

MARINE PROTECTED AREAS IN BULGARIA PRESENT AND PROSPECTS

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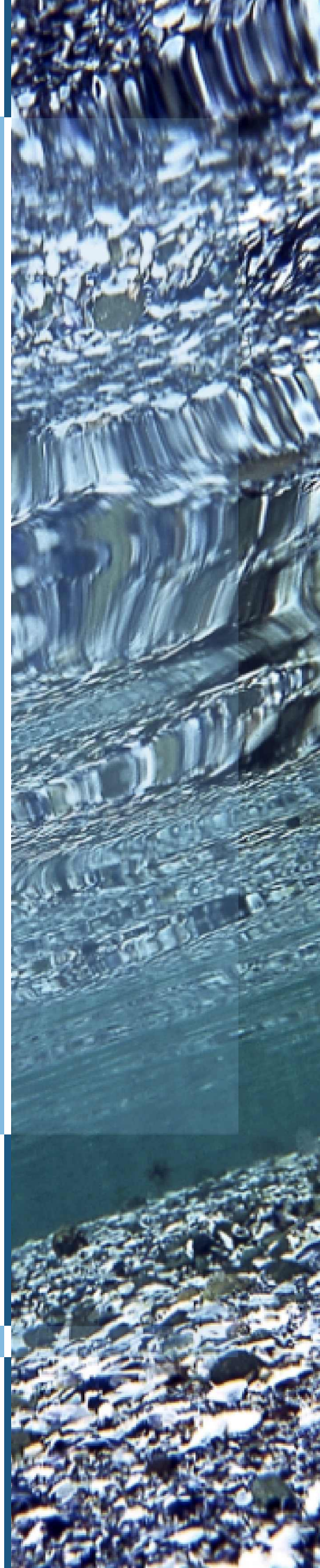
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REVIEW OF THE MARINE PROTECTED AREAS IN BULGARIA

According to the Bulgarian Protected Areas Act (1998) protected areas are designated for the conservation of biological diversity in ecosystems and of the natural processes occurring therein, as well as of typical or remarkable non-living natural features and landscapes.

The purpose of this Act is to safeguard protected areas as a national and universal human wealth and asset and as a special form of conservation of the Bulgarian nature, favourable to the advancement of culture and science and to public welfare.

The following categories of protected areas are present in Bulgaria:

- strict nature reserve;
- national park;
- natural monument;
- managed nature reserve;
- natural park;
- protected site.

The Act stipulates that the protected areas shall incorporate forests, terrestrial and aquatic areas. Therefore the Act regulates the regime of protection and use, designation and management of marine protected areas (MPAs) as well as terrestrial areas.

The protected areas in Bulgaria census 2004 encompass 858 sites with a total area of 544394.9 ha, which represents 4.9 % of the Bulgarian territory (Georgiev G., 2004). Strictly protected areas, including strict nature reserves, national parks and managed nature reserves cover 2.1 % of the national territory.

MPAs in Bulgaria are only 2: part of "Kaliakra" nature reserve and the protected site "Koketrays sandbank". They constitute just 0.2% of the total protected area in Bulgaria, barely 0.2% of the Bulgarian territorial waters and no more than 0.1% of the shelf area to 100 m depth.

Cape Kaliakra is one of the first protected areas in Bulgaria, declared a national park as early as 1941 (Dobrudzha and Kaliakra, 1997). In 1966 it was

View from „Kaliakra” Reserve

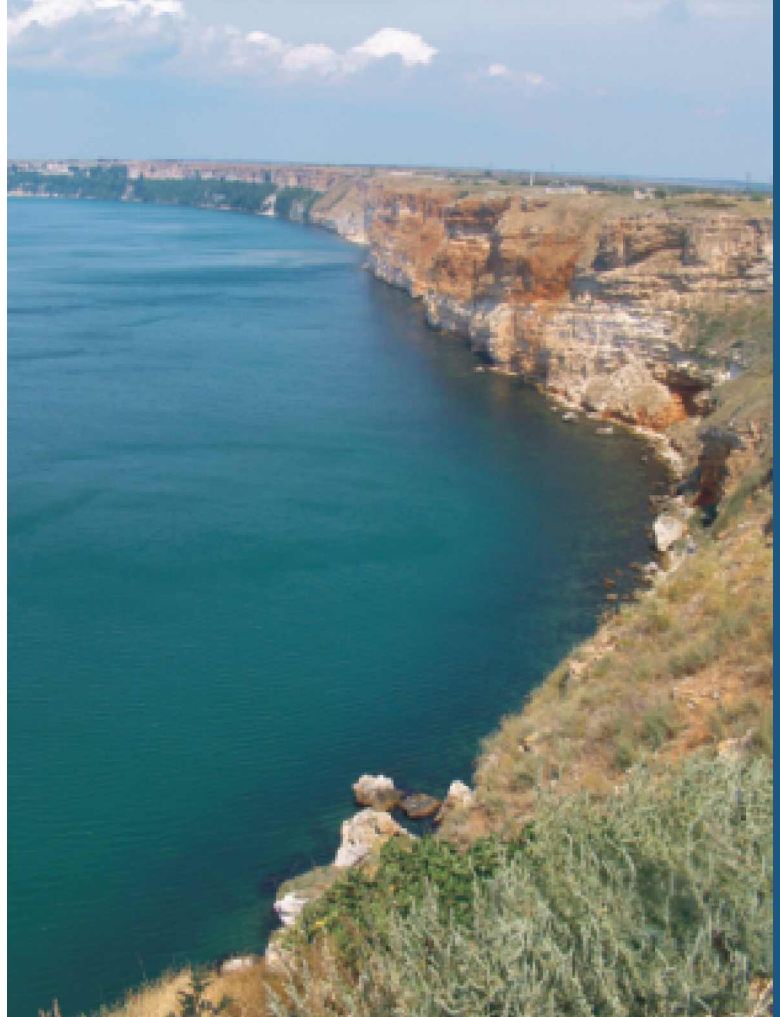


photo: Valentina Todorova

designated as a strict nature reserve with an area of 53 ha. In 1980 the reserve was extended to its present size of 687.5 ha. In 1983 a buffer zone of 109 ha was included.

The reserve covers 400 ha of marine area - a stretch of sea 500 m wide and 8 km long and 287.5 ha of terrestrial area - a strip of land along the coast from c. Kaliakra to Taukliman marsh. It is situated at the end of a long and narrow peninsula. The site is famous historically and for its nature and pristine condition.

The entire terrestrial part of the reserve is uncultivated land with natural habitats. Limestone cliffs up to 70 m high are crimson red due to iron oxides. One third of the coastal area comprises natural pastures, steppes, woodlands, bushes and coastal wetlands in a strip along the coast. The flora encompasses over 450 vascular plants,

among which 45 are rare, threatened or endemic species. Kaliakra stands on the autumn migration route of over 220 species of birds, 39 of which breed in the reserve.

The marine habitats comprise rocky bottoms overgrown by brown, red and green algae, mussels (*Mytilus* and *Mytilaster*), sponges, colonial ascidians, bryozoans and hydroids. Sandy and muddy soft bottoms are dominated by different bivalves (*Chamelea gallina*, *Lentidium mediterraneum*, *Anadara inequivalvis*, *Mya arenaria*, *Abra alba*, *Cardiidae*, *Mytilus galloprovincialis*). 78 fish species are encountered of which 44 are resident. The limestone is punctured with caves: former refuges of the Monk Seal, now extinct from the Bulgarian coast.

The following activities are strictly prohibited in the reserve: fishing, hunting, killing, collecting and harvesting of any fauna and flora, disturbing the wild fauna, destroying bird nests and animal lairs, mining, extraction and excavation, building constructions of any kind, pollution with chemicals and litter, camping and fire making, trampling outside the indicated pathways.

The local human pressures on the area are currently negligible due to small population, lack of industry, absence of large harbours and minor touristic coastal development. Moderate eutrophication from the Danube has been documented. Recently a number of wind power electric generators have been built in the area adjacent to the reserve, however their ecological impact is still unknown. Tourism is supposed to expand significantly in the near future and increase the pressures on the coastal and marine environments thus threatening not only the



Statistics of the Bulgarian Black Sea and location of the two existing MPAs indicated.

biological diversity, but also the aesthetic, cultural and spiritual values sustained by “Kaliakra” nature reserve.

Koketrays sandbank was designated as a protected site with area of 760 ha in 2001. The purpose of the site is to conserve benthic fauna diversity, which is exceptionally high in the area (Konsulova, Tokmakov, 1995). The prohibited human activities include sand mining, dredging and bottom trawling for mussels, whelks and fish, pollution with oil, litter and any other contaminants.

In 2007 in compliance with the national Biodiversity Act and the Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora a list of special areas of conservation was proposed for inclusion in the national NATURA 2000 network. 14 sites of the network include marine area with total surface of 61 100 ha, which represents 9.4% of Bulgarian territorial waters, 6 % of the shelf area to 100 m depth and 2.4 % of EEZ.

A look from the sea at c. Kaliakra during winter



Information board for visitors



CRITERIA FOR SELECTION OF MARINE PROTECTED AREAS

The criteria for selection of regions suitable for MPAs designation are defined according to the objectives that have to be achieved at the protected sites.

When the main goal is biodiversity conservation and maintenance of vital ecological processes, priority is given to ecological criteria with emphasis on uniqueness or rarity of ecosystems, diversity and representativeness of habitats, occurrence of threatened species and habitats and preserved naturalness.

In case the protected areas aim at ensuring sustainable fisheries, the criteria should focus on identification of critical marine habitats associated with the life functions (breeding, nurseries, feeding, migration routes, etc.) of the target species.

If the objectives are mainly to safeguard areas for tourism and recreation in wilderness settings, the criteria could emphasize scenic value, remarkable seascapes and features of non-living nature, the presence of such other interests as cultural or archaeological sites, accessibility and carrying capacity; i.e., the number of visitors the area can sustain without degrading the environment or destroying the quality of the wilderness experience by crowding.

Clearly, social acceptance of the MPAs is critical to successful implementation. During the selection process eligible areas should be assessed relative to traditional livelihoods and economic activities practiced by local residents. Conflicts between nature conservation and human activities should be taken into account and minimized. Areas, where pollution or commercial development have caused problems so severe that they would override any protective benefit from the reserve and so intractable that the situation is unlikely to improve, should be excluded.

The criteria listed below comply with the requirements of the Bulgarian legislation (Protected Areas Act, Biodiversity Act) regarding the objectives and purposes of the protected areas. The European and international Acts used in defining selection criteria encompass Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, Convention on the conservation of European wildlife and natural habitats, Bern, 1979, IMO Resolution A.982 (24) for the identification

Variety of sponges on rocky bottom

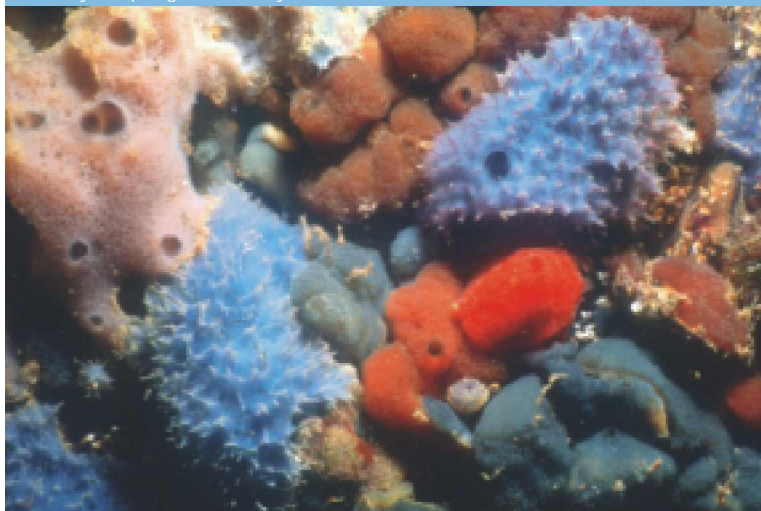


photo: Lyubomir Klisurov

Blue mussels, barnacles, sea anemones and sponges on rocky bottom



photo: Lyubomir Klisurov

The green form of *Actinia aequina*



photo: Lyubomir Klisurov



and designation of particularly sensitive sea areas, 2005. A number of IUCN guidelines for MPAs designation and management of the have been consulted as well (Kelleher, G. & Kenchington, R., 1992, Salm et al., 2000).

Ecological criteria

Uniqueness or rarity

- ecosystems and habitats which are the only one of its kind or occur in few locations
- rare, threatened or endangered species and their habitats

Representativeness

- typical, outstanding and illustrative examples of ecosystems, communities, ecological processes and other natural characteristics and processes

Diversity

- exceptional variety of species or genetic diversity
- highly varied ecosystems, habitats, and communities

Naturalness

- a relative lack of human-induced disturbance or degradation

Dependency

- ecological processes and biological diversity are highly dependent on biologically structured systems (e.g. biogenic reefs, seagrass meadows)

Critical habitats

- Areas essential for the survival or recovery of fish stocks or rare or endangered marine species (spawning, nursery, feeding grounds, migration routes)

Vulnerability

- Habitats, communities and species with low tolerance to natural and anthropogenic disturbance

Representative and outstanding seascapes and features of non-living nature

– reefs

– sandbanks

– sea caves

– underwater structures made by leaking gasses

Seagrasses *Zostera marina* and *Zannichellia pedicellata*



Social, cultural and economic criteria

Social or economic dependency

– Environmental quality and sustainable utilization of living resources are important for the continuation of traditional livelihoods and uses fisheries, tourism, recreation, etc.

Cultural heritage

– Occurrence of significant historical remains and archaeological artefacts

Applicability/ feasibility

– Level of isolation from external destructive influences

– Social and political acceptability, level of community support

– Compatibility with existing uses

– Management feasibility, compatibility with existing management regimes

Remnants of a shipwreck



photo: Lyubomir Klisurov

Scientific and educational criteria

Scientific value

– Areas of high scientific interest

Educational value

– opportunities for illustration of typical natural processes and phenomena

Reference conditions

– Baseline for long-term monitoring studies

Blennius tentacularis



photo: Lyubomir Klisurov

Ecological coherence of the MPAs network

A solitary MPA is usually not sufficient to fulfill the purposes of its designation since there are strong interactions between distant marine areas due to the dispersal of substances and organisms by marine currents and the migration of many species. The open nature of the marine environment requires the development of a network of interconnected MPAs that are close enough for resident populations to interact through dispersal or migration. The principle of ecological coherence is based on two conditions:

Replication of features

– Identical species, communities, habitats and seascapes are represented in the individual areas in the network.

Connectivity

– within a network, MPAs should have some level of connectivity; that is, they should be close enough for resident populations to interact through dispersal or migration.

Pomatomus saltatrix



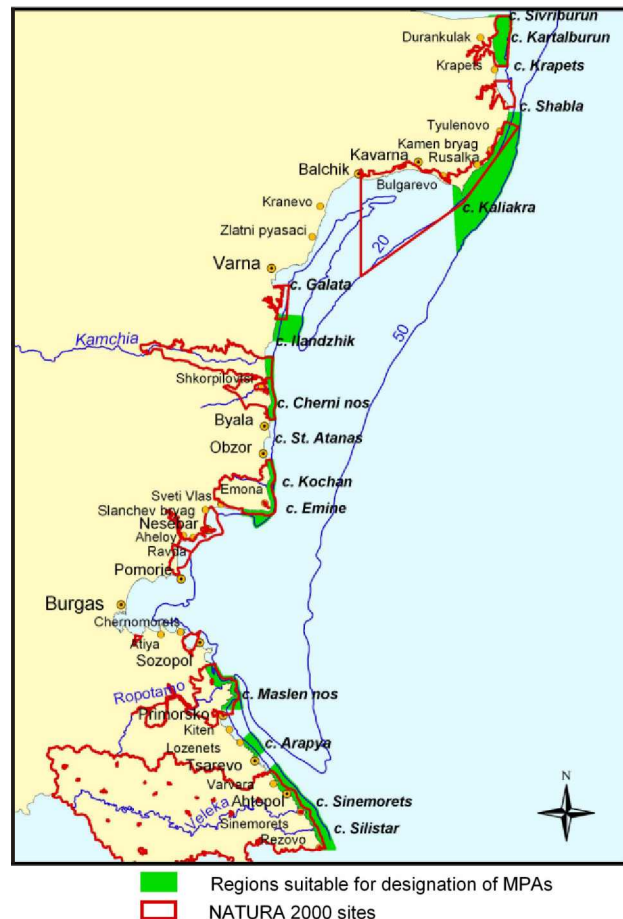
photo: Lyubomir Klisurov

PRIORITY REGIONS FOR DESIGNATION OF MARINE PROTECTED AREAS IN BULGARIA

The selection of priority regions for designation of MPAs in Bulgaria was made according to the set of criteria listed above after considering the complete information acquired through:

- literature review,
- consultation with a range of professionals and amateurs dealing with marine studies or using the marine resources and environment (marine biologists, geologists, coastal zone managers, environmentalists, fishermen, divers, underwater photographers, etc.),
- field work carried out during summer 2007 by SCUBA diving visual census and underwater photography for identification and documentation of marine habitats and species with high conservation importance and mapping of their distribution.

During the survey we documented 33 Black Sea habitats (Micu and Todorova et al., 2007), which are elemental habitats of the following general



Salaria pavo



Brown seaweeds *Cystoseira barbata*



natural habitat types listed in Annex I of the Council Directive 92/43/EEC (Habitats Directive) and Annex I of the Bulgarian Biodiversity Act:

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

8 elemental habitats

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

2 elemental habitats

- 1170 Reefs

21 elemental habitats

- 1180 Submarine structures made by leaking gases

- 8330 Submerged or partially submerged sea caves

The habitat types 1130 Estuaries and 1150 Coastal lagoons also occur in the Bulgarian Black Sea coastal area, however they were not within the scope of the current study.

A total of 141 species were recorded during the field observations, of which 22 algae, 3 seagrasses, 4 sponges, 1 sea anemone, 4 polychaete worms, 19 crustaceans, 9 gastropods, 19 bivalves, 2 ascidians, 56 fishes and 2 reptiles (Dimitrova-Konaklieva, 2000; Karapetkova, Zhivkov, 2006; Marinov, 1990).

Rare and threatened species observed during the survey encompass:

- 36 species included in the Black Sea Red Data Book (Dumont, 1999)

- 6 species included in IUCN world red list of threatened species.

Field and desk studies resulted in the selection of 8 candidate regions eligible for designation of MPAs. The network of sites is characterized by considerable ecological coherence in terms of repeatability of habitats and species of conservation interest. The connectivity within the network is ensured by the small distance between sites.

Donax trunculus



photo: Lyubomir Klisurov

Natrix tessellata

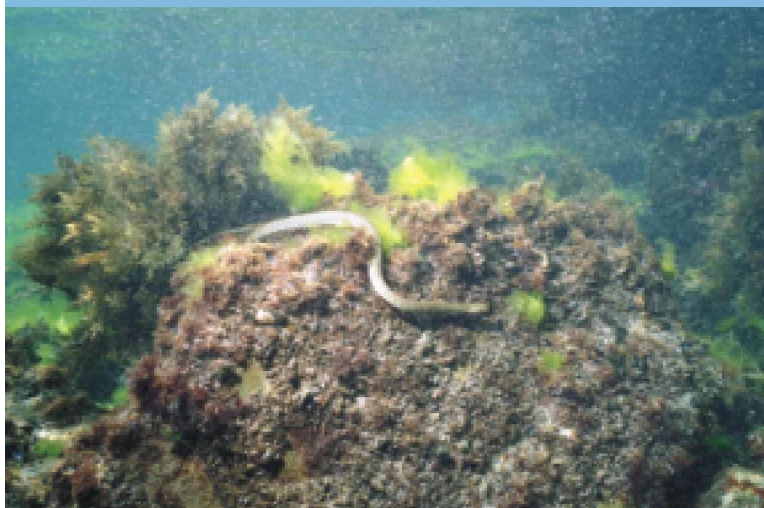


photo: Lyubomir Klisurov

Strandzha mountain coast

The marine area along Strandzha mountain coast is distinguished by clear waters, preserved naturalness, and very good ecological state. Magnificent underwater seascapes of rippled sands and rocky reefs overgrown by colourful sponges and blue mussels entice the fascinated divers.

Underwater habitats are highly varied. The most representative among them encompass clean sands inhabited by psamophilic clams (*Donax trunculus*, *Chamelea gallina*) and rocky seabed luxuriously covered by the brown alga *Cystoseira*

barbata and the blue mussels *Mytilus galloprovincialis* and *Mytilaster lineatus*. The coarse sands in the mediolittoral zone, well flushed by the wave action, are inhabited by dense populations of the small wedgeclam *Donacilla cornea*, a species threatened by tourist impact on beaches, water pollution and building of coastal defence constructions that impair the water exchange (Micu D., Micu S., 2006).

Among rare fish species we chanced upon *Arnoglossus kessleri*, *Diplodus annularis*, *Aidablennius sphinx* and *Salaria pavo*.

Conditions nearly undisturbed by human activities make the region important in scientific and educational terms and provide reference for ecological state assessment studies.

Strandzha coast might be still 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 theoretic possibility exists for restoration of the monk-seal population.

photo: Valentina Todorova

Callionymus pusillus



photo: Lyubomir Klisurov

Sea anemones on rocky seabed

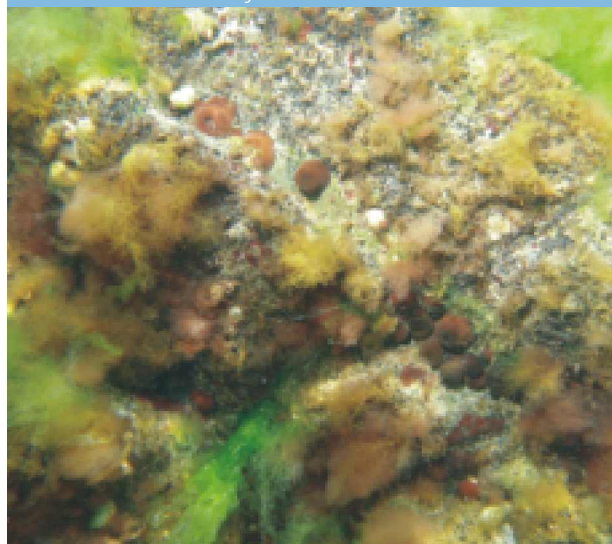
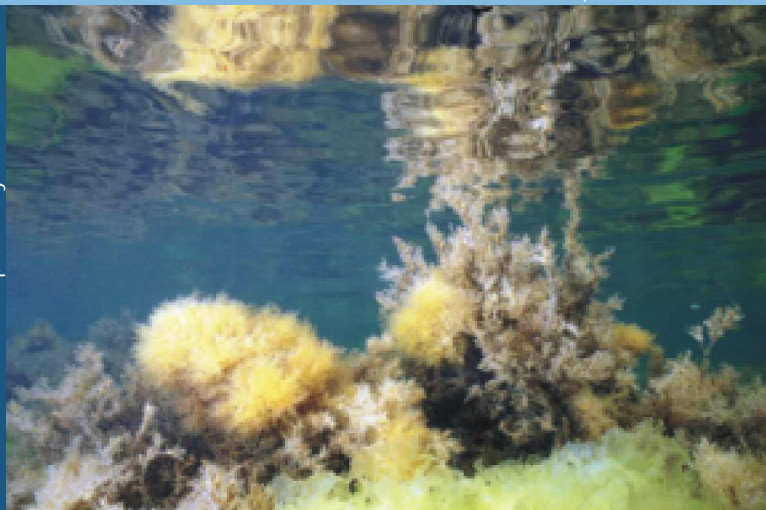
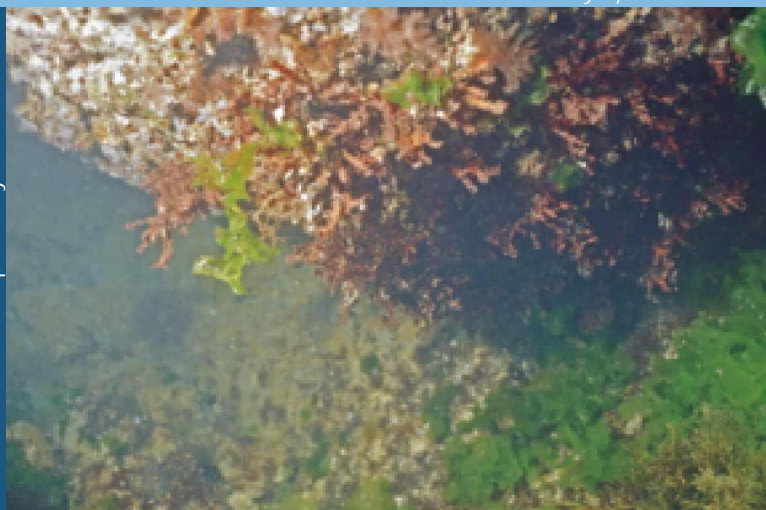


photo: Dragos Micu

Underwater seascape with seaweeds

Red seaweed *Phyllophora nervosa*

Overgrowth of seaweeds and mussels on bedrock

*Parablennius sanguinolentus*

Tsarevo - Lozenets

The small secluded bays between Tsarevo and Lozenets possess unique charm and attractiveness. The underwater seascape is a colourful carpet of brown, green and red algae abundantly overgrowing rocks and boulders. In this area we came across the rare red alga *Phyllophora nervosa*, a species which loss has become a symbol of the Black Sea ecological degradation during the second half of the 20th century. Its huge previous stocks in the North-western shelf are now depleted. Along the Bulgarian coast it is scarce, occurring in small tufts on rocky bottom at depth 3-10 m, usually under overhangs to avoid direct sunlight. The area harbours a number of other rare species. In the sandy bottom we found the rare bivalve *Loripes lacteus*. We also encountered the rare fishes *Pomatoschistus minutus*, *Coryphoblennius galerita* and *Symphodus ocellatus*.

Preserved naturalness and very good ecological conditions, highly varied representative habitats and occurrence of rare and threatened species, undoubted value for research and monitoring and aesthetic attractiveness qualify the area as priority site for conservation.

Symphodus ocellatus

Cape Maslen nos - Ropotamo river estuary

This region of the Bulgarian Black Sea coast is distinguished by extraordinary variety of coastal and marine habitats. The coasts are characterized by indented fjords and small sheltered bays, delineated by numerous peninsulas ending with unapproachable capes with steep volcanic cliffs. Relict oak forests extend almost to the shoreline. Beaches with dunes, lagoons and marshes, and the estuary of Ropotamo river complete the mosaic of habitats.

Underwater habitats are equally varied and remarkable. The rocky bottom slopes down vertically to invisible depths at some places. The rose-coloured turfs of the calcareous red alga *Corallina officinalis* overgrow the shallow bedrock and boulders making them look like coral reefs. The bushy brown seaweeds *Cystoseira* spp. form a zone below the coral weed. Their dense branches provide a habitat for a range of invertebrate epifauna such as bryozoans, hydroids and ascidians and epiflora such as crustose red algae (*Dermatolithon cystoseirae*). Other typical inhabitants of *Cystoseira* thickets are the mussels *Mytilaster lineatus*, the snail *Tricolia pullus*, the decapods *Pachygrapsus marmoratus*, *Pilumnus hirtellus* and *Xantho poressa*, the sea horse *Hippocampus guttulatus*, a variety of wrasses, blennies and gobies. Below the *Cystoseira* zone the rocky seabed is dominated by the blue mussel *Mytilus galloprovincialis*. A rare rocky habitat established in the area is limestone punctured by the rock-boring bivalve *Petricola lithophaga*.

Sedimentary bottom provides a variety of habitats as well. Habitats of high conservation interest are seagrass meadows of *Zostera marina*, *Zannichellia pedicellata* and *Potamogeton pectinatus*, which are representative of shallow sheltered locations with fine sand. In front of Ropotamo river estuary *Z. marina* shoots attain the extreme length of 2.5-3 m. Among seagrasses we chanced upon the rare goby *Zosterisessor ophiocephalus*, which is included in the IUCN world list of threatened species. Other important habitats are sediments inhabited by Thalassinid

Pilumnus hirtellus



photo: Lyubomir Klisurov

Pestarella candida is a rare Thalassinid crustacean



photo: Lyubomir Klisurov

Wrasses and blennies among colourful seaweeds

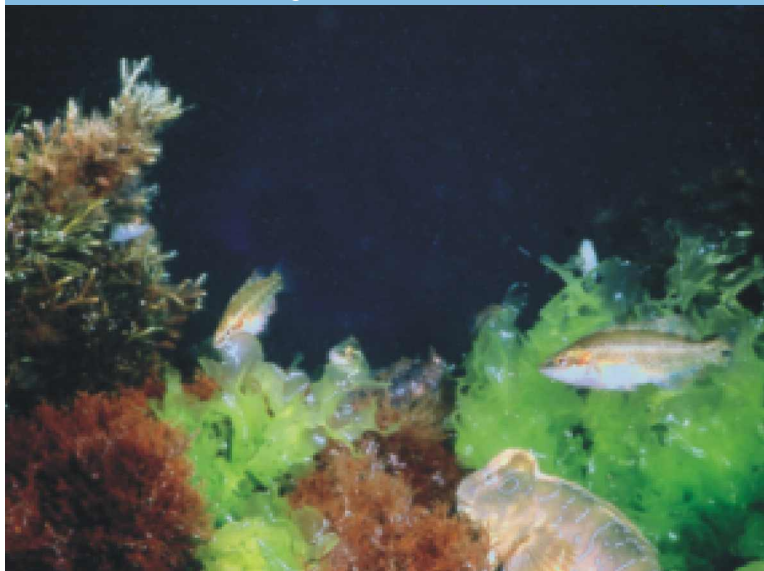
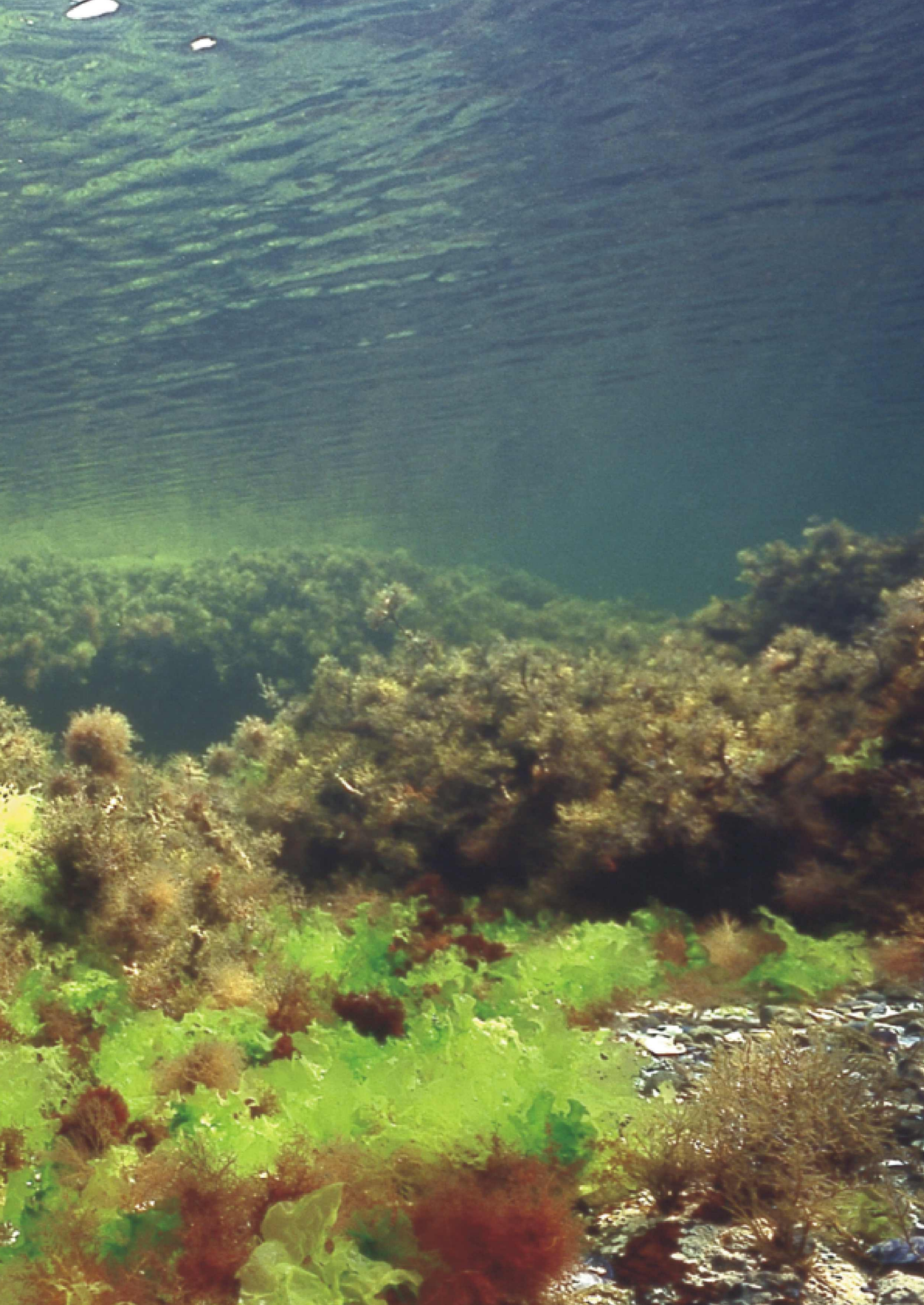


photo: Lyubomir Klisurov



We are responsible for the conservation
of the fascinating "world of silence"
for the future.





crustaceans: fine sands with *Pestarella candida* and sandy silts with *Upogebia pusilla*, the former being a rare species. Ample trophic resources carried by Ropotamo river determine particularly high diversity of gastropods (*Cyclope neritea*, *Nassarius nitidus*, *Rissoa splendida*, *Bittium reticulatum*) and bivalves



(*Loripes lacteus*, *Lentidium mediterraneum*, *Chamelea gallina*, *Donax trunculus*, *Tellina tenuis*, *Cerastoderma glaucum*) that inhabit the sands in front of the estuary.



A newly discovered unique habitat

Amazingly, in the 21st century the Black Sea still keeps undiscovered secrets. Diving along the coasts of cape Maslen nos during the summer of 2007 we found out a remarkable unknown habitat - huge biogenic reefs built by the native flat oyster *Ostrea edulis* (Micu and Todorova, 2007). Tube-building serpulid polychaetes also contribute in the reef structure as cementing element.

"Ostrak" this is how those reefs are called by the local fishermen. They think the name comes from the Bulgarian word "ostar", meaning sharp, and associate it with the edges of oyster shells sticking out from the reef, sharp enough to cut the hands or the neoprene suit of a careless diver. However, in our opinion the name originates from the Greek word "Ostrakon" meaning oyster shell and has probably been given to the oyster reefs by the ancient Greeks, who first witnessed their existence thousands of years ago.

Unlike the flat oyster beds commonly known from the intertidal of Western Europe and North America, at 7 m height, 30-50 m length and 10 m width for each mound, Black Sea ostrak are massive, towering biogenic structures, dwarfing the human observer.

Unlike the small, estuarine oyster reefs built by *Crassostrea virginica* on the south-eastern US coast (Posey et al., 2003; Grizzle et al., 2002), ostrak reefs occur in clear marine waters with no freshwater input, forming a belt between 7 and 23m depth, parallel to rocky coasts.

Reefs are overgrown by blue mussels, sponges and sciaphilic algae (*Delesseria ruscifolia*, *Zanardinia prototypus*) and harbour diverse marine life - abundant crabs (*Eriphia verrucosa*), blennies, gobies (*Aphia minuta*, *Mesogobius batrachocephalus*), scorpionfishes (*Scorpaena porcus*), wrasses and mullets.

Fresh oyster shells were visible on the reefs but at neither of the sites did we find live oysters. Local spear-fishermen found solitary live oysters on the reefs as recently as 2 years ago. However records of abundant oysters date back decades ago.

Do live reefs still exist? Why did the oysters perish at the sites investigated by us? Is oyster reef restoration possible? These are some of the questions to be addressed in future studies.

Scorpaena porcus



photo: Dragos Micu

"Ostrak" is a massive biogenic reef

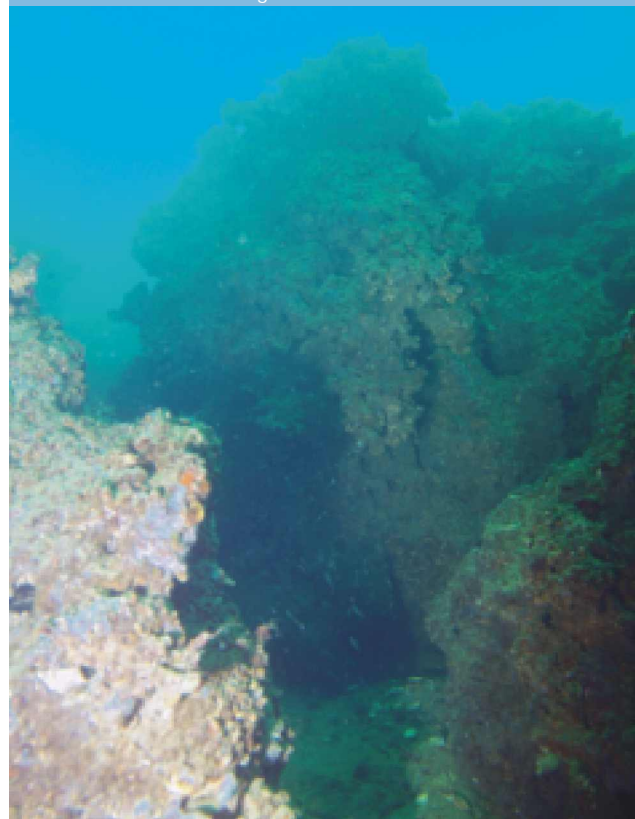
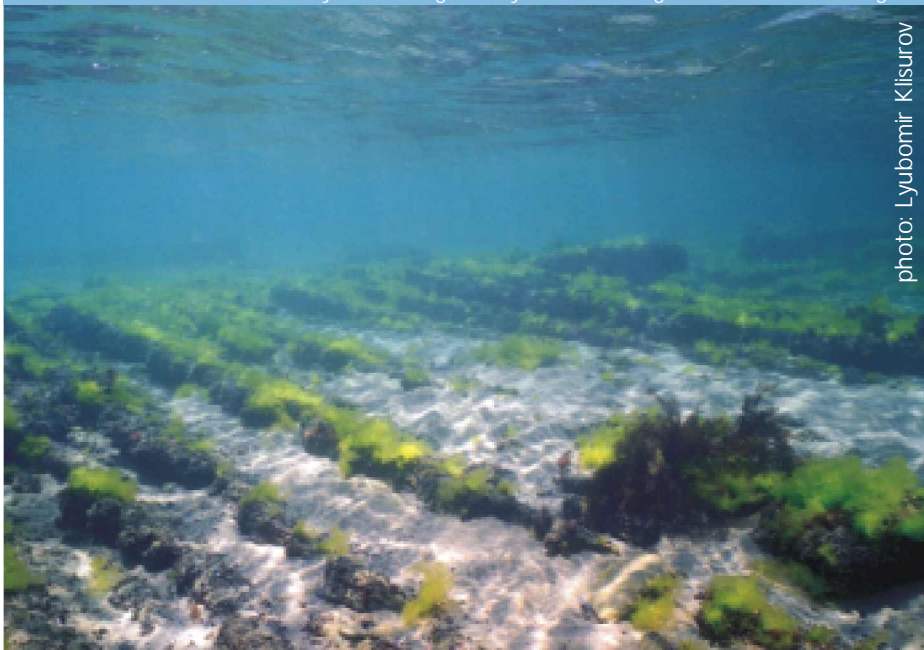


photo: Dragos Micu

Typical serrated appearance of the oyster reefs



photo: Dragos Micu



Cape Emine - Irakli beach

The rocky coast between c. Kochan and c. Emine is structured of sandstone and marl layers that shape the distinctive laminated appearance of the shore cliffs (Peychev, 2004).

The underwater seascape is also peculiar due to the irregular abrasion of different layers, which form a sequence of curved rocky ribs. Bedrock and boulders are overgrown by green (*Enteromorpha* spp., *Cladophora* spp.) and red (*Corallina officinalis*, *Callithamnion corymbosum*, *Ceramium* spp.) seaweeds, as well as association of the brown seaweed *Cystoseira* spp. with the green alga *Ulva rigida*.

Another distinctive habitat in the area is soft marl rock in the upper infralittoral punctured by the boreholes of the common piddock *Pholas dactylus*, a bivalve that drills its perfectly round burrow by shell rotation. The species is officially protected by the Bern convention (Appendix II).

Destruction and fragmentation of its typical habitat by building of coastal defence constructions and covering of the hard substratum with sand for beach enhancements represent threats to the common piddock. Its conservation status is unclear at present in Bulgaria, however it is recognized as Critically Endangered in the Romanian Black Sea (Micu, 2007). The region under consideration is particularly suitable for designation of marine protected area aimed at conservation of *Pholas dactylus* and its habitat.

Irakly is the only beach in this sector of the Bulgarian coast. Its coarse sands in the swash zone are inhabited by the corneous wedgeclam *Donacilla cornea*. The underwater slope in front of the beach to 25 m depth is occupied by coarse and medium sands populated by the clams *Donax trunculus* and *Chamelea gallina*. Although they are not traditionally consumed by local people, more and more often these clams are poached by dredges due to high prices on the export market. The site is suitable for designation of protected area to conserve the above mentioned bivalves.



A further characteristic habitat is the sandy/silty bottom inhabited by the Thalassinid crustacean *Upogebia pusilla*. The presence of Thalassinids in the sediment is evident by the burrow holes apparent on the surface. During the 1980-90-ies *U. pusilla* was threatened by recurrent hypoxic/anoxic events due to eutrophication driven phytoplankton blooms along the Bulgarian Black Sea coast. At present we found it at many different locations in its typical habitat - sand and silty sand at depth 2-30 m.

In front of cape Kochan we came across fine sands inhabited by the polychaete *Arenicola marina*. The habitat of the lugworm is distinctive by numerous coiled casts evident on the surface of the sediment. Underneath, the lugworm excavates deep J- or U-shaped burrows.

In addition to the presence of rare and threatened species and habitats of high conservation interest, the region is important for its very good ecological conditions that can be used as reference in ecological assessment studies.

Kara dere beach - cape Cherni nos - Shkorpilovtsi beach

This region is distinguished by the longest beach along the Bulgarian Black Sea and the estuary of Kamchia river. South of cape Cherni nos is located Kara dere beach known for its preserved naturalness.

Clean, well flushed sands of the swash zone are suitable habitat for the wedgeclam *Donacilla cornea* that occurs in abundance at those beaches. Infralittoral medium sand is populated by *Donax trunculus* and *Chamelea gallina*. On the sandy bottom at this place we had the only sighting of the rare stargazer fish *Uranoscopus scaber*.

Blennius tentacularis



photo: Dragos Micu

The common piddock *Pholas dactylus* in marl plates

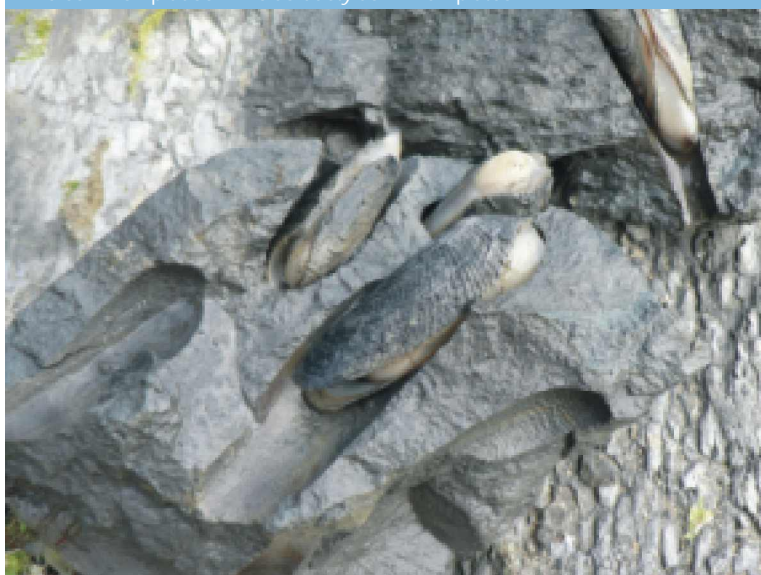


photo: Marina Panayotova

The underwater seascape is characterized by rocky reefs extending all along the shore. Reefs are typically overgrown by green algae (*Enteromorpha*, *Cladophora*, *Ulva*), blue mussels, sponges and colonial ascidians and harbour a range of rare species, among which the rarest encounters during our field work: the endemic mysids *Hemimysis* sp., the decapod crustacean *Polybius navigator*, the damselfish *Chromis chromis* and the pipe-fish *Nerophis ophidion*.

Colonial ascidians *Botryllus schlosseri*



photo: Dragos Micu

Variety of sponges



photo: Dragos Micu

Uranoscopus scaber

photo: Dragos Micu



Clibanarius erythropus

photo: Lyubomir Klisurov



Marl plates perforated by *Pholas dactylus* occur in the infralittoral as well.

The region is also attractive because of the abundant historical and archaeological underwater artefacts. Throughout the ages submerged shallow reefs have been a dramatic arena of numerous shipwrecks, which remnants are scattered all over the seabed.

Underwater seascape with boulders

photo: Lyubomir Klisurov



Yaila Tyulenovo - cape Shabla

This fascinating coast is abundant in remarkable examples of the non-living nature and spectacular seascapes. The limestone cliffs, landslides and caves at Yaila site, the stone arch next to Tyulenovo village and the karst terrace with deep fissures and sinkholes near cape Shabla compete with each other in peculiar shapes and scenic value.

Numerous submerged or partially submerged sea caves, protected by the Habitats Directive and the national Biodiversity Act occur all along the coast.

Impressive limestone blocks up to 10 m in height are arrayed on the seabed with spots of sand between them. Rose-pink turfs of the coral weed *Corallina officinalis* cover densely the rocks in the lower mediolittoral and upper infralittoral. Luxuriant foliage of the bushy brown seaweeds *Cystoseira* spp. and the emerald green seaweeds *Ulva* spp. is swayed by the waves along those exposed coasts. Boulders are wrapped in blue mussels and colourful sponges. At Yaila site the rare red seaweed *Phyllophora nervosa* occurs at depth 3-6 m attached under overhangs. Another red alga *Polysiphonia denudata* can be found more than 10 m deep.

Arch in the cliffs near Tyulenovo village



photo: Valentina Todorova

Rockpools are extreme habitats



photo: Dragos Micu

Submersed sea caves are typical of the region



photo: Lyubomir Klisurov

Karst terrace near c. Shabla



photo: Valentina Todorova

Phyllophora nervosa grows in thickets under overhangs

photo: Lyubomir Klisurov



Tyulenovo village is the northern distribution limit of the barnacle *Chthamalus stellatus* and the snail *Melaraphe neritoides* association, which occupies the supralittoral rock.

Rockpools and caverns on the karst terrace south of cape Shabla represent extreme habitats available only to the most tolerant to desiccation and variable temperature and salinity species - blue mussels, few green algae (*Enteromorpha* sp., *Cladophora vagabunda*) and Cyanophyta.

Further habitats typical of the region are the methane and oil seeps that are to be found close to the shore at depth of only few meters. The ecology and physiology of organisms in the vicinity of the methane seeps is of high scientific interest. Probably due to insufficient knowledge this habitat was omitted from the national Biodiversity Act though submarine structures made by leaking gasses are included in Annex I of the Habitats directive.

Eryphia verrucosa is the largest native crab in the Black Sea

photo: Lyubomir Klisurov



Aidablennius sphinx

photo: Dragos Micu



Mullus sp. searching for their food in the sandy bottom



photo: Lyubomir Klisurov

Gaidropsarus mediterraneus



photo: Lyubomir Klisurov

Cape Krapets - cape Sivriburun

The northernmost part of the Bulgarian coast is flat, covered with loess. Vast beaches alternate with small capes. The region is prominent with Durankulak freshwater lagoon, which is recognized as a wetland of international importance and a Ramsar site.

The seabed in front of the capes is terraced, covered by boulders of 1-2m length and 0.5 m height, shelly detritus and sand spots. Representative rocky bottom habitats include reefs overgrown by the seaweed association of *Cystoseira barbata* and *Ulva rigida* and reefs with mussels.

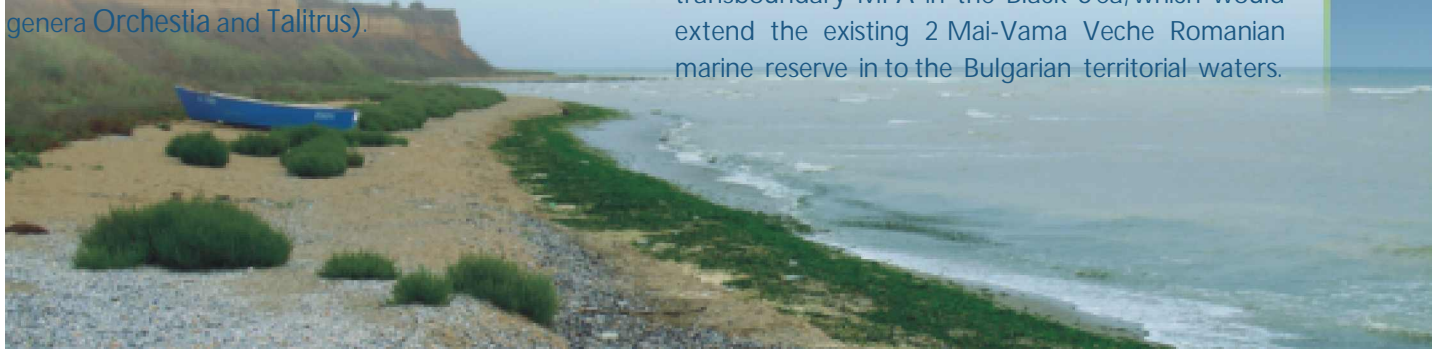
Beaches are flooded during storms and accumulate considerable algal debris, which forms a specific supralittoral habitat inhabited by typical marine fauna (amphipod crustaceans from the genera *Orchestia* and *Talitrus*).

The seafloor in front of the beaches is covered by fine and middle sands with considerable content of shelly detritus, inhabited by the snails *Cyclope neritea* and *Nassarius nitidus* and various bivalves - *Lucinella divaricata*, *Lentidium mediterraneum*, *Chamelea gallina*, *Tellina tenuis*, *Mya arenaria* and *Anadara inaequalis*.

Fish fauna comprises species characteristic of the rocky bottom such as *Gaidropsarus mediterraneus*, *Neogobius melanostomus*, scorpionfishes and wrasses as well as the sandy bottom inhabitants *Merlangius merlangus*, *Mullus barbatus* and *Platichthys flesus*.

The region offers a special environmental management opportunity for designation of the first transboundary MPA in the Black Sea, which would extend the existing 2 Mai-Vama Veche Romanian marine reserve into the Bulgarian territorial waters.

photo: Valentina Todorova



Syngnathus typhle



photo: Drago Micu

Platichthys flesus



photo: Lyubomir Klisurov

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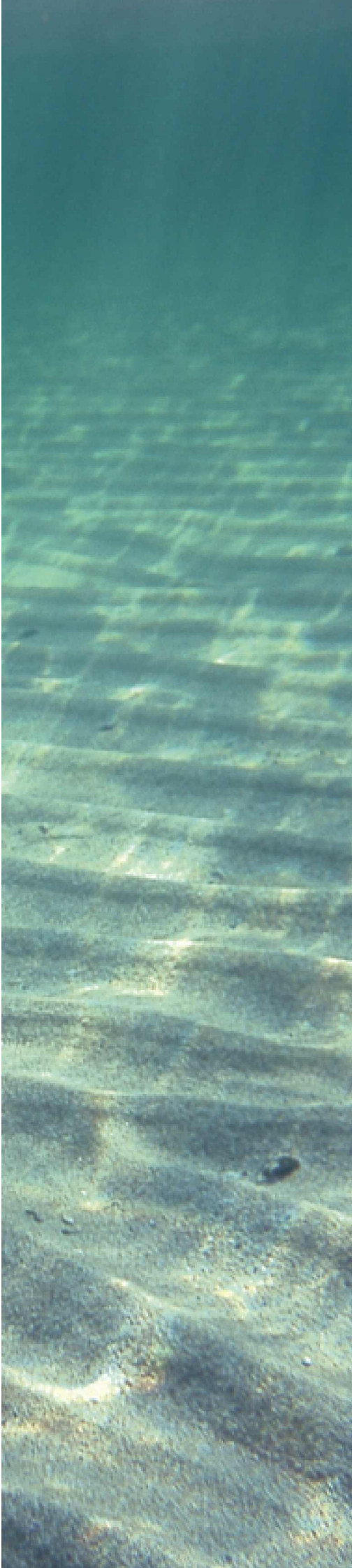


photo: Lyubomir Klisurov

We, the members of the team, led by scientific interests and conservation goals, not only studied the marine biodiversity but enjoyed the tranquility and beauty of the underwater world.

Dragos Micu, NIMRD, Constanta

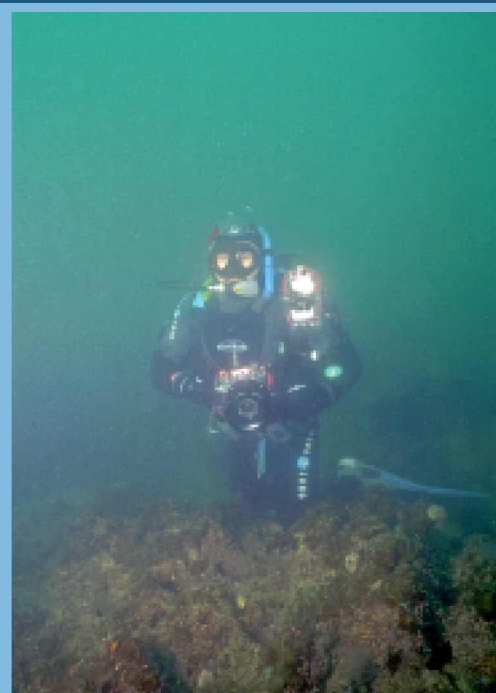


photo: Lyubomir Klisurov

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