the rest of Aypolos in the area called tumuli, mounds, old buildings, ruins and graves are located to forty. Swamp in the forest belonging to the Thracians sited on piles of old, wooden house is said to be the ruins, but exactly where is not known. Evliya Celebi travels in 1660 in the light passing through İğneada Bulanıkdere tiled over the estuary where about 300 digit wrote that a Greek settlement. İğneada many shipwrecks are located in the open. A ship carrying Jews during World War II was sunk in these waters. Again, the period of Romof a military ship sank in the open. In many guns, cannons and rifles are said to be. Park İğneada many balls in the construction of the Ottoman period and roses have been found. Solo has exploded at the thought of these balls would be dangerous. İğneada is a seaside resort on the coast of the Black Sea. Therefore, each year, the Black Sea Yacht is one of the popular destinations of the Tour. İğneada's position in terms of tourism should be evaluated.

Traditional local products:

- Non-timber forest products: Honey, mushrooms, wild fruits
- Marine products: fish, seashells as souvenirs
- Agriculture and crafts: Dairy products, organic fruits and vegetables, carpet weaving,
- Handmade wood products

1.4. Existing uses

1.4.1 Recreational

Overall the terrestrial and coastal habitats of **Strandzha area** are characterised by preserved naturalness and vast wild areas with relatively low fragmentation due to limited urbanization, roads and other infrastructure in the site. The marine habitats of underwater sandbanks and reefs have also preserved their natural character due to relative lack of human-induced disturbance or degradation. In addition to the nature conservation values, due to being a bridge between Europe and Asia Strandzha Mountain area has a very rich culture and history, ancient folklore customs and traditions.

Iğneada has a beach of 40-50 m width and 10 km lenght. In recent years, the tourist facilities, training camps and resorts founded by both public bodies and private enterprises are modern elements of forest and marine integrity. İğneada has entered into the process of being a Nature City with this structuring (Karaçam, 1995). İğneada beach has an interesting feature. Years ago MTA conducted a research at the area and found gold granules among sand grains. İğneada, among the most beautiful coasts of the Black Sea, has ideal water and sand to go swimming during June-July-August.

Dupnisa Cave located near İğneada is a golden natural wonder for adventurers and nature lovers. It is composed of two floors and three caves different in evolutional properties. Dupnisa cave is at 5 km south of Sarpdere Village, Demirköy district 50 km northeastern of Kırklareli. Total length of Dupnisa Cave System is 2720 m and it is a natural wonder flooded by visitors. Therefore in recent years, day trips are organized from nearby cities, mainly from İstanbul especially at weekends. Tent camping is developing owing to cave visits.

Longoz Forests of İğneada is 39th national park of Turkey and it is one of a few sites in Turkey and Europe and are visited for botanic purpose. Longoz forests are seen at three places in the world

and one of these is İğneada. Longoz forests, still harboring wild life, are protected by a project called GEF 2.

İğneada is on ornithologically significant migration path of Paleoarctic. Three bird species existing at İğneada and its vicinity are listed among (probable) endangered species according to European Red List criteria. Approximately half (194) of Turkish bird diversity (454 species) are observed in İğneada Longoz Forests within a year. The area is the passage way during autumn migration for many water birds and hunting birds but particularly for storks. Nine bird species occurring in the area are accepted to be the species indicating whether the İğneada ecosystem is healthy or not. İğneada and its vicinity is a significant potential natural tourism opportunity for bird watching due to the aforementioned features. Nature tourism continues during all seasons since different bird species visit the area at different time intervals.

1.5. Threat and conflict analysis

Pressures and threats analysis

Sources of pressures and threats to the marine area of SCI Strandzha

Strandzha is a relatively pristine area with few sources of land based and maritime human pressures as compared to the rest of the Bulgarian territory and coastal marine area.

Land based sources of pressures

Pressures from point sources:

Wastewater treatments plans (WWTPs) and sewers

The following point sources are identified, which might have potential impact on the marine area of SCI Strandzha:

- 3 WWTPs (Lozenets, Tsarevo, and Primorso-Kiten) discharge treated wastewaters to the Black sea by rivers or gullies. Although situated to the north of SCI Strandzha, the loads of BOD, N, P and other substances might reach the marine area of the protected site by means of the marine currents. The average loads for the period 2006-2011 are given in Table 30.
- 3 sewers of the coastal city of Ahtopol and the villages Varvara and Sinemorets discharge unthread wastewaters directly to the marine area of SCI Strandzha. The average loads of BOD, N and P for the period 2006-2011 are given in Table 30.

Table 30. Average loads of BOD total N and total P from the WWTPs and sewers. Source: Doncheva, 2013. In: Moncheva, Todorova et al., 2013.

Loads	BOD	NTOT	PTOT
WWTP Primorsko-Kiten	10.1	24.6	3.7
WWTP Lozenets	6.3	3.9	0.8
WWTP Tsarevo	54.7	11.7	0.0
Sewer Ahtopol	31.3	5.6	0.7
Sewer Varvara	44.5	0.0	0.0
Sewer Sinemorets	75.8	8.0	1.2

Rivers

- The rivers flowing into the coastal waters of SCI Strandzha are considered clean as compared to the rest of the Bulgarian rivers. Monitoring on the river loads is carried out only at the largest river in the site – Veleka River. An average of Veleka loads for the period 2006-2010 is given in Table 31.

Table 31. Average loads of BOD total N and total P from Veleka River for the period 2006-2010. Source: Doncheva, 2013. In: Moncheva, Todorova et al., 2013.

Loads (tonnes.year^{-1})	BOD	NTOT	PTOT
Veleka	664.3	69.9	62.6

Pressures from diffuse sources

Land use

Overall the diffuse pressures from different types of land use can be considered negligible. The predominant type of land use is broad leaved forest (80 %). Agricultural land is limited to the river valleys and some in the northern coastal area of SCI Strandzha. Urbanized areas are very few and of small scale, mainly along the coast (Ahtopol, Varvara, Sinemorets, Rezovo). Industrial areas are absent from the protected site.

Maritime sources of pressure

Shipping

The shipping traffic through the marine area of SCI Strandzha is of low intensity (Fig. 41). Therefore the pollution from shipping is deemed negligible.

Fisheries

The nearest fishing port is situated to the north boundary of SCI Strandzha at Tzarevo city (Fig. 41). Lack of fishing ports in the site is a prerequisite for a decreased pressure from fisheries.

The physical pressure on the seabed from mobile bottom fishing gear is assessed for 2011 based on the Vessel monitoring system (VMS) data provided by the National Agency on Fisheries and Aquaculture (Fig. 41) under MSFD Initial Assessment (Moncheva, Todorova et al., 2013). Low density of the trawling routes through SCI Strandzha marine area indicate little physical disturbance. Potentially, bottom trawling may exert physical disturbance over the mussel beds, which are qualified as a subtype of the habitat of European conservation importance 1170 Reefs.

The number of stationary pound nets placed along the coast of SCI Strandzha is limited as compared to the rest of the Bulgarian coast (Fig. 1.5.1). *Alosa immaculata* and *A. tanaica* may be potentially impacted during migration if catch ban is not introduced during the reproduction period.

Threats identified in the Standard Data Form for SCI Strandzha are given in Table 32.

According to it high rank is given to the pressures on the terrestrial habitats and species including forestry clearance, trapping, poisoning, poaching and hunting.

Moderate and low rank of the pressures is attributed to terrestrial, coastal and marine habitats.

Table 32. Threats and pressures identified in the Standard Data Form for SCI Strandzha

Rank (High/Moderte/Low)	Threats and pressures	Code	inside/outside/ both
H	forestry clearance	B02.02	i
H	trapping, poisoning, poaching	F03.02.03	i
H	hunting	F03.01	i
M	abandonment of pastoral systems, lack of grazing	A04.03	i
M	removal of beach materials	C01.01.02	i
M	electricity and phone lines	D02.01	i
M	pipe lines	D02.02	i
M	disposal of household / recreational facility waste	E03.01	b
M	pelagic trawling	F02.02.02	b

M	taking and removal of animals (terrestrial)	F03.02	i
M	taking / removal of terrestrial plants, general	F04	i
M	pollution to surface waters by industrial plants	H01.01	b
M	oil spills in the sea	H03.01	b
M	antagonism with domestic animals	K03.06	i
L	roads, motorways	D01.02	i
L	discontinuous urbanisation	E01.02	i
L	Professional passive fishing	F02.01	i
L	motorised vehicles	G01.03	i
L	other point source pollution to surface water	H01.03	o
L	diffuse pollution to surface waters due to household sewage and waste waters	H01.08	b
L	eutrophication (natural)	K02.03	i

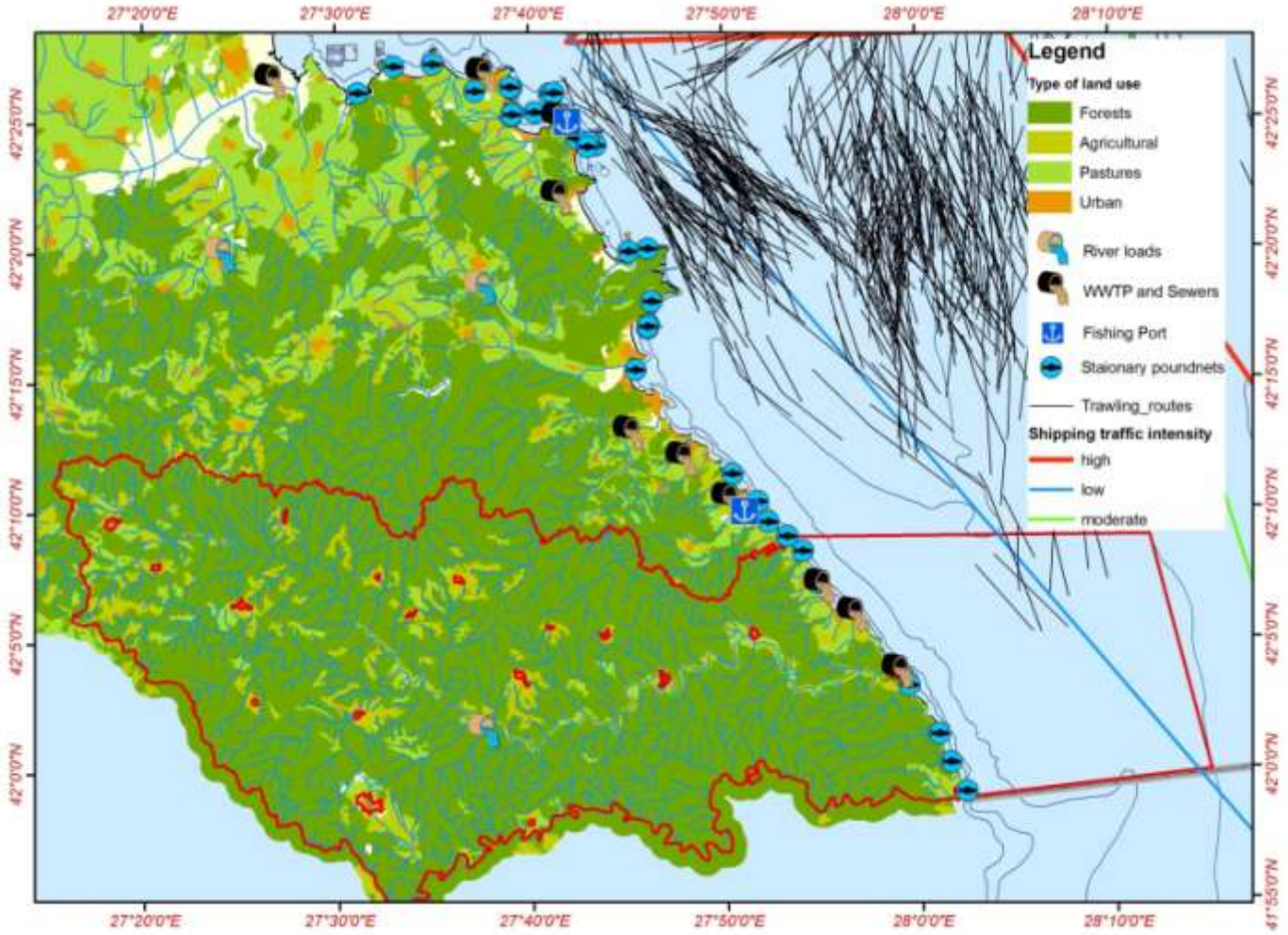

Figure 41. Map of land use and human pressure in SCI Strandzha and adjacent areas. Source: CORINE 2006 (MOEW), Moncheva, Todorova et al., 2013.

The major threat to İğneada Longos Forest is the plan by ISKI (Istanbul Water and Sewerage Administration) to divert water from the streams of the Istranca Mountains to Istanbul as a new source of potable water. Since any major reductions in the water input to the forest will have an irrevocable environmental impact, the General Directorate of Nature Conservation and National Parks has not given the necessary permission to ISKI. However, pressure for development is increasing, and the possible impacts must be studied before such plans are developed further.

The transborder biosphere reserve area comprises North-East of Thrace region. One of the most important settlements is Igneada located on the Bulgarian Turkish border and its surroundings have remained free from pollution and show a very high degree of biodiversity. Similarities exist on the other side of the border. Local people have made their living on the forest product and fishing. However, currently local people are experiencing difficulties in sustaining their life standards due to the application of stringent rules on forest products and decrease observed in the fishing activities as well as the increase in the national and international investments. Under these circumstances local people began to sell their land to people interested in building summer houses in the area which in turn brings about a new source of pollution.

Fishermen in İğneada are in great expectations in season of turbot fisheries. Large fishing vessels which come into the area cause damage to fish habitats by the nets they throw into the sea. Therefore, fish are not able to find shelter off İğneada shores like before. The decrease in fish stocks is getting conspicuous day by day because of inappropriate fishing methods. This is the main factor that threatens fisheries. During non-fishing months, turbots are brought to Igneada and Kiyikoy fishing ports by Romanian fishermen. Several local fishermen indicated that turbot stocks along the Bulgarian, Romanian and Russian coasts are in better condition and more abundant, which resulted in trials of Turkish fishermen found fishing illegally for turbot along these coasts. According to FAO Statistics (2007), the mean turbot catch at the Turkish Black Sea coast between 1970 and 2005 was 1,927 tones /year. Maximum production occurred during 1979 (5,250 tones), and the lowest production was 203 tones in 2003. More recently in 2007, Turkey produced 769 tones of turbot (346 tones from the western Black Sea), clearly demonstrating the results of overfishing. Kirklareli coast is one of the known feeding and spawning areas of turbot species and conservation measures should be taken to enable the population to recover (Sözen and Karataş, 2010) (Fig. 42).

Figure 42. Feeding and spawning areas of turbot (left) and feeding areas of sturgeons (right) in the Black Sea (UNEP/GRID-Arendal, 2001).

According to official records of the Kirklareli harbour master, there are a total of 192 registered fishery vessels (130 in Kiyikoy and 62 in Igneada fishing ports), from which 44 operate as trawl/purse seine boats. This number reaches 350-500 fishery vessels by the beginning of the fishing season, since hundreds of boats come to the area from other parts of the Black Sea to capture commercial stocks. Several local fishermen have complained about this situation because many purse seine boats originating from the eastern Black Sea use technological instruments (satellites, echo-sounders) for fishing anchovy, Atlantic bonito, bluefish etc., unlike the Kirklareli fishermen, who still prefer traditional techniques. Since many fish stocks in the area give their highest catch during their seasonal migrations, the presence of hundreds of fishing boats at that time causes great fishing pressure. The President of the Fishery Cooperative (supported by dozens of its members) suggests a quota system, which is likely to be the best way to conserve existing commercial stocks. However, concrete data is required to regulate local fisheries and the population dynamics of highly commercial species should be studied, in order to determine maximum sustainable yields and permissible off takes. The minimum landing sizes given in the official Fishery Bulletin should also be revised accordingly in the light of scientific research results. Special emphasis should be given to ecological studies of threatened species, especially for those commercially exploited and subjected to fishing pressure. Official fishery statistics indicate the significant severe decline of mackerels (*Scomber* spp.), dogfish shark (*Squalus acanthias*) etc. Understanding the biological characteristics of threatened fish will enable appropriate conservation measures to be taken (Sözen and Karataş, 2010).

Kirklareli Province has 60 km of coastline, lying within the proposed Yildiz Mountains Biosphere. Although it constitutes only 4.3% of the entire Turkish Black Sea coast, the local ichthyofauna is rich and merits appropriate management measures to protect biodiversity and sustain its utilization as a fishery. Such measures will need to be better informed by further detailed taxonomical and ecological studies to provide a sound basis for conservation planning (Sozen and Karatas, 2010).

Agriculture in the region

VILLAGE NAME	TOTAL AGRICULTURAL LAND	VINEYARD LAND	WOODLAND	FEED CROP PLANTATION	VEGETABLE GARDENING	GRAIN AND LEGUME LAND	FRUIT GROWING LAND	TOTAL PLANTATION LAND	FALLOW AND OTHERS
MERKEZ	10579	0	1260	130	216,9	599	615	2820,9	7758
ARMUTVEREN	5382	0	300	4	79,7	180	45	608,7	4773
İNCESIRT	3275	0	500	0	22,5	13	41	576,5	2699
BALABAN	2221	0	301	13	94,9	245	9	662,9	1558
SARPDERE	5652	0	500	0	27,2	135	2	664,2	4988
GÖKYAKA	3734	0	150	88	28,2	85	21	372,2	3362
YEŞİLCE	2630	0	300	28	27	130	7	492	2138
YİĞİTBAŞI	2567	0	25	77	17,4	184	174	477,4	2090
KARACADAĞ	1852	0	40	10	9,8	2	25	86,8	1765
HAMDİBEY	7921	0	50	25	32,2	110	82	299,2	7622
SİVRİLER	3084	0	875	20	49,1	257	73	1274,1	1810
BOZTAŞ	4580	0	152	20	63,3	670	0	905,3	3675
İĞNEADA	5688	2	184	15	79,2	110	6	396,2	5292

Figure 43. Total plantation land in the region (www.kirklarelitarim.gov.tr)

Iğneada longos forest with its rare natural areas and ecosystems is one of the most important of Europe. In 2007 it was declared as a national park and a management plan for the area has been set but it has not been published yet.

İğneada is considered within the category (A) of quality: "very clean" seawater. Many species of endemic plant species are hosted in the longos forests and their protection has a great importance.

In the same time, the economic value of the area is very high being on this ground subject of increased pressure and threat exerted by local people and other stakeholders. Future studies using economical analysis of ecosystem services uses in terms of sustainability should be set forth.

The freshwater and marine water provide habitats for many fish species and egg-laying areas, and are a migratory route for birds, providing a positive contribution to ecosystem conservation value.

2. Management

2.1 Goals and objectives (general and specific)

Development of the transboundary process

The first step for joint management of the Strandzha - Igneada is the recognition of the fact that the area has to be protected in a way that looks at ecological, not national, boundaries. On this purpose, a Joint Bilateral Declaration between Turkey and Bulgaria (or Memorandum of Understanding) should be adopted. In this document, both countries must declare their intention to coordinate their activities and measures in respect with the international agreements, mainly the EU Habitats and Birds Directive, the 1971, Ramsar Convention on Wetlands of International Importance, the Convention on Biological Diversity, the 1996, Black Sea Landscape Protocol and Black Sea Strategics Action Plan, the Water Framework Directive, The Espoo Convention on Environmental Impact Assessment in a transboundary context and the SEA Directive.

After the official document would has been signed, it is recommended to adopt the decision to establish an institutional Body (Advisory Committee) for common decisions taken regarding different aspects of joint management.

The following step should consist of adoption of common management principles and objectives for a large set of human activities. The guiding principle should sound as, for example: *"to achieve, as far as possible, a natural and sustainable ecosystem in which natural processes proceed in an undisturbed way and in compliance with the latest European requirements regarding the attaining of good ecological status, maintaining in a favorable conservation status of species and their habitats".* Common delimitation and common ecological targets should be set for all habitats and species identified as in need of protection and conservation.

What should be laid down in bilateral agreements are:

- a common long-term goal
- a common business plan for the management
- common procedures and timelines
- regularly revised common targets and objectives
- a regularly revised common management plan
- a common monitoring plan

- a common enforcement scheme

The general goals and objectives for realizing the Management Plan are:

- To set the general scheme for applying the measures of conservation, protection and restoration of species and habitats on short, medium and long time
- To provide an unique tool for supporting the decisions and actions of main actors and stakeholders involved in the process of management
- To be an effective tool to support the initiatives taken in favor of sustainable development and integration of cultural and socioeconomic values
- To set the ecological targets in accordance with ecological objectives set by the regional conventions and plans (BL SAP) and MSFD.

The specific goals and objectives are directed to:

- Set the legal and conceptual framework for actions of conservation and protection to be taken in both areas
- To encourage the participation as much as possible of local and international community at reaching the aims of conservation and sustainable development
- To draw up the specific measures of conservation for sensitive species such as mammals and certain species of alga, invertebrates and fishes
- To establish the zoning plan and in the context the different functional zones and uses

The Management Plan stipulates the main goals and objectives for managing the area

Management objectives	Goals
• Set the legal framework for carrying out the management responsibilities; • Issuing the administrative, social and financial resources for conservation and protection of the area; • To obtain the support of and enhance the communication between parties involved; • Increase the visibility and awareness on	• Approval of the Management Plan by the central authorities and its publication as legal document in both countries legislation; • Creation of administrative structure within the area with coordinated role and responsibilities in the field of managing the financial and human resources with maximum rentability for the areas; • Creation of well trained teams with socio - and psychological communicative capacity to interact

sustainable conservation and protection of nature;

- Sustain the initiatives taken with the aim of socio - economic development in a way that not jeopardizes the future generations' rights to enjoy the nature biodiversity and landscape.
- To encourage amiable solving of any matter and institute a clearing house mechanism to promote technical and scientific cooperation and joint programmes between Turkey and Bulgaria and maintain a permanent platform of dialog with stakeholders and authorities;
- Creation of task force teams formed of specialists and representatives of local community and authorities to periodically debate, analyze and decide on different plans, programmes and activities concerning socio-economic development of the area and its neighboring;
- Creation of Transboundary Clearing - House Mechanism.

Socio-economic objectives	Goals
• To ensure the sustainable socio-ecological development in the region by implying traditional local community, interethnic, multicultural and economic exchange of handcrafts skills, products and promoting ecotourism; • To promote among people the feeling of responsibility and proudness for living in the area • To create an open and permanent dialog between all categories of people with interest in the area • Education through training events and seminars, carrying out educational programs, and works with children and students on environment conservation related themes; carries out environmental events and campaigns, provides professional guides upon request.	• Creation of local facilities by creation of associations/crafts of traditional cultivators, producers (e.g., small fisheries using traditional fishing methods, traditional cuisine based on sea resources); limit as much as possible by prevailing of legal instruments the industrial exploitation of resources; • Encourage the creation of artistic association (painters, musicians, writers) and manifestations to promote the unique landscapes; • Limit the actions of intentional/accidental pollution especially coming from the land by organizing periodic informative communications and notes among the people and media; • Organizing periodic trainings and seminars dedicated to students, children and different professional categories (to promote eco-friendly practices) using the support of universities and scientists; • Permanent formation and recruitment of volunteers from community and scientific field interested in helping to attain the goals of protection and conservation of nature.

Conservation and protection objectives in transboundary marine protected area Strandzha - Igneada	Goals
• To contribute at realizing the objectives and targets foreseen by the National strategies and National Biodiversity Conservation Plans in both countries; • To contribute at realizing the objectives and targets foreseen by European biodiversity strategies (e.g., CBD) • Protection, restoration and conservation of habitats included in different categories of protection under Directives and Conventions or Agreement closed by both countries; • Protect the integrity of habitats on both sides especially of those which are closely interconnected in terms of geomorphological features or as nursery or migratory routes for different species; • Increase the level of protection of both areas against the illegal/harmful actions such as those having transboundary impacts by strengthening the international binding law instruments to take effect in case of infringement from either one side or another • Improve the scientific knowledge by promoting common actions and research programmes especially targeted on vulnerable or at risks habitats and species	• Applying the protection, maintaining and conservation objectives of habitats and species in accordance with national strategies and National Biodiversity Plans (available in both countries) • Extending the protection and conservation objectives and measures to a larger European context by applying the provisions referring to transboundary cooperation from: Habitats and Birds Directives (Art.18, par.2), MSFD, CBD, UNCLOS, SEA Directive, the EIA Directive, the Espoo Convention; • Enhancement of joint protection of Natura 2000 terrestrial, coastal and marine habitats and preserve their conservation values (1110, 1130, 1140, 1150, 1170) (Annex I of Habitat Directive) and of species from Annex II of Habitat Directive present within the site; • Enhancement of joint protection of terrestrial, coastal and marine species under Bern Convention protection • Enhancement of joint protection of terrestrial, coastal and marine species protected under Black Sea Convention and present in both sites • Enhancement of joint protection of terrestrial, coastal and marine species mentioned in the National and Black Sea Red List; • Establishing a joint monitoring programme of habitats and species; • Establish the indicators and targets for good environmental status of the habitats and the favorable conservation status of species of plants and animals; • Set a joint programme of measurements and strategy of conservation and protection.

2.2. Management tactics

Currently, there are several state institutions/authorities that share the responsibility for administration or deals with the protected areas both in Bulgaria and Turkey (e.g., Ministry of Environment and Urbanization, Ministry of Forestry and Water etc.). In order to be realized the actions foreseen by the management plan a more straightforward structure is needed as to increase the effectiveness of measures taken. A short way from decision to action is more desirable than to get ending up into an entangled system of bureaucracy. Therefore, the more the people involved are part of local authorities the more efficient the administration would be. The management should be integrative, adaptative and sustainable. Therefore, it is needed to:

- create of a central body (Advisory committee) (see bellow its attributions)
- institute an administrative structure with increased participation of local authorities and people and autonomy regarding the decisions and actions taken for conservation and protection purpose of protected sites
- to set the targets of management based on current and foreseen human and financial resources
- to take into consideration different possible scenarios to deal with current and/or future threats at the address of conservation and protection targets
- to involve more scientists and NGOs to put the bases of conservation needs on medium and long term

2.2.1. Advisory committees

The creation of a central body, be it an Advisory committee or just a single position, is critical for a smooth and truly transboundary work. The body should be only in charge of the transboundary aspects of the cooperation and should be provided with financial resource to be able to independently commission external consultancy. It can further keep the information flow between cooperating parties on a high level and facilitate the solving of problematic issues from an impartial perspective. Neutrality should be cared for by a filling of positions and a rotation of the head, reflecting the involvement of parties. Leading positions – or the single existing position – will need to be filled with a profile candidate (Neumann, 2006). The Advisory committee could be regulated through the legislative framework, its

main role being to provide expert advice and recommendations for area managing. The decisions about the planning of actions and uses of the resources should be taken based on the agreement between parts and through consultation with stakeholder groups.

In view of carrying out the management activities it is recommended to function according to a well organizational scheme that should include representatives of central and local authorities, the managers of the areas, the custodian representatives, technical, financial and communication specialists, the scientific body and local stakeholders.

The Committee is intended to provide, among other things, a forum through which the Strandzha and Igneada managers and harvesters – subsistence, commercial and recreational – can regularly meet and exchange information on results of applied measures and on conflicts and benefices raised out.

In order to avoid the conflicts, the attributes of the committee as well of the managers and other staff should be clear stated in the Management Plan and the Regulations of the area. This shall include all responsibilities and obligations of staff from both areas.

Based on the common objectives of protection and management as well as on social and economic sustainability targets of the areas the staff team as number of personnel involved and the qualifications should be chosen accordingly.

2.2.2 Boundaries

The protected area **BG0001007 Strandzha** was designated under the Habitats Directive (transposed in the Bulgarian Biodiversity Act) as a Natura 2000 SCI with the Decision of the Council of Ministers N 122 of 2nd March 2007 (State Newsletter N 21/2007). The marine extent of the site covered 2296.35 ha limited to the 20 m isobath.

As a result of an initiative undertaken by the Institute of Oceanology - BAS (implementation of the project "Extension of the marine Natura 2000 in the Bulgarian Black Sea" carried out in 2011-2012 and an official proposal to the MOEW) a Decision of the Council of Ministers N 660 of 1st November 2013 (State Newsletter N 97/2013) extended significantly the marine range of SCI Strandzha to the current 37 612.52 ha and 75 m depth, which comprises 15 % of the overall national coverage of marine protected areas within Natura 2000 ecological network in Bulgaria.

Currently Strandzha SCI has a total area of 153541.2 ha of which 24.5 % represents marine area. It is located in the South-eastern part of Bulgaria having the Turkish border and Rezovo River in the south. The marine boundaries (42°09' N - 41°54' S and 28°15' E - 27°33' W) stretch between the Bulgarian coastline to the West (from Rezovo river to south of Tsarevo City), the Bulgarian-Turkish marine boundary to the South and the 75 m isobath to the East.

The surface area of the **Igneada** proposed marine area is 19.910 hectares Fig. 44 and on the land side the size is of 3155 hectares.

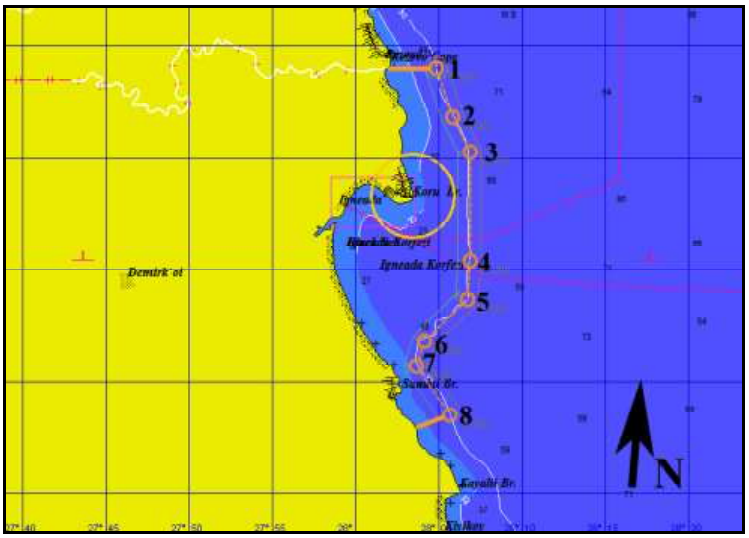

Figure 44. Boundaries of proposed marine protected area in İgneada region

2.2.3 Zoning plan

Fortunately, the Strandzha Protected area has already in place a Management Plan and Regulations for each of the protected sites, which implies a functional organizational scheme. However, the challenges of creating the Transboundary Marine Protected Area Strandzha-Igneada will require an extensive revision of it and of the objectives focused on common protection and conservation in a synergic way.

SCI Strandzha

SCI Strandzha encompasses four categories of nationally designated areas under the Protected Areas Act. These include:

BG 01 Strict Nature Reserves

There are six Strict Nature Reserves designated within SCI Strandzha: Vitanovo, Sredoka, Uzunbodzhak, Silikosia, Tisovitsa. Their main conservation objectives aim at protection of the unique forest ecosystem of Standzha Mountain characterised by endemic flora.

Uzunbodzhak is also internationally designated as a biosphere reserve.

The regimes in the reserve prohibit the execution of any human activity with the exception of: safeguarding, 2. scientific visits, 3. crossing along demarcated routes, 4. Collection of seed, wild plants and animal with scientific purpose or recovery of the species at other locations in quantities, by harvest method and in time that do not exert ecosystem disturbance.

BG05 Nature Park

Nature Park Strandzha encompasses the whole territory of SCI Strandzha. Its main objective is to conserve of in the long-term the unique nature within the watersheds of Veleka and Resovska Rivers, as well as to ensure the sustainable socio-ecological development in the region.

The regimes in the Park lay down the following bans and restrictions:

1. Prohibition for collection, storage and decontamination of hazardous substances included in the catalogue of Ordinance of the Council of Ministers № 153/1993.
2. Prohibition for introduction of any kind of waste.
3. Prohibition for introduction of alien wild plants and animal species, subspecies and forms.
4. Prohibition for cutting of high beech forest with undergrowth of *Rhododendron ponticum*
5. It is prohibited to use wild flora and fauna resources in quantities and in ways, which threaten the species survival, decease the biological diversity or disturb the normal functioning of the ecosystems.

BG 06 Protected site (Zashtitena mestnost)

Thirteen Protected sites are designated for the protection of the forest with its endemic flora. Veleka River Estuary is designated to conserve the characteristic coastal landscape, cliffs, fjords, xerothermic flora and diverse fauna.

The regimes prohibit:

1. The industrial and urban building development;

2. Geologic exploration;
3. Building of new roads;
4. Quarries and stone-pit excavation;
5. Sand extraction from the river and the coastal sands;
6. Pollution with household, industrial and any other waste;
7. Boats navigation in the river from 15 September to 15 June, in the rest of the year only touristic boats are allowed within a restricted area;
8. Camping and fire making outside the specially designated sites;
9. Collection of wild plants, except herbs for individual use;
10. Cutting of trees during the period 30 March – 1st September; forestation with non-indigenous species; cutting of trees with nests larger than 0.5 m and with hollows;
11. Hunting outside the permitted periods (different for different species of game);
12. Fishing, except for recreational fishing in specified area;
13. Chasing, collection, catching and killing of wild animals that are not game;
14. Grazing of wild goats and swine; domestic animals pasture shall be limited to 0.5 cattle per ha;
15. Plough of pastures, use of pesticides, and irrigation with motor pumps.
16. Archaeological excavation, except from the regulated by law occasions.

BG03 Natural Monument (Prirodna zabelezhitelnost)

The natural monuments protect rocky features, caves and springs.

2.2.4. Regulations

The marine area of SCI Strandzha is not subdivided into zones. The regimes proposed in the Standard Data Form apply to the entire marine area and include bans and restrictions aiming the protection of the marine habitats and species of European importance as given in Table 33.

Table 33. Regimes proposed for SCI Strandzha marine area

Regimes	Conservation objectives
Measures against physical pressures	
Prohibited extraction of sand and gravel	**1110**
Prohibited destruction of bedrock and boulders, dislocation of boulders.	**1170**

Prohibited dumping of dredged material and smothering of the seabed habitats.	**1110** **1170**
Prohibited sealing of the seabed habitats by structures including artificial reefs and islands.	**1110** **1170**
Prohibited disturbance of the hydrological processes leading to significant changes in the temperature, salinity, currents and wave action regimes.	**1110** **1140** **1170**
Prohibited use of mobile bottom trawling and dredging gear, including suction dredges.	**1110** **1170**
Prohibited exploration of ores and minerals in the marine coastal zone "A" in the sense of the Black Sea Coast Constitution Act.	**1110** **1170** **4125 *Alosa immaculata*** **4127 *Alosa tanaica*** **1349 *Tursiops truncatus*** **1351 *Phocoena phocoena***
Prohibited introduction of hard litter.	**1110** **1170**
Measures against chemical pressures	
Prohibited discharge of untreated waste water, the quantities and quality of the treated waters must correspond to the requirements of the individual emission restrictions indicated in the discharge permission issued according to the regulations of the Water Act.	**1110** **1170** **4125 *Alosa immaculata*** **4127 *Alosa tanaica*** **1349 *Tursiops truncatus*** **1351 *Phocoena phocoena***
Prohibited discharges of treated waste water at depth < 20 m. (Deep water discharge to be implemented).	**1110** **1170**
Prohibited introduction of hazardous substances – synthetic, non-synthetic and radionuclides.	**1110** **1170** **4125 *Alosa immaculata*** **4127 *Alosa tanaica*** **1349 *Tursiops truncatus*** **1351 *Phocoena phocoena***
Measures against selective catch and harvess, and by-catch	
Prohibited commercial and recreation fishing of fish and shellfish with the following gear and methods: **1. explosives;** **2. poisonous and anesthetic substances;** **3. electric current and other numbing methods;** **4. mobile bottom trawling and dredging gear;** **5. fire weapons;** **6. hooks;**	**1110** **1170** **4127 *Alosa tanaica*** **4125 *Alosa immaculata***
Prohibited catch *Alosa* spp. During reproduction period.	**4127 *Alosa tanaica*** **4125 *Alosa immaculata***
Prohibite catch, transport and trade of Alosa spp. With length < 22 cm.	**4127 *Alosa tanaica*** **4125 *Alosa immaculata***

If *Alosa* spp stocks are decreased in such a way that the natural reproduction and commercial importance are threatened, the Minister of Agriculture and Food in consultancy with the Minister of Environment and Waters orders ban for the exploitation for a certain period but not shorter that 1 year.	**4127 *Alosa tanaica*** **4125 *Alosa immaculata***
Prohibited commercial catch of the sand clams *Donacilla cornea, Donax trunculus, Chamelea gallina* and the crustaceans *Upogebia pusilla.* **Allowable recreational catch is:** **- up to 2 kg for sand clams;** **- up to 0.5 kg for *Upogebia pusilla***	**1110**
Prohibited commercial and recreational catch of polychaete worms *Arenicola marina* and crustaceans *Callianassa* spp.	**1110**
Prohibited commercial catch of *Mytilus galloprovincialis* from the natural mussel beds over the reefs and the sediments. Allowable recreational catch is up to 2 kg.	**1170**
Prohibited catch of *Mytilus galloprovincialis* with size < 7 cm.	**1170**
Prohibited commercial catch of *Eryphia verrucosa.* Allowable recreational catch is up to 1 kg.	**1170**
Prohibited catch of *Eryphia verrucosa* with size < 5 cm.	**1170**
Prohibited catch of *Eryphia verrucosa* during the period 1st April - 31st of May.	**1170**
Prohibited harvesting of *Zostera marina, Z. noltii, Zannichellia palustris, Potamogeton pectinatus*	**1110**
Prohibited harvesting of Cystoseira spp, *Phyllophora crispa.*	**1170**
It is prohibited to: **1. all forms of intentional catch and killing with any kind of methods and gear;** **2. disturbance, especially during the period of reproduction, nursery, wintering and migration;** **3. gathering of found dead individuals ;** **4. holding, raising, transport, export, trade and exchange of wild individuals;** **5. taxidermy, holding, exposing in public places, transport, export, trade and exchange of stuffed individuals.**	**1349 *Tursiops truncatus*** **1351 *Phocoena phocoena*** **1350 *Delphinus delphis***
Prohibited equipment of stationary pound nets with pingers.	**1349 *Tursiops truncatus*** **1351 *Phocoena phocoena***
Measures against invasive alien species.	
Subsidizing catch of *Rapana venosa* and egg capsules by means of divers and traps.	**1110** **1170**
Prohibited intentional introduction of alien species.	**1110** **1170**
Prohibited ship ballast water exchange.	**1110** **1170**
Preventive measures	

Impact assessment on the conservation objectives to be carried out for the following investment proposals: **- Port and marina construction** **- Coastal defense construction** **- Exploration and exploitation of ores minerals and oil;** **- Oil and gas pipelines construction** **- Construction of wind power generators;** **- Aquaculture of fish and shellfish;** **- Construction of underwater and floating structures for recreational purposes.**	**1110** **1170** **4125 *Alosa immaculata*** **4127 *Alosa tanaica*** **1349 *Tursiops truncatus*** **1351 *Phocoena phocoena***
Control measures	
Regular monitoring to be carried out on the conservation status of the habitats and species of conservation importance.	**1110** **1170** **4125 *Alosa immaculata*** **4127 *Alosa tanaica*** **1349 *Tursiops truncatus*** **1351 *Phocoena phocoena***

2.2.5. Social, cultural and resource studies plan

Until now, some efforts were made concerning transboundary cooperation at the scale of bilateral relations between Bulgaria and Turkey Draft Possible Priorities and Measures signed in Ankara, 19 November 2003, for the CBC Program between Bulgaria and Turkey for the period of 2004-2006 consist mainly of the following titles:

- Cross-border Infrastructure,
- Protection, Improvement and Management of the Environment,
- People to People Actions, Technical Assistance and Project Preparation Facility

2.2.6. Natural resources

Located in the South East of Bulgaria the SCI Strandzha encompasses the Strandzha Mountains ridges and foot reaching to the Black Sea coast and the adjacent marine area to the 75 m depth. The area is unique in Europe for its endemic and diverse flora and fauna. The special nature is a result of Strandzha's geological past, climate and geographical location. The plant communities in Strandzha developed before Europe was separated from Asia by the formation of the Bosphorus strait that now

connects the Black Sea and the Mediterranean Sea. Land-ice never reached Strandzha during the ice-ages of the Pleistocene and the Holocene. This lack of glaciations has created a unique window to the past. Plants that were once widespread on the European continent during the Tertiary period are now only preserved in Strandzha. It is a living museum.

In addition to the nature conservation values, due to being a bridge between Europe and Asia Strandzha Mountain area has a very rich culture and history, ancient folklore customs and traditions.

Diversity of monuments of culture from all the historical epochs, supplements the specific spirit of the territory. Here complement each other almost all culture layers from Eneolit and bronze epoch, Thracian megalith culture, antiquity, Middle Ages, Bulgarian renaissance up to new history, in concentration, rarely seen in Europe. Unique phenomenon is the sunken towns in the Bulgarian part of the Black Sea. Objects established in inlets of Varvara, Ahtopol, Sinemoretz, Silistar, north of Rezovska estuary are evidence for developed Thracian culture with active navigation, shipbuilding, economic and commercial connections far away from Greece civilization. Some of the villages with their original architecture complement the uniqueness of nature in the park.

The Igneada region was accepted as one of the most important fauna and flora areas of Turkey. The area of Turkey includes different ecosystems and a wide range of biodiversity, making it one of the Turkey's most important areas. The region and the surrounding environment have unique characteristics; in other parts of Turkey and Europe, the types of wild forests found in the İğneada area have been damaged by anthropogenic effects. Lakes Mert and Erikli in the İğneada area play an important role in the formation and maintenance of the Longos forest. The land is covered by mainly oak forests, typical flora of the Yıldız (Istranca) Mountains. Forestry, fishing and tourism are the main occupations of the town population. The Lake Saka Nature Reserve Area is in the south of the town. It harbours one of the few remaining floodplain forests in all of Europe, which is home to many different bird species. İğneada flooded forest is a unique assemblage created by various diverse ecosystems through thousands of years and it is a part of Istranca humid forest which is an independently natural richness. Lagoons, freshwater and salty lakes, coastal sand dunes, alluvial flooded forests, seasonal marshes, reed beds and meadows generate a wild nature around İğneada which has an enviable and valuable beauty. It is an extremely diverse nature in terms of living species. Although not investigated completely, scientists have identified 180 bird, 33 mammalian, 6 amphibian, 94 tree and bush and 500

grassy plant species living in this small geographical area. It is obvious that these numbers can not be encountered in another natural place with a similar coverage area.

2.2.7. Education and public awareness

A centre of education must function permanently within the area where documentaries and other informative sources should provide attractively and concise the characteristic features of the area and its importance for present and future preservation. A programme of training and education carried out by specialized personnel of the area and volunteers should be designed. There must be involved all categories of stakeholders/professional categories and also the tourists and visitors of the area. The topics of training should be focused on: conservation values and biodiversity richness of the area, techniques and methods to protect the nature, educative games and activities. One special target category is constituted of children, which are known as one of the most receptive public when it comes about the ecological education.

The activity performed by the personnel and volunteers of the centre should be made public through all media channels.

2.3. Administration

2.3.1. Staffing

The main organizational scheme should contain:

- The Advisory Committee
- The Manager and the administrative personnel (financial, communication responsible)
- The custodian representative
- The active personnel (scientific and rangers)

2.3.2. Training

The training activity should be addressed periodically besides to personnel of the protected area itself also to visitors and different professional categories such as the employees of local industry with impact in the area, to scientists and volunteers.

2.3.3. Facilities and equipment

The personnel of the area should beneficiate of minimum facilities and adequate equipment to insure the periodical surveillance/monitoring of the area and also the informative and training activities. The minimum facilities should comprise:

- A building for social activities equipped with all facilities (technical equipments for presentations);
- Due to relative isolation of the area and keeping in mind that the transboundary cooperation will require frequent collaboration between scientists, a laboratory with minimum equipment to be used by scientific personnel in monitoring activities, primary processing of samples and analysis should be arranged;
- Minimum accommodation facilities for personnel and guests
- Annexes

2.3.4. Budget and business plan

The budget of the area will be decided by the members of the Advisory Committee. On the other hand, the budget will depend of funds attracted through different programmes and projects. The managers of the area will direct the financial sources according to financial plan established in consent with activities approved to accomplish the objectives proposed through the Management Plan.

Looking at the experience shared by other countries which implemented a transboundary management within their MPAs, as is the example of Trilateral Wadden Sea Cooperation, the budget of transboundary area is decided by a special committee (The Senior Officials' (SO)), which adopts each year's budget, financial statement and the work programme for the Common Wadden Sea Secretariat.

The premises for a future joint management of the Transboundary area exist. In Turkey, for example, the Ministry of Environment has in subordination professional staff from different backgrounds such as, city planners, architects, landscape architects, environmental engineers, civil engineers, chemical engineers, electrical engineers, agronomists, aquaculture product specialists, marine scientists; biologists (include experts on botany and biotechnology), geologists and so on. As it requires the staff is more or less trained through international and national planning courses and

seminars. The Authority has an individual budget which is supported by a special fund established for environmental protection purposes.

2.4. Monitoring and evaluation of plan effectiveness

This activity should be set through the Management plan and consists in periodical monitoring and evaluation of results of activities performed towards attaining the objectives and targets proposed either concerning the social, economic or biodiversity ones. This monitoring should be performed using different indicators of performance that can be measurable and adaptable (see the example bellow).

MONITORED OBJECTIVES	INDICATORS
1. Annual monitoring of evolution of flora and benthic and pelagic fauna	- Update the old database with data obtained within the monitoring programme - Evince the dynamic evolution and tendency of changes occurred in the biota components and populations abundance
2. Monitoring the indicators of good ecological status for important conservation habitats and species	- Evince the indicators which don't fit into the values limits corresponding to a good conservation status - Evince the effectiveness of researches and measures carried out in order to remediate the situation and bring the indicators in normal range
3. Monitoring the human activities in the site and assessment of their impact on species and habitats;	- Evince the activities with significant impact on biodiversity and the measures for their limitation/banning

2.5. Timetable for implementation

TOPIC	A. BIODIVERSITY												
OBJECTIVE	**Maintaining the biodiversity through conservation of key species and habitats as well as of landscapes within the MPA**												
ACTIVITY	OUTPUT	Year 1		Year 2		Year 3		Year 4		Year 5		Involved partners	Observation
		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2		
A1. Establishment and implementation of Biodiversity Monitoring Plan, focused on species and habitats of interest and setting of indicators	Monitoring functional Plan											Scientific institutions	
A2. Annual check of level of achieving of conservation objectives of conservation	Monitoring Report on indicators concerning good conservation status											Scientific institutions	
A3. Specific measures of protection of species and habitats of interest (including the functional zoning)	Protecting of species and habitats											Competent authorities	
A4. Clean the MPA's area and the surroundings	clean MPA											Communities, NGOs	

TOPIC	A. BIODIVERSITY												
OBJECTIVE	**Maintaining the biodiversity through conservation of key species and habitats as well as of landscapes within the MPA**												
ACTIVITY	OUTPUT	Year 1		Year 2		Year 3		Year 4		Year 5		Involved partners	Observation
		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2		
A5. Monitoring of physical and chemical parameters of marine water bodies within the MPA	Preventing of pollution		▬▬▶	▬▬	▬▬	▬▬	▬▬	▬▬	▬▬	▬▬	▬▬▶	Scientific institutions	
A6. Monitoring of major pollution sources within MPA and reporting the infringement to competent authorities	Preventing of pollution		▬▬▶	▬▬	▬▬	▬▬	▬▬	▬▬	▬▬	▬▬	▬▬▶	Scientific institutions	
A7. Actions to combat the poaching in MPA	Minimize the poaching											Agency of Fishery and Aquaculture, The Costal Guard	

TOPIC	B. TOURISM												
OBJECTIVE	Promoting the eco-touristy activities and extending the period of visiting the area by developing the natural, traditional and cultural values of the region												
ACTIVITY	OUTPUT	**YEAR 1**		**YEAR 2**		**YEAR 3**		**YEAR 4**		**YEAR 5**		Involved partners	Observation
		S1	**S2**	**S1**	**S2**	**S1**	**S2**	**S1**	**S2**	**S1**	**S2**		
B1 Development of the database and catalogue of pensions within the zone	Catalogue, tourist agencies contracts		*2*	▬▬	▬▬▶							Custodian, NGOs, Touristic Agencies	

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TOPIC	B. TOURISM											
OBJECTIVE	Promoting the eco-touristy activities and extending the period of visiting the area by developing the natural, traditional and cultural values of the region											
ACTIVITY	OUTPUT	YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		Involved partners	Observation
		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2		
B2 Development, elaboration and valorization of informative materials	Informative materials, revenues sources image											NGOs, Mayoralty	
B3. Development and installation of informative indicatives and stands for visitors	Stands, informative signs/warning/guides, posters											NGOs, Mayoralty	
B4. Creation of facilities for exploration of flora, fauna and underwater landscapes within MPA	Observatories on shore bank, boats for the tourists, underwater incursions											NGOs, Mayoralty	
B5. Developing of attractive programmes for tourists in collaboration with local entrepreneurs	Increasing tendency of tourists number											Local entrepreneurs	
B6. Creation of independent MPA's infrastructure	Informative Center												
B7. Collaboration with touristic agencies for implementing the ecological touristy practices	Annual comparative statistics, questionnaires, observatories											Agencies tourism	
B8.Carry out scientific tourism (study of flora, fauna and habitats)	Studies, researches, seminars on MPAs topic											Specialists, marine research	

TOPIC	B. TOURISM												
OBJECTIVE	Promoting the eco-touristy activities and extending the period of visiting the area by developing the natural, traditional and cultural values of the region												
ACTIVITY	OUTPUT	**YEAR 1**		**YEAR 2**		**YEAR 3**		**YEAR 4**		**YEAR 5**		Involved partners	Observation
		S1	**S2**	**S1**	**S2**	**S1**	**S2**	**S1**	**S2**	**S1**	**S2**		
B9. Instruction and coordination of field personnel for surveillance of tourists activities	Surveillance actions carried out by MPA's personnel, Instruction seminars												
B10. Elaboration and implementation of monitoring program	Monitoring												
B11.Elaboration and implementation of MPA's tourism strategy in the local, national and international context	Strategy, effects analysis											Consultants, Universities	

TOPIC	C. COMMUNITIES AND LOCAL ECONOMY												
OBJECTIV	To promote and create opportunities for sustainable development of local economy in consensus with MPA's												
ACTIVITY	OUTPUT	**YEAR 1**		**YEAR 2**		**YEAR 3**		**YEAR 4**		**YEAR 5**		Involved partners	Observation
		S1	**S2**	**S1**	**S2**	**S1**	**S2**	**S1**	**S2**	**S1**	**S2**		

TOPIC	C. COMMUNITIES AND LOCAL ECONOMY											
OBJECTIV	To promote and create opportunities for sustainable development of local economy in consensus with MPA's											
ACTIVITY	OUTPUT	YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		Involved partners	Observation
		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2		
C1. Support the development of activities which generate incomes for local communities in concordance with MPAs targets of management	Increasing of community life standard		⇢	⇢	⇢							Communities, NGOs	
C2. Collaboration with MPA's custodian and local communities to actions of collecting of waste	Reduction of pollution within MPA. Increasing the level of comfort and civilization of people	⇢	⇢	⇢	⇢	⇢	⇢	⇢	⇢	⇢	⇢	Local communities, NGOs Governmental Agencies represented in the territory	
C3. Support the instructive activities of owners of pensions and touristic guides	Increasing the quality of services	⇢	⇢	⇢	⇢	⇢	⇢	⇢	⇢	⇢	⇢	Residents, tourism entrepreneurs	
C4. Supporting of local entrepreneurs who actively participate at MPA's activities and promoting of their image	Mutual advantages Increasing the popularity of MPAs	⇢	⇢	⇢	⇢	⇢	⇢	⇢	⇢	⇢	⇢	Entrepreneurs, NGOs	

TOPIC	D.EDUCATION AND PUBLIC AWARENESS											
OBJECTIV	Public and communities participation to conservation of MPAs values through educational and awareness programs											
ACTIVITY	OUTPUT	YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		Involved partners	Observation
		S1	S 2	S 1	S 2	S 1	S 2	S 1	S 2	S 1	S 2		
D1. Construction and endowment of informative center	Informative center											NGOs, Mayoralty	
D2 Developing and implementation of ecological education center in educational institutions in close- by area	Educative material Meetings with educational personnel and students Teaching the ecology in classes											Educational Institutions	
D3 Periodical update of internet website of the area	Updated website												
D4. Design and deliver educational materials	Educational materials												
D5. Meetings with local administration to discuss the solutions for attaining the custodian's objectives regarding MPA's protection and conservation	Seminars, working meetings Increasing the local administration involvement											Mayoralty	

TOPIC	D.EDUCATION AND PUBLIC AWARENESS											
OBJECTIV	Public and communities participation to conservation of MPAs values through educational and awareness programs											
ACTIVITY	OUTPUT	YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		Involved partners	Observation
		S1	S 2	S 1	S 2	S 1	S 2	S 1	S 2	S 1	S 2		
D6. Organizing of local inter/intra scholar events and contests	Events, contests											Mayoralty, Schools	
D7. Promoting the MPA's image during different events	Active participation											Communities, NGOs	
D8. Diffusing of informative bulletin of MPAs	informative Bulletin												
D9. Implication of children in actions of environmental protection	Increasing the awareness and responsibility											Schools, NGOs	
D10. Working meetings with interested factors (economic and tourism agents)	Increasing the awareness and responsibility											Economic agents	
D11. Mass media participation through articles, interviewers, broadcasts, press conferences	Increasing the visibility and awareness activities											Mass media	
D12. NGOs participation to supportive actions of MPAs objectives	Projects, Partnership											NGOs	

TOPIC	D.EDUCATION AND PUBLIC AWARENESS											
OBJECTIV	Public and communities participation to conservation of MPAs values through educational and awareness programs											
ACTIVITY	OUTPUT	YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		Involved partners	Observation
		S1	S 2	S 1	S 2	S 1	S 2	S 1	S 2	S 1	S 2		
D14. MPAs' image promoting	Participations to manifestations, conferences, symposiums		⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	→		

TOPIC	E. MPAs Management											
OBJECTIV	1. Strengthen the administrative capacity, setting the appropriate mechanisms to carry out the specific activities and promoting the collaboration with interested factors											
ACTIVITY	OUTPUT	YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		Involved partners	Observations
		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2		
E1. Elaboration of MPAs organization scheme and establishing the responsibilities	Organization scheme and personnel attributions	⋯	→										
E2. Establish the training necessities and the participation to adequate programmes	Elimination of professional gaps	⋯	⋯	⋯	⋯	⋯	⋯	⋯	→			Consultants	
E3. Elaboration and application of MPAs Regulation	Functional MPA's Regulation	⋯	⋯	⋯	⋯	⋯	⋯	⋯	→				
E4. Endowment with adequate equipment and technology	Facilities	⋯	⋯	⋯	→								

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TOPIC	E. MPAs Management												
OBJECTIV	1. Strengthen the administrative capacity, setting the appropriate mechanisms to carry out the specific activities and promoting the collaboration with interested factors												
ACTIVITY	OUTPUT	YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		Involved partners	Observations
		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2		
E5. Updated database in GIS system	Digital maps and associated database												
E6. Collaboration with NGOs to attract funds and development of common projects	Financing											NGOs	
E7. Identification of financing sources for the activities carried out within the MPA	Financing												
E8. Elaboration and implementation of auto financing strategy	Financing												
E9. Promote of modern management	Increasing the personnel efficiency												
E10. Delimitation of special management areas	MPAs zonation and map												
E11. Elaboration of annual programs according to the Management Plan	Annual Working Plan												
E12. Collaboration with local authorities for applying the legal provisions	Preventing the illegal activities											Authorities	

ANNEX

ANNEX 1. The species list of phytoplankton in cruise periods

SPECIES LIST	SAMPLING PERIOD			
Bacillariophyceae	**Nov-12**	**May-13**	**Jul-13**	**Oct-13**
Achnanthes longipes C.Agardh	+	-	-	-
Cylindrotheca closterium (Ehrenberg) Reimann & J.C.Lewin	+	-	-	+
Nitzschia longissima (Brébisson) Ralfs	-	-	-	+
Nitzschia tenuirostris Mer.	-	-	-	+
Gyrosigma sp.	+	-	-	+
Navicula sp.	+	-	-	-
Pleurosigma elongatum W. Smith	+	+	+	+
Pseudo-nitzschia delicatissima (Cleve) Heiden	+	+	+	+
Pseudo-nitzschia seriata (Cleve) H.Peragallo	-	-	-	+
Coscinodiscophyceae				
Biddulphia mobiliensis (J.W.Bailey) Grunow	+	-	-	-
Cerataulina pelagica (Cleve) Hendey	-	-	+	+
Chaetoceros affinis Lauder	+	+	+	+
Chaetoceros compressus Lauder	+	+	+	-
Chaetoceros curvisetus Cleve	-	+	+	+
Chaetoceros decipiens Cleve	-	+	-	+
Chaetoceros didymus Ehrenberg	-	-	-	+
Chaetoceros diversus Cleve	-	-	-	+
Chaetoceros peruvianus Brightwell	-	-	-	+
Chaetoceros radicans F.Schütt	-	-	+	-
Chaetoceros similis P.T. Cleve	-	-	-	+
Chaetoceros simplex Ostenfeld	+	-	-	+
Chaetoceros sp.	+	-	-	-
Coscinodiscus centralis Ehrenberg	-	-	-	+
Coscinodiscus granii Gough	+	-	+	+
Coscinodiscus gigas Ehrenberg	+	-	-	-
Coscinodiscus sp.	-	-	-	+
Dactyliosolen fragilissimus (Bergon) Hasle	-	+	+	-
Ditylum brightwellii (T.West) Grunow	+	-	-	+
Hemiaulus hauckii Grunow ex Van Heurck	+	-	-	-
Leptocylindrus danicus Cleve	+	+	+	+
Melosira moniliformis (O.F.Müller) C.Agardh	-	-	-	+
Melosira sp.	-	-	-	+
Proboscia alata (Brightwell) Sundström	+	+	+	+
Pseudosolenia calcar-avis (Schultze) B.G.Sundström	+	+	+	+
Rhizosolenia setigera Brightwell	-	-	-	+
Rhizosolenia styliformis T.Brightwell	-	-	-	+
Skeletonema costatum (Greville) Cleve	+	-	+	+

SPECIES LIST	SAMPLING PERIOD			
Thalassiosira eccentrica (Ehrenberg) Cleve	+	+	+	+
Thalassiosira parva Pr.-Lavr.1955	-	-	-	+
Fragilariophyceae				
Licmophora abbreviata C.A. Agardh	-	-	+	-
Licmophora ehrenbergii (Kützing) Grunow	+	-	-	-
Licmophora flabellata (Grev.)C.Agardh	+	-	+	+
Striatella unipunctata (Lyngbye) C.Agardh	+	-	+	-
Thalassionema nitzschioides (Grunow) Mereschkowsky	+	+	+	+
Dinophyceae				
Akashiwo sanguinea (Hirasaka, 1924) G. Hansen et Moestrup	-	-	+	-
Alexandrium tamarense (Lebour) Balech	-	-	-	+
Biceratium furca (Ehrenberg) Vanhoeffen	+	+	+	+
Dinophysis acuminata Claparède & Lachmann C	+	-	-	-
Dinophysis acuta Ehrenberg	-	-	-	+
Dinophysis caudata Saville-Kent	+	-	+	+
Dinophysis fortii Pavillard	+	-	-	+
Dinophysis sacculus Stein, 1883	-	-	-	+
Glenodinium sp.	-	-	-	+
Gonyaulax monacantha Pavillard	-	-	+	-
Gonyaulax polygramma Stein	-	-	+	+
Gonyaulax scrippsae Kofoid	-	-	-	+
Gonyaulax spinifera (Claparède & Lachmann, 1859) Diesing	-	-	-	+
Gymnodinium sp.	-	-	+	+
Gyrodinium fusiforme Kofoid & Swezy	+	+	+	+
Gyrodinium lachryma (Meunier) Kofoid & Swezy	+	-	-	+
Gyrodinium sp.	-	-	-	+
Lingulodinium polyedra (F.Stein) J.D.Dodge	+	+	+	+
Neoceratium fusus (Ehrenberg) F.Gomez, D.Moreira & P.Lopez-Garcia	+	+	+	+
Neoceratium tripos (O.F.Müller) F.Gomez, D.Moreira & P.Lopez-Garcia	-	+	+	+
Neoceratium lineatum (Ehrenberg) F.Gomez, D.Moreira & P.Lopez-Garcia	+	-	-	-
Phalacroma rotundatum (Claparéde & Lachmann) Kofoid & Michener	+	-	+	+
Podolampas palmipes Stein	+	-	-	-
Polykrikos schwartzii Bütschli	-	-	+	-
Prorocentrum compressum (J.W.Bailey) Abé ex Dodge	+	+	+	+
Prorocentrum cordatum (Ostenfeld) Dodge	-	-	+	+
Prorocentrum micans Ehrenberg	+	+	+	+
Protoceratium reticulatum (Claparède & Lachmann) Bütschli	-	-	-	+
Protoperidinium brochii (Kofoid & Swezy) Balech	+	-	-	-
Protoperidinium claudicans (Paulsen) Balech	+	-	+	+
Protoperidinium curtipes (Jorgensen) Balech	+	-	-	+
Protoperidinium depressum (Bailey) Balech	+	+	+	+
Protoperidinium divergens (Ehrenberg) Balech	+	-	+	+
Protoperidinium grande (Kofoid) Balech	+	-	-	+
Protoperidinium granii (Ostenfeld) Balech	+	+	+	+

SPECIES LIST	SAMPLING PERIOD			
Protoperidinium steinii (Jörgensen) Balech	+	-	+	+
Protoperidinium pallidum (Ostenfeld) Balech	+	-	+	+
Protoperidinium pellucidum Bergh ex Loeblich Jr.& Loeblich III	+	-	-	+
Scrippsiella trochoidea (Stein) Balech ex Loeblich III	+	+	+	+
Dictyochophyceae				
Dictyocha polyactis Ehrenberg	-	-	-	+
Distephanus speculum (Ehrenberg) Haeckel	+	-	-	+
Octactis octonaria (Ehrenberg) Hovasse	+	-	-	+
Ebriophyceae				
Ebria tripartita (Schumann) Lemmermann	+	-	-	+
Prymnesiophyceae				
Emiliania huxleyi (Lohmann) W.W.Hay & H.P.Mohler	+	+	+	+

Annex 2. Macrozoobenthos density (ind./m^2) at the stations sampled along the coasts of İğneada

Crt. nr.	TAXA	Nov. 2012	May 2013	July 2013	Oct 2013
1	Turbellaria (sp.)				1.11
2	Nemertea (sp.)	1.11	26.67	24.4	11.11
3	Oligochaeta (sp.)	95.56	2422.22		
4	*Aonides paucibranchiata* Southern, 1914	11.11	10.00		5.56
5	*Aricidea claudiae* Laubier, 1967		38.89		183.33
6	*Aricidea* sp.1	37.78	34.44	143.3	156.67
7	*Capitella capitata* (Fabricius, 1780)		393.33		
8	*Capitomastus minima* (Langerhans, 1881)	7.78	332.22	272.2	34.44
9	*Cirratulus* sp.			1.1	
10	*Cirriformia tentaculata* (Montagu, 1808)		1.11	3,3	
11	*Eumida sanguinea* (Örsted, 1843)		1.11		
12	*Eunice* sp.	1.11			
13	*Exogone (Exogone) naidina* Örsted, 1845			8.9	1.11
14	*Exogone* sp.		125.56		1.11
15	*Glycera alba* (O.F. Müller, 1776)		3.33	12.2	2.22
16	*Glycera* sp.			77.8	1.11
17	*Glycera* sp.1	1.11	2.22		
18	*Glycera* sp.2	2.22			
19	*Glycera* sp.3			1.1	7.78
20	*Harmathoe* sp.		8.89	6.7	
21	*Harmothoe imbricata* (Linnaeus, 1767)			1.1	
22	*Hediste diversicolor* (O.F. Müller, 1776)		3.33		
23	*Heteromastus filiformis* (Claparède, 1864)		16.67	368.9	93.33
24	*Lagis koreni* Malmgren, 1866			1.1	
25	*Laonice cirrata* (M. Sars, 1851)	2.22			
26	*Leiochone leiopygos* (Grube, 1860)		3.33	31.1	3.33
27	*Magelona* sp.1	1.11	1.11		1.11
28	*Magelona* sp.2	2.22	7.78	13.3	1.11
29	Maldanidae (sp.)				1.11
30	*Melinna palmata* Grube, 1870			4.4	

Crt. nr.	TAXA	Nov. 2012	May 2013	July 2013	Oct 2013
31	*Micronephthys stammeri* (Augener, 1932)			230.0	44.44
32	*Microphthalmus* cf. *sczelkowii* Metschnikow, 1865		71.11	53.3	
33	*Mysta picta* (Quatrefages, 1866)			2.2	
34	*Nephthys hystricis* McIntosh, 1900	56.67			
35	*Nepthys* sp.	12.22	101.11	73.3	151.11
36	*Nereis* sp.			2.2	6.67
37	*Odontosyllis* sp.		3.33		
38	Ophelia sp.	11.11	7.78	52.2	4.44
39	*Owenia fusiformis* Delle Chiaje, 1844				3.33
40	*Pholoe inornata* Johnston, 1839		7.78	2.2	
41	*Phyllodoce* sp.			8.9	6.67
42	*Pisione* sp.	13.33	7.78		
43	*Platynereis dumerilii* (Audouin & Milne Edwards, 1834)		2.22	61.1	5.56
44	*Polycirrus* sp.		2.22		
45	*Polydora cornuta* Bosc, 1802		15.56	1.1	
46	*Polygordius* sp.	103.33	278.89		
47	*Polyophthalmus pictus* (Dujardin, 1839)		1.11		
48	*Prionospio* (*Minuspio*) *maciolekae* Dagli & Çinar, 2011	3.33	232.22	53.3	8.89
49	*Prionospio* sp.				2.22
50	*Protodorvillea* sp.	203.33	264.44	124.4	105.56
51	*Scolaricia* sp.	2.22			
52	*Scolelepis* (*Parascolelepis*) *tridentata* (Southern, 1914)	4.44	2.22		
53	*Sphaerosyllis hystrix* Claparède, 1863		12.22		
54	*Spio* cf. *filicornis* (Müller, 1776)		25.56	1.1	1.11
55	*Spio decoratus* Bobretzky, 1870		23.33	727.8	16.67
56	*Spiophanes* sp.		3.33		
57	*Syllis* sp.		2.22		2.22
58	*Terebella* sp.			1.1	
59	Terebellidae (sp.)				3.33
60	*Terebellides stroemii* Sars, 1835			1.1	
61	Phoronida (sp)				2.22
62	*Ampelisca diadema*		2.22	6.7	7.78
63	*Ampelisca pseudospinimana*		3.33	60.0	7.78
64	*Ampelisca sp.*	2.22			
65	*Ampithoe raimondi*		13.33	8.9	2.22
66	*Apseudopsis ostroumovi*				7.78
67	*Atylus massilensis*	2.22	25.56	3.3	
68	*Balanus improvisus*		15.56	1.1	
69	*Bathyporeia guilliamsoniana*	2.22	28.89	41.1	5.56
70	*Bodotria arenosa mediterranea*		4.44	1,1	
71	*Bodotria scorpioides*	2.22			
72	*Bodotria sp.*	1.11			
73	*Brachynotus sexdentatus*		1.11		
74	*Callianassa truncata*			1.1	2.22
75	*Crangon crangon*			2.2	
76	*Cumopsis goodsir*	3.33	38.89	52.2	5.56
77	*Dexamine spinosa*		3.33	3.3	
78	*Diogenes pugilator*		7.78	6.7	12.22

Crt. nr.	TAXA	Nov. 2012	May 2013	July 2013	Oct 2013
79	*Dynamene bidentata*	1.11			
80	*Ericthonius brasiliensis*			2.2	
81	*Eurydice pulchra*	5.56	2.22		6.67
82	*Eurydice racovitzai*	2.22	4.44	1.1	1.11
83	*Gammarus aequicauda*		3.33		
84	*Idotea baltica*		2.22		2.22
85	*Iphinoe maeotica*			7.8	1.11
86	*Iphinoe serrata*			1.1	1.11
87	*Iphinoe tenella*				2.22
88	*Iphinoe trispinosa*		1.11	1.1	
89	*Leptochelia savignyi*				2,22
90	*Megaluropus massiliensis*	2.22	2.22	21.1	2.22
91	*Microdeutopus gryllotalpa*		2.22		
92	*Microdeutopus versiculatus*		1.11	2.2	
93	*Monocorophium acherisicum*		7.78	10.0	4.44
94	*Perioculodes longimanus longimanus*	2.22	40.00	16,7	1.11
95	*Pisidia longimana*		1.11		
96	*Pseudocuma longicornis*		5.56		
97	*Siriella jaltensis jaltensis*		2.22		
98	*Tanais dulongii*			1.1	
99	*Ubogebia pusilla*		1.11	1.1	6.67
100	*Anadara inaequivalvis*	1.11	1.11		
101	*Bela nebula*	1.11	23.33	41.1	30.00
102	*Bittium reticulatum*	1831.11	8310.00	8908.9	4934.44
103	*Caecum trachea*	267.78	150.00	5284.4	1321.11
104	*Calyptrae chinensis*		6.67	63.3	131.11
105	*Chamelea gallina*	50.00	817.78	573.3	347.78
106	*Chrysallida interstincta*	1.11	2.22	3.3	5.56
107	*Cyclichnina robagliana*		4.44	7.8	1.11
108	*Cyclope neritea*	10.00	114.44	120.0	44.44
109	*Cylichnina umbilicata*	1.11	24.44	20.0	55.56
110	*Donax trunculus*	1.11			
111	*Donax venustus*	3.33	10.00	4.4	2.22
112	*Ecrobia ventrosa*	2.22	3.33	310.0	125.56
113	*Epitonium commune*			4.4	
114	*Epitonium turtonis*		4.44	15.6	5.56
115	*Gibbula albida*	1.11	3.33	17.8	5.56
116	*Gibbula divaricata*	8.89	4.44	2.2	2.22
117	*Gouldia minima*	1.11	8.89	5,6	
118	*Hydrobia acuta*	4.44	23.33		15.56
119	*Lentidium mediterraneum*	36.67	55.56	1.1	5.56
120	*Lucinella divaricata*	141.11	281.11	1352.2	291.11
121	*Mangelia coarctata*		1.11	12.2	
122	*Mangelia pontica*	3.33	16.67	27.8	2.22
123	*Mangelia sp.*	3.33	10.00	2.2	
124	*Manzonia crassa*		1.11		
125	*Marshallora adverse*	3.33	1.11	26.7	
126	*Modulus sp.*		4.44		

Crt. nr.	TAXA	Nov. 2012	May 2013	July 2013	Oct 2013
127	*Monophorus perversus*	7.78	18.89	11.1	6.67
128	*Mytilaster lineatus*	1.11	6.67	2.2	
129	*Mytilus galloprovincialis*		12.22	3.3	
130	*Nassarius reticulatus*	10.00	65.56	200.0	53.33
131	*Paphia aurea*		2.22	3.3	3.33
132	*Parvicardium exiguum*	1.11	6.67	5.6	
133	*Pitar rudis*		3.33	26.7	
134	*Pusillina lineolata*		3.33	13.3	37.78
135	*Pusillina radiata*			155,6	
136	*Pusillina sp.*	10.00	76.67	32.2	
137	*Rapana venosa*		3.33		3.33
138	*Retusa truncatula*	17.78	13.33	405.6	2.22
139	*Rissoa labiosa*		67.78	104.4	
140	*Rissoa lineolata*		7,78		
141	*Rissoa membranaceae*	1.11	72.22	540.0	601.11
142	*Rissoa sp.*	6.67	17.78		
143	*Rissoa splendida*	6.67	965.56	155.6	130.00
144	*Rissoa ventricosa*	2.22	1.11		
145	*Setia pulcherrima*	1.11			
146	*Spisula subtruncata*		60.00	72.2	8.89
147	*Tellina tenuis*	2.22	14.44	5,6	20.00
148	*Theodoxus fluviatilis*	1.11		1,1	3.33
149	*Tricolia pullus pullus*	267.78	461.11	181,1	42.22
150	*Tritaeta gibbosa*		1.11		
151	*Turbonilla delicata*		7.78		4.44
152	*Turbonilla pusilla*	3.33	5.56	82.2	27.78
153	*Branchiostoma lanceolatum* (Pallas, 1774)	2.22	1.11	1.1	
TOTAL		**3315.6**	**16496.7**	**21426.7**	**9223.3**

Annex 3. Macrozoobenthos on the hard bottom stations (İğneada)

TAXA/400 cm^2	November 2012		May 2013		July 2013	
	B1	B2	B2	B1	B1	B2
Eteone sp.			1			
Harmothoe sp.						1
Hediste diversicolor	140	31	32	12		
Nereis sp.	42	16				
Nereis zonata						26
Platynereis dumerilii			14	7	57	87
Perinereis cultrifera	3	4			12	42
Polyophthalmus pictus	409	88	47	3	17	397
Syllis armillaris	17	1				2
Syllis sp.					1	
Ampithoe raimondi			1	20	11	4
Atylus massilensis	2					
Balanus improvisus			1			

TAXA/400 cm^2	November 2012		May 2013		July 2013	
	B1	B2	B2	B1	B1	B2
Coroghium achenicum			2		4	
Dexamine spinosa	27			12	1	
Ericthonius brasiliensis				2	9	4
Gammarus insensibilis			15			
Gammarellus angulosus	43	1				
Heterotanais sp.	11	9				
Hyale crassipes	23	62	4	2	21	33
Hyale perieri		15				
Hyale pontica			4			6
Idotea baltica		3	126	55	28	150
Idotea sp.		4				
Melita palmata						1
Microdeutopus gryllotalpa				4		
Pachygrapsus marmoratus			1			
Pilumnus minutus			1	1		
Sphaeroma serratum	3					
Stenothoe monoculoides			4	1		
Tanais dulongii		5	16	101	123	29
Bittium reticulatum				3	28	
Mytilaster lineatus	200	2010	235	450		7
Mytilus galloprovincialis	125	6	105	254	94	48
Rapana venosa	3			1		
Rissoa splendida	80				86	
Tricolia pullus pullus	403		21	3	7	

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