

ECOLOGICAL observing System in the Adriatic Sea: oceanographic observations for biodiversity

Priority Axis 3: Environment and cultural heritage

Specific Objective 3.2: Contribute to protect and restore biodiversity

D2.6.3. Educational trails

WP2 – Project communication and Capitalization activities

A2.6 – Educational activities

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Content

1. INTRODUCTION2

 1.1. Activity 2.6.3 and deliverable 2.6.3.....2

 1.2. Work outline.....2

2. DEFINITIONS.....3

 2.1. ECOS project.....3

 2.2. EcoAds.....4

 2.3. European ecological network Natura 20004

 2.3.1. Natura 2000 areas involved in ECOS project.....5

 2.4. Marine protected areas (MPAs).....10

 2.5. Autochthonous and allochthonous species.....11

3. THREE EDUCATIONAL TRAIL TYPOLOGIES.....11

 3.1. Educational panels.....11

 3.2. Educational catalogues.....20

 3.3. Educational videos.....22

4. EDUCATION ABOUT NATURE CONSERVATION.....23

 4.1. Importance and benefits of education about nature conservation.....23

 4.2. An example of good practice and suggestions for future educational methods.....24

5. CONCLUSIONS.....25

6. LIST OF LITERATURE.....27

1. INTRODUCTION

1.1. Activity 2.6 and deliverable 2.6.3

This deliverable is the result of the Activity 2.6 Educational activities. It was prepared by PIDNIC, one of the partners at the project ECOlogical Observing System in the Adriatic Sea: oceanographic observations for biodiversity (ECOSS).

This deliverable explains and presents the final product of what's reported in application form for the activity 2.6 – 3 educational trails typologies.

According to application form, 3 educational trail typologies should be developed considering the available information on Natura 2000 site as well as the deliverable of the project, with focus on target habitats and species. They will have positive effect on Natura 2000 site because they will directly affect awareness of visitors and stakeholders about the importance of conservation issues and its proper and shared management.

PIDNIC developed 3 educational trail typologies through educational panels, educational catalogues and educational videos about Malostonski zaljev, which is protected as a special marine nature reserve and as Natura 2000 area.

1.2. Work outline

The present deliverable is divided into several sections. In the first part (paragraph 2) are explained the definitions used in this deliverable, such as target species and target habitats, marine protected areas, ecological network, autochthonous and allochthonous species etc.

In paragraph 3, three educational trail typologies are presented (panels, catalogues and videos), which were made to present natural heritage of special marine nature reserve and Natura 2000 area Malostonski zaljev.

In paragraph 4, the importance of education about nature is presented and 3 types of educational trails are presented as an example of good practice.

In paragraph 5, for each N2K site selected as case study within ECOSS, suggestions on how to interpret the natural heritage of each selected area in an interesting and educational way are presented.

2. DEFINITIONS

This paragraph provides the definitions of key elements used in this report aiming at linking monitoring programmes, conservation strategies and management strategies for the N2K sites selected as case studies within the ECOSS project. The definitions are a framework for all the ECOSS activities and, while most of them are taken from published scientific literature, others are taken from the ECOSS deliverables that were already approved.

2.1. ECOSS project

Project “ECOlogical Observing System in the Adriatic Sea: oceanographic observations for biodiversity”, ECOSS, is a collaboration among 10 organizations from Italy and Croatia, co-funded by Interreg Italy-Croatia CBC Programme. Project ECOSS aims to provide an essential contribution for improving the conservation status of the habitat types and species of the marine N2K sites in the Adriatic Sea. To achieve this, ECOSS is: Integrating knowledge through a series of case studies, assess the current state of knowledge, merge the existing data infrastructures and create a basis for integrated future ecological and oceanographic monitoring in the Adriatic. Successful marine conservation relies on much more than just ecology and oceanography. Therefore, ECOSS will involve stakeholders from scientific community, governance, local economies and general public. Investing in our future Current marine conservation initiatives is meaningful only in the long run. This is why ECOSS will produce educational materials to engage future generations of marine scientists and conservationists. (D.3.3.1 and ECOSS Brochure).

The ECOSS project, through the establishment of ECOAdS, aims at supporting the realization of an ad-hoc monitoring approach able to describe the environmental state of N2K sites in the Adriatic Sea and to identify humans’ derived pressures acting on them, and at helping the implementation of N2K network by informing the present and future conservation and management goals and sustaining the achievement of EU Nature directives’ objectives (D.3.3.1).

2.2. ECOAdS

ECOSS project overall objective is the establishment of an ECOlogical observing system in the Adriatic Sea (ECOAdS), shared between Italy and Croatia, and eventually extended to other Adriatic countries, able to integrate the ecological and oceanographic research and monitoring with the N2K conservation strategies.

ECOAdS will tightly connect, in a permanent and stable partnership, different actors in the science-society-policy context, within each Country and across the two Countries, through a joint partnership for the monitoring of ecosystem, biodiversity, and resources to support their management. ECOAdS will be built on the facilities, infrastructures and long-term ecological monitoring and observing systems already existing in the Adriatic Sea. (D.3.3.1).

The N2K sites considered in ECOSS will be used as case studies for the establishment of the ecological observatory ECOAdS. The development of case studies on selected N2K sites, will allow testing the usefulness and the relevance of the ecological observing system to support significant management questions in biodiversity conservation. Following the principles of open science, data collected within the frame of ECOAdS will be made, whenever possible, available publicly through an online platform, to any private and public users which might be interested in using them.

2.3. European ecological network Natura 2000

The European Commission considers the N2K network as the “centrepiece of EU nature and biodiversity policy” and has reunited in the Directive 2009/147/EC, both the Habitats Directive (92/43/CEE) and the Birds Directive (79/409/CEE and 2009/147/CE) aiming to conserve and assure the survival of threatened habitats and species.

The N2K network, concerning terrestrial and marine environments, focuses on the future sustainable management of protected areas and on the establishment of protected areas as part of its obligations for the UN Convention of Biological Diversity. The aim of N2K is to preserve the natural values triggering the designation of these sites while keeping human activities in a sustainable way.

These areas have to be delimited geographically, based on the ecological necessities of the species that have been declared as of community interest, and evaluated and managed as important sites. The Birds

Directive establishes that the designation of the areas important for birds are based on the number and occupied surface of bird individuals and communities as well as for the groups migrating in the area. Bird conservation areas in the Adriatic include Special Protection Areas for birds (SPA-IBA) and Ramsar Sites, which concern either migrating stops, nesting zones or accumulation sites for feeding (<https://natura2000.eea.europa.eu/>).

The N2K network includes two types of protection areas: Sites of Community Importance (SCIs) under the Habitats Directive (92/43/EC), and Special Protection Areas (SPAs) under the Birds Directive (2009/147/EC). The protection and conservation of natural areas is regulated by the Directive 92/43/EEC, for which each member state (EU) provides and establishes areas aimed to restore and guarantee the best conservation status of the wild flora and fauna as well as their habitats.

2.3.1. Natura 2000 areas involved in ECOSSE project

Seven marine and coastal protected areas included in the N2K network were used as case studies in the ECOSSE project (Figure 1). Diverse oceanographic, ecological and anthropogenic features of these sites were used to investigate their conservation requirements and extrapolate the lessons learned to other N2K sites in the Adriatic. N2K case studies of ECOSSE project are:

Po River delta Tratto Terminale Delta Veneto (IT3270017) and Po River delta (IT3270023)

The two Italian Delta del Po N2K sites are geographically overlapping and they compose a single river-delta-sea system with the same species. For the aim of this project and based on expert opinion, only species strongly dependent on the marine environment, where they can be observed regularly or during some stages of their life cycle, are considered.

IT 3270017 Po River delta Tratto Terminale Delta Veneto is characterized by a stretch of river of considerable size and flow, with a delta system, coastal dune systems, valley wetlands, sandy formations (sandbanks) and river islands with floodplains and lakes. The site has complex vegetational associations, with extensive reeds and psammophilous and halophilic series, but also thermophilic forest flaps and hygrophilous wrecks (D.4.1.1).

IT3270023 Delta del Po is characterized by a stretch of river of considerable size and flow, with a delta system, coastal dune systems, valley wetlands, sandy formations (stalls) and river islands with floodplains and lakes, with associations typically belonging to the psammophilic series and, limited to some areas, relict flaps of forests. The area constituted by the fluvial branches of the Po hosts hygrophilous woods of *Salix* sp.pl. and *Populus alba*. In the floodplains there are floating meadows of *Trapa natans* (D.4.1.1).

Tegnùe di Chioggia (IT3250047)

This marine environment consists of coralligenous outcrops of variable extension (from the few square meters of the smallest outcrops up to over a thousand square meters) locally called tegnùe or trezze. It is possible to identify outcrops of great extent and discrete elevation that constitute the only hard substrates of natural origin in a mainly sandy-silty bottom. The presence of these structures provides a support on which sessile organisms can attach. The occasional presence of *Chelonia mydas* has been found, although with non-significant populations. On 3 August 2002, Zona di Tutela Biologica - ZTB was established by Ministerial Decree. Professional and sport fishing are prohibited and recreational diving is regulated, allowing anchoring exclusively to special buoys upon notice to the association that manages it. (D.4.1.1).

Trezze San Pietro e Bardelli (IT3330009)

The site is based around rocky outcrops known locally as trezze, characterized by substrates of various origins (clastic sedimentary, sedimentary sediments, organogenic) and with extent ranging from a few to several hundred meters. The geological nature of the outcrops reveals that not all of them can be attributed to bioconstruction, but there are also slabs deriving from the cementation of sand or rocks by methane gas. From recent research, around 250 outcrops have been identified only in the Gulf of Trieste between Punta Sdobba and Punta Tagliamento; the most widespread range of these outcrops is on the seabed in front of the lagoon of Grado and Marano at a distance from the coastline of between 2 and 17 km, and a depth varying between 8,3 and 21,5 m. The areas involved in rocky outcrops extend from the Gulf of Trieste to the coast of Ancona, along the entire north-western and western coast of the North

Adriatic. The calcareous concretions are attributable to corallinaceous algae and secondly to bryozoa, molluscs (*Arca noae*, *Chama gryphoides*), anthozoans (*Cladocora caespitosa*), serpulids (*Serpula concharum*, *Serpula vermicularis*, *Pomatoceros triqueter*, *Rotula* sp.plur.). The typology of the San Pietro and Bardelli trezze is of the tabular type consisting of a fractioned set of many outcrops of the same type, however there are some major elements of larger dimensions (D.4.1.1).

Cres-Lošinj (HR3000161)

This large marine site is located in the Kvarner area around the sheltered coast and waters of the eastern part of the Lošinj and Cres archipelago (Figure 5). It is one of the most important feeding and breeding areas for bottlenose dolphins (*Tursiops truncatus*) in the Eastern Adriatic. Lithostratigraphic units represented on the coast are dolomites and post sedimentary diagenetic breccia (upper Albian, lower Cenomanian), rudist limestones (Cenomanian-Maastrichtian). Soils on the coast are rocky ground, anthropogenic soil on karst. In July 2006, a preventive protection of a part of the Kvarner region (Cres-Lošinj Special Marine Reserve – CLSMR) was declared for 3 years as a Special Marine Reserve (D.4.1.1). This area is an important site for the Mediterranean population of the loggerhead sea turtle (*Caretta caretta*), Mediterranean endemic seagrass (*Posidonia oceanica*), coral biocenoses, and nesting sites of the common European Shag (*Phalacrocorax aristotelis*). The target species of the site is the bottlenosed dolphin (*Tursiops truncatus*). Due to the continuous research effort by the BWI, there has been more recent data on the target population suggesting that this N2K site hosts a discrete, resident bottlenose dolphin population of around 200 individuals (D.4.1.1).

Viški akvatorij (HR3000469)

This large marine site covers a wider marine area around the Island of Vis and the Island of Biševo, except the marine areas surround the same islands in a buffer 500 m from the coast, which are covered by other N2K sites. This marine site has an area of 51.888,50 hectares.

In 2003, the international ecological organization World Wildlife Fund declared the Vis archipelago one of the 10 “last paradise oases of the Mediterranean”, thus including it, together with the islands of Mljet and

Lastovo, in the “Adriatic Blue Corridor”, based on scientific research which revealed that this maritime zone has the largest biodiversity in the Mediterranean. In 2019, due to significant geological and geomorphological importance of the Vis archipelago, it has been designated officially as a UNESCO Global Geopark (D.4.1.1).

The target species of the site is the bottlenose dolphin (*Tursiops truncatus*). In the area of the Vis Archipelago some other Cetacean species are seen: the striped dolphin (*Stenella coeruleoalba*), fin whale (*Balaenoptera physalus*) and Risso's dolphin (*Grampus griseus*). It is an area of high underwater biodiversity importance.

During research performed by the BWI, several other species were observed: giant devil rays (*Mobula mobular*), blue-fin tuna (*Thunnus thynnus*), swordfish (*Xiphias gladius*), Eleonora's falcons (*Falco eleonora*), Mediterranean flying fish (*Cheilopogon heterurus*), Yelkouan shearwater (*Puffinus yelkouan*) and Scopoli's shearwaters (*Calonectris diomedea*), and European shags (*Phalacrocorax aristotelis*) among others. There are also occasional unconfirmed reports of sightings of monk seals (*Monachus monachus*), great white sharks (*Carcharodon carcharias*) and other endangered animals (D.4.1.1).

Malostonski zaljev (HR4000015)

The ecological conditions in the bay are greatly influenced by the surface run-off and groundwater run-off from the mainland, and by the currents coming from the open sea. The influence of the Neretva River varies, it is occasionally more pronounced in outer and middle part of Mali Ston Bay, while strong underwater freshwater springs in the inner part of the bay have a more significant impact on the inner part of the bay. Specific biocenoses are inhabited by a large number of filter feeding organisms, among them commercially significant shellfish which has been consumed and farmed from ancient times, especially European flat oyster *Ostrea edulis*.

N2K site Malostonski zaljev (HR4000015) is a completely marine area and a part of a Special marine nature reserve in the sea Malostonski zaljev Bay declared in 1983. According to the proclamation act, Malostonski zaljev (HR4000015) belongs to the habitat class N01 Marine areas and Sea inlets, and two habitat types are present at the site: mainly 1160 large shallow inlets and bays and small area 1170 Reefs.

HR4000015 Malostonski zaljev includes only the marine area, officially protecting just two habitat types important for the European Union 1160 - large shallow bays and coves (5718.76 ha), and partially (325 ha) 1170 - reefs (Bioportal, 2020). Other habitat types and associated habitats, even those which occupy large areas, have been neglected. In the outer part of the Mali Ston Bay, habitats typical for habitat type 1150 - coastal lagoons and habitats 1120 – *Posidonia* beds and 1110 - sandy bottoms permanently covered by the sea were also recorded.

Furthermore, it is necessary to take into account the present protected species among which they are: algae *Cystoseira spinosa* (*C. adriatica*), *Cystoseira foeniculacea* and *Cystoseira crinitophylla*, *Fucus virsoides*, seagrasses *Posidonia oceanica* and *Cymodocea nodosa*, sponges *Sarcotragus foetidus*, *Sarcotragus spinosulus*, *Tethya citrina*, *Tethya aurantium* and *Geodia cydonium*, a cnidarian *Cladocora caespitosa* and bivalves *Lithophaga lithophaga*, *Pholas dactylus* and *Pinna nobilis*, a fish seahorse *Hippocampus guttulatus*. Besides indigenous organisms, there are a number of non-indigenous ones, such as green algae *Caulerpa cylindracea* and *Caulerpa racemosa*, red algae *Asparagopsis armata*, a sponge *Paraleucilla magna*, a polychaete *Hydroides elegans*, nudibranchs *Bursatella leachii* and *Melibe viridis*, a bryozoan *Amathia verticillata* (Cvitković and Žuljević, personal communication).

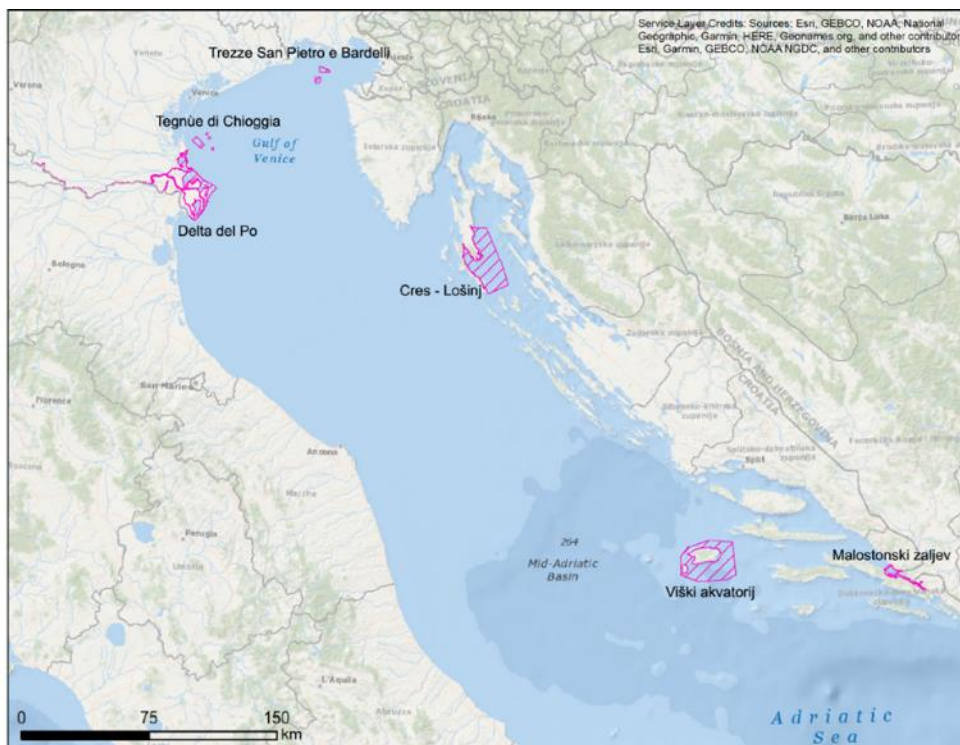


Figure 1. Map of the N2K sites studied in ECOS project.

2.4. Marine protected areas (MPAs)

IUCN defines MPAs as “a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values”.

Marine Protected Areas (MPAs) are globally recognised as one of the most effective ways for the conservation and protection of the marine environment when they are managed effectively and have sufficient resources to address local management issues. MPAs can provide a wide variety of benefits ranging from the conservation of whole areas that are home to important biodiversity, serving as nursery grounds for fisheries and enhancing fish stocks. They can also provide more sustainable tourism and recreational benefits, as well as enhance other non-use values such as cultural and heritage values (OECD, 2017).

While MPAs are crucial components to help ensure marine conservation and sustainable use, they are not sufficient to ensure that the broader environmental goal is achieved. Efforts to address multiple pressures simultaneously need to be intensified in order to improve the effectiveness and resiliency of MPAs in achieving their intended objectives.

2.5. Autochthonous and allochthonous species

Autochthonous species are the species that have been natives of a particular habitat for a long time, those which are adapted to that habitat's conditions and whose presence is a result of entirely natural processes. Both direct and indirect human influence can endanger autochthonous species through the introduction of new, that is allochthonous, species into the habitat. Allochthonous species are those that have been transferred from their original habitat into a new habitat, where they haven't lived before.

3. THREE EDUCATIONAL TRAIL TYPOLOGIES

This paragraph provides descriptions of three types of educational trails, which were made to present key natural values and heritage of *HR4000015 Malostonski zaljev*. Three typologies of trails are bilingual educational panels, bilingual educational catalogues and bilingual educational videos.

3.1. Educational panels

As first type of educational trails, PIDNIC developed 3 different types of educational panels - 2 panels represent brown signalization signs (panels that stand along the main road and indicate to passengers that they enter the protected sea area) and their dimension are 250x220 cm (height x width), 3 panels are interpretive and describe the main features and characteristics of Malostonski zaljev, placed on lookouts in different locations within Malostonski zaljev and their dimension are 150x100 cm (width x height), and 4 panels are located in Mali Ston and they are intended primarily for the education of the locals and these panels explain the key features and processes of Malostonski zaljev and present the list of target species and habitats in this N2K area. Their dimension are 120x90 cm (width x height). Each panel is placed on different location and the locations of each of them are shown in figure 2., figure 3. and figure 4. There's a link from PIDNIC's website where all educational panels are presented: <https://www.zastita-prirode-dnz.hr/promotivni-materijali/>

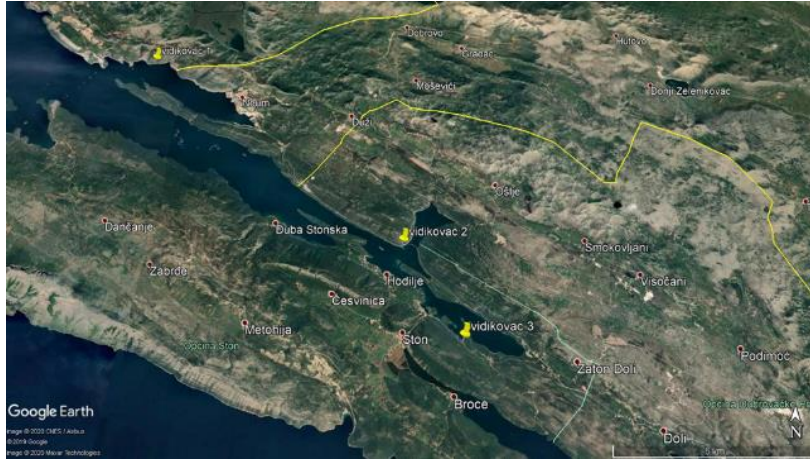


Figure 2. Map of locations of 3 interpretative panels placed on 3 lookouts.

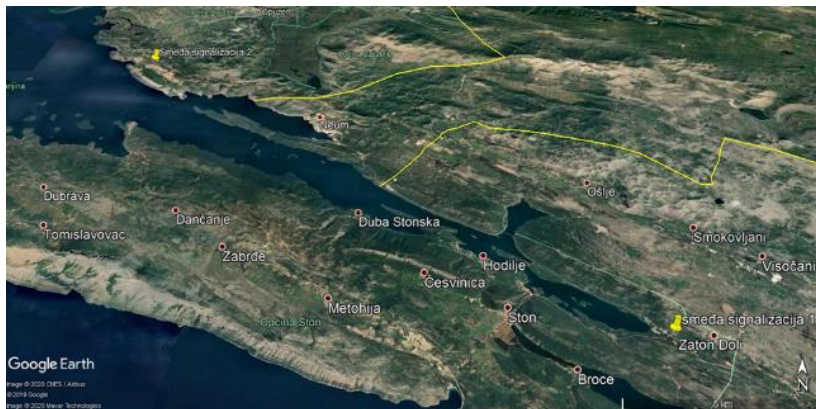


Figure 3. Map of locations of 2 brown signalization signs.



Figure 4. Map of locations of 4 educational panels located in Mali Ston.

On the brown signalization panels, which are placed at the northern and southern entrances (Figure 3.) to the marine protected area, a photograph of the Malostonski zaljev is shown and it is indicated that this area is protected as a special marine nature reserve and as a Natura 2000 area. In addition, the panel clearly indicates that the board was made as part of the Interreg Italy-Croatia project ECOSSE (with full name of the project in English and Croatian language), the method of financing and the duration and value of the project are highlighted. In Figure 3., the markings "*smeđa signalizacija 1*" and "*smeđa signalizacija 2*" indicate the 2 locations where these 2 panels are placed. On 3 interpretative panels the main ecological and geographical features of Malostonski zaljev, and the biodiversity of the bay is described. In addition, the panel clearly indicates that the board was made as part of the Interreg Italy-Croatia project ECOSSE (with full name of the project in English and Croatian language), the method of financing and the duration and value of the project are highlighted. Also, on the panels are prohibited actions in the protected area shown. Each interpretative panel is placed on another lookouts within special marine nature reserve Malostonski zaljev (Figure 2). In Figure 2., the markings "vidikovac 1", "vidikovac 2" and "vidikovac 3" indicate the 3 locations where these 3 panels are placed.

On the remaining 4 educational panels, target Natura 2000 species, habitats and key processes are described. Also, on one panel autochthonous and allochthonous species in the Natura 2000 area HR4000015 Malostonski zaljev are described. In addition, the panel clearly indicates that the board was made as part of the Interreg Italy-Croatia project ECOSSE (with full name of the project in English and

Croatian language), the method of financing and the duration and value of the project are highlighted. These panels were placed along a promenade along the coast in Mali Ston (Figure 4). In Figure 4., the markings “*igra 1*”, “*igra 2*”, “*igra 3*” and “*igra 4*” indicate 4 locations where these 4 panels are placed. In Figure 5. – Figure 7. the final design and panels placed in the field could be find.



Figure 5. Two brown signalization signs in the field.

As it can be seen these two panels are both in English and Croatian language (all text is bilingual).



Figure 6a. Interpretative panel on first lookout.



Figure 6b. Interpretative panel on second lookout.



Figure 6c. Interpretative panel on third lookout.

As it can be seen each interpretative panel is both in English and Croatian language (all text is bilingual).



Figure 7a. Front and back side of first educational panel.

Unlike brown signalization signs and interpretive panles, 4 educational panels placed in Mali Ston are not completely bilingual because there was no enough space for all text to be bilingual. On the first educational panel placed in Mali Ston, the text on the front side of the panel is bilingual, with text on Croatian language on the front and text on English language on the back. In addition, the names of the species of organisms shown on this panel are in English, Croatian and Latin language, but their descriptions are only in Croatian language and on the back of the panel.

This educational panel shows descriptions of eight species – *Posidonia oceanica*, *Pinna nobilis*, *Condylactis aurantiaca*, *Holothuria tubulosa*, *Paracentrotus lividus*, *Symphodus tinca*, *Scorpaena porcus* and *Savalia savaglia*. These species are either Natura 2000 species such as *Posidonia oceanica*, *Paracentrotus lividus*, *Symphodus tinca*, *Scorpaena porcus* and *Pinna nobilis*, or strongly protected species such as *Savalia savaglia*. *Condylactis aurantiaca* is neither strongly protected species in Croatia or Natura 2000 species, but it is very common and characteristic for HR4000015 Malostonski zaljev.



Figure 7b. Outer side of second educational panel.

Second educational panel is also bilingual, but not all text is bilingual. The text on the top of the panel is in English and Croatian language, while the names of the species of organisms shown on this panel are in English, Croatian and Latin language, but their descriptions are only in Croatian language on inner side of this panel. This educational panel is conceived as a comparison of autochthonous and allochthonous species. It shows descriptions of three autochthonous (*Cymodocea nodosa*, *Ostrea edulis*, *Hexaplex*

trunculus) and three allochthonous species (*Caulerpa cylindracea*, *Melibe viridis* and *Asparagopsis armata*). *Ostrea edulis* and *Hexaplex trunculus* are very common autochthonous species in HR4000015 Malostonski zaljev while *Cymodocea nodosa* is Natura 2000 species in this N2K site.

Third educational panel is also bilingual, where on the outer side of panel the text on the top of panel and the key processes and features of HR4000015 Malostonski zaljev are in English and Croatian language, but the descriptions of these processes and features are only in Croatian language on inner side of panel. This panel shows six key ecological processes, variables and features specific for Malostonski zaljev and HR4000015 Malostonski zaljev. Terms described on this panel is: ecological network, special marine nature reserve, submarine springs, sediment, plankton and benthos (benthic organisms).

On the fourth educational panel placed in Mali Ston, the text on the front side of the panel is bilingual, with text on Croatian language on the front and text on English language on the back. In addition, the names of the species shown on this panel are in English, Croatian and Latin language, but their descriptions are only in Croatian language and on the back of the panel. This panel shows explanation of Natura 2000 species (*Lithophaga Lithophaga*, *Hippocampus guttulatus*, *Tursiops truncates*, *Actitis hypoleucos*), strongly protected species in Croatia (*Fucus virsoides*, *Cystoseira* spp., *Phalacrocorax pygmeus*) and endangered species in Croatia *Cladocora caespitosa*.



Figure 7c. Outer side of third educational panel.



Figure 7d. Back side of fourth educational panel.



Figure 7d. Front side of third educational panel.

3.2. Educational catalogues

As second type of educational trails, PIDNIC developed educational catalogues on Croatian and English language, to represent natural heritage of special marine nature reserve and Natura 2000 area Malostonski zaljev. Educational catalogues will be distributed to the local population and all visitors to Mali Ston Bay, with the ultimate goal of protecting and preserving the natural values of this protected area. The layout of the catalogues is shown in the Figure 8. There's a link from PIDNIC's website where educational catalogues are presented: <https://www.zastita-prirode-dnz.hr/promotivni-materijali/>.



Figure 8a. The layout of the catalogues in Croatian language.



Figure 8b. The layout of the catalogues in English language.

Educational catalogues are A5 format (210x148 millimeters). It consists from 6 parts – first part is foreword, then introduction, then protected natural heritage, then biodiversity, then cultivation of bivalves, then codes of conduct in Mali Ston Bay and the final part represent all Natura 2000 areas involved in ECOS project (Figure 9).



Figure 9. Chapters in educational catalogue.

The foreword in the catalogue describes the project, also all target Natura 2000 areas involved in ECOSSE project are listed and shown on the map. The introductory part of the catalogue describes the geographical position, natural features (relief, climate, temperature, ecology, hydrology, geology) of the Mali Ston Bay and its protection at the national and European level. The chapter on protected values of Mali Ston Bay describes the general characteristics of the special marine nature reserve Mali Ston Bay, as well as the area of the ecological network HR4000015 Malostonski zaljev. In the chapter on biodiversity of the Mali Ston Bay, its biodiversity is described on land (emphasis on a special marine nature reserve) and in the sea (emphasis on the ecological network HR4000015 Malostonski zaljev). The chapter on the tradition of shellfish farming describes the past and present way and process of shellfish farming, and there is noted that Mali Ston Bay is protected as a special marine nature reserve for this very reason. The following is the chapter in which all the rules of conduct for the special marine nature reserve Mali Ston Bay are listed. The last chapter is dedicated to the description of all Natura 2000 target areas included in ECOSSE project. This chapter also presents all ECOSSE project partners.

3.3. Educational videos

As third type of educational trails, PIDNIC developed three educational videos on Croatian and English language, to represent natural heritage of special marine nature reserve and Natura 2000 area Malostonski zaljev. The videos are made so that their content follows educational catalogs and educational panels. Educational videos will be displayed on PIDNIC's official webpage and Tourist board of Municipality of Ston will also help to promote it to locals and tourists in Mali Ston area.

There's a link from PIDNIC's website where all educational panels are presented: <https://www.zastita-prirode-dnz.hr/promotivni-materijali/>. Also, videos can be found on project ECOSSE official website and project ECOSSE official You Tube channel.

Each of the three videos is conceived in a different way, with one video representing the flora, the other the fauna of the Mali Ston Bay, and the third the tradition of shellfish farming and human coexistence with nature in the Mali Ston Bay.

The video interpreting the flora of Mali Ston Bay shows the most significant species such as *Quercus ilex*, *Arbutus unedo*, *Erica arborea*, *Myrtus communis*, *Pistacia lentiscus*, *Phillyrea latifolia*, *Limonium dictyophorum*, *Viola adriatica* and *Tanacetum cinerariifolium*. Also, this video includes Natura 2000 target species such as brown algae *Cystoseira* genus, *Cymodocea nodosa* and *Posidonia oceanica*. The video interpreting the fauna of Mali Ston Bay shows the most significant species (including Natura 2000 species) such as *Salamandra salamandra*, *Bufo bufo*, *Bufo viridis*, *Rana temporaria*, *Hyla arborea*, *Rana dalmatina*, *Testudo hermanni*, *Dalmatolacerta oxycephala*, *Podarcis melisellensis*, *Lacerta trilineata*, *Hierophis gemonensis*, *Malpolon monspesulanus*, *Pseudopus apus*, *Telescopus fallax*, *Vipera ammodytes*, *Elaphe quatuorlineata*, *Turdus merula*, *Passer domesticus*, *Alcedo atthis*, *Hirundo rustica*, *Monticola solitaries*, *Parus major*, *Motacilla alba*, *Savalia savaglia*, *Tursiops truncatus*, *Caretta caretta*, *Pinna nobilis*, *Hippocampus guttulatus*, *Ardea cinerea*, *Ardea alba*, *Larus michahellis*, *Phalacrocorax carbo*, *Mergellus albellus*, *Larus audouinii*, *Podiceps nigricollis* and *Phalacrocorax pygmeus*. The video interpreting tradition of shellfish farming and human coexistence with nature in the Mali Ston Bay shows the development of shellfish farming and the way of shellfish farming from the period of the Roman Empire until today. In addition, it describes old fishing tools that people once used, the way they burned carbonate rocks (limestone and dolomite) to get lime and the use of plants in everyday life.

4. EDUCATION ABOUT NATURE CONSERVATION

This paragraph provides main advantages of education about nature conservation and conservation of protected natural areas. In addition, three types of educational trails developed for HR4000015 Malostonski zaljev are presented as an example of good practice for other Natura 2000 target areas involved in ECOSSE project. Also, for the remaining Natura 2000 sites included in the ECOSSE project, proposals for the establishment of future educational methods are given.

4.1. Importance and benefits of education about nature conservation

The most widely used definition and concept of environmental education was identified at the first intergovernment conference on environmental education in Georgia, USA in 1977. This concept was stated as follows: “Environmental Education is a process aimed at developing a world population that

is aware of and concerned about the total environment and its associated problems, and which has the knowledge, attitudes, motivation, commitment, and skills to work individually and collectively toward solutions of current problems and the prevention of new ones.”

Conservation of nature is highly important for the good development of social and economic life. A serious contemporary problem is posed by pollution and environment protection. The changes going on with the planet ask for new solutions to maintain the ecological balance. It is therefore necessary to come up with ideas and implement projects for the conservation of biodiversity in protected natural areas to reduce the pressure over target species and habitats. This is impossible without education, information, without raising awareness regarding the importance of protected natural areas.

Education about conservation and protection of nature and protected natural areas can help people of various ages and social standing to find out about values, motivation, skills and responsibility regarding maintaining the quality of the environment and human health. The purpose of education is to improve the quality of life, recognize the nature and values and clarify concepts regarding the environment. Education can help people gain knowledge, skills, motivation values and an engagement needed to manage Earth’s resources efficiently and to take responsibility for maintaining the quality of the environment. Analyzing the problem globally, the objectives of environmental education are generally the same: to maintain and improve the quality of the environment in order to prevent future problems (Morara & Peterlicean, 2012).

Also, the UN has declared that the decade between 2005th and 2014th should be a decade for sustainable development education. Chapter 36 of Agenda 21 refers to the importance of education in sustainable development under the following terms: the need to channel education as a promoter of sustainable development, raising awareness of the need for sustainable development, the importance of training (Morara & Peterlicean, 2012).

4.2. An example of good practice and suggestions for future educational methods

Three types of educational trails developed by PIDNIC through project ECOS could be seen as an example of good practice for future educational methods and trails typologies for other Natura 2000 target areas

included in ECOSSE project. By implementing such educational trail typologies the awareness of locals and visitors could be raised.

There are some suggestions for future educational methods (educational typologies) for remaining Natura 2000 target areas involved in ECOSSE project:

- audio-visual media campaign at local, regional and national level to raise interest and awareness of visitors and the local community on the problems regarding the protection of nature, releasing pressures on target species and habitats;
- implication of local and regional factors in debates and seminars in order to increase awareness levels about the need to preserve biodiversity in protected areas;
- making of documentaries for youth to present issues found in protected natural areas and to ask for support by presenting the benefits to the local community, sustainable development, health, etc. ;
- creation, launch and permanent updating of web pages for the public that uses the Internet elaborations and spreading of leaflets and informational/educational materials;
- making photo albums that present the existing target species and habitats of protected natural areas which, for example, could be presented in interpretational centers;
- implementation of hiking trails or thematic playgrounds in a child-friendly way which would present target species and habitats of protected natural area.

5. CONCLUSIONS

Conservation of nature depends over the long term on the social and economic welfare. An important problem nowadays is pollution and the protection of the nature. Modifications at global level regarding the quality of the nature ask for solutions for maintaining ecological balance (Morara & Peterlicean, 2012). Development of the management and monitoring framework for protected natural areas, especially of Natura 2000 sites demands that important actions and measures be taken such as: development of administrative structures, elaboration/revision of management plans for protected natural areas, creation of specific infrastructure, studies, inventory, mapping, conservation of species and natural

habitats, campaigning to inform and raise public awareness. By the National Strategy and the Action Plan for the Conservation of Biodiversity 2010 2020 priority actions were set in accordance with the seriousness of the threats, the vulnerability of biodiversity components and the need to meet international and community requirements in biodiversity conservation (Morara & Peterlicean, 2012). There are numerous advantages of education about nature protection and conservation.

In general, while a passerby on the street threw down a package on the pretext that "there are still others who threw garbage, I threw I do not see, we will not have a clean environment. Everyone must have a position on the issue in question and to appreciate our common goods. In this respect, the experts' advice is to organize various activities with environmental goals for a deeper knowledge of the environment, output in nature, excursions, seminars, workshops with wide participation (not only for specialists and specialized teachers), whereas to protect the nature means to protect the very lives and health of everyone (Helena Maria, 2011).

6. THE LIST OF LITERATURE

1. D.3.3.1 ECOSSE Report on the key oceanographic processes and performance indicators for Natura 2000 marine sites.
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