Work Package 4.2
Monitoring case studies in Croatia

Plićina Konjsko

REV. 20201222

Deliverables: D4.2.1, D4.2.2, D4.2.3, D4.2.4

Titles:
D4.2.1 Explorative survey with multibeam echosounder (MBES) and/or ROV/scuba
D4.2.2 Set up of an integrated monitoring system in situ (including high tech foto/video and 3D filming for monitoring and communication purposes
D4.2.3 Extension of monitoring execution to other parameters (i.e. biological components)
D4.2.4 Collection and reporting of obtained data

Due date of deliverable: M22 Submission date: M32

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Dissemination level:

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Specified group (if applicable):

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EXECUTIVE SUMMARY

This report describes the results of a survey carried out from September 2019 until June 2021 in the area of the Konjsko reef, on the north coast of Island of Krk near small town of Šilo (Adriatic Sea), Croatia. Monitoring of reefs is essential for the continuous evaluation of their structural and ecological evolution, hence their capacity of sustaining different economic activities, in line with the principles of Blue Economy. This activity, funded by the EU through the Interreg Italy-Croatia CBC programme, was initiated in recognition of the underexploited potential for sustainable use of some natural and artificial reefs located in the Adriatic Sea and is part of ADRIREEF (Innovative exploitation of Adriatic Reefs in order to strengthen blue economy) project.

- Aim of the survey is a transborder investigation aimed at highlighting the unexploited potential of 7 selected reefs, natural or artificial, located offshore the Italian and Croatian coasts of the Adriatic Sea.

- During the survey, innovative technologies with low environmental impact were tested, based on the outcomes of ADRIREEF WP3.4 “Identification of technologies for underwater monitoring of reefs.”. However, a few modifications may have been introduced to reflect Case Studies specifics or to address unexpected situations occurred during practical activities at sea.

- Explorative survey was carried out using Side scan sonar Humminbird Solix 12 CHIRP MSI+ GPS G2 and software Autochart Pro Humminbird, Underwater drone model Blueye Pioneer and Scuba diving equipment (diving bottles, fins, dive computers, manometers Apex, etc.) all buyed wih ADRIRREF project funding.

- The scope of this work also includes an assessment of the potential reef vocation for the specific CS (e.g. tourism, farming, aquaculture, fishing, environmental safeguard, ...).

The main findings of this study were as follows:

Natural reef Pličina Konjsko was chosen for research and monitoring activities. The location of this reef is in the northern part of the Adriatic Sea close to the island of Krk, place Šilo. In order to examine exploitation potential, the following equipment was purchased and used: side scan sonar, underwater drone and scuba diving equipment for three people. The monitoring activities were done during summer 2019, spring/summer 2020 and spring/summer 2021. During those activities detailed geomorphological characteristics and complete structure of the reef and seabed were done using the sonar. Pličina Konjsko is a shoal that drops with a vertical wall to the bottom from the depth of 7 to 18 m, 200 m from the coast. Also, water parameters and the quality of water were measured during the monitoring phase. One part was dedicated to the analysis of benthic community found on the reef as well as for the analysis of observed fish population. In order to get a complete picture and to recognise economic and ecological aspects of the reef, human impact and tourist pressure were analysed. Therefore, it can be concluded that this reef offers potential development for various commercial activities such as diving activities, especially for the beginners. It could be also suitable for small

scale fishing or a place for making underwater photography. There is also a threat during summer for diving activities because of the big tourist pressure and quite big maritime traffic (jet ski, boats..).

1. INTRODUCTION

Monitoring activities has been taken for the natural reef Plićina Konjsko. The main objective of the monitoring was to examine exploitation potential of natural reef but also to determine morphological, chemical, biological as well other features of the reef including environmental load and quantity of maritime traffic at the reef. Furthermore, the monitoring aimed to recognise ecological and economic aspects related to the reef. Also, potential threats to reef and opportunities was analysed. The monitoring has been carried out by using innovative and integrated monitoring system.

The natural reef Plićina Konjsko has not been yet explored systematically. That was one of the incentives that this specific reef has been chosen for exploration and subject for research and monitoring activities. Given its good location, vicinity to tourist and diving centres, this reef offers potential development for various commercial activities which are in accordance with the project objectives and Blue Economy requirements.

After an introductory explanation of the research subject, the section on geomorphological mapping follows. In this part, geographical position of the reef, its composition and detailed morphological characteristics is presented. The quality of the water and its main parameters (biological, chemical, physical) is presented in the next chapter. Benthic community found on the reef with description of observed fish population is also described as a result of monitoring. Furthermore, the human impact on the environment is shown in line with tourist potential of the surrounding area that could develop exploitation activities at the reef, including diving and fishing. Main results of the monitoring are presented in the conclusion chapter.

The location of the natural reef Plićina Konjsko is in the northern part of the Adriatic Sea close to the north-eastern shore of the island Krk on western side of Vinodol Channel on the Geographical position φ = 45° 09.10'N; λ = 14° 40.50' E. The reef is located 2.4 km offshore from Crikvenica and about 150 m from the coastline of the island of Krk near small tourist town of Šilo in front Rt Šilo.

2. GEOMORPHOLOGICAL MAPPING

2.1. Description of equipment and acquisition/processing techniques

The most appropriate equipment to get a complete structure of the reef and monitor it is sonar. On the other side, taking pictures and video recording of the site was carried out with underwater drone. The use of the equipment and explorative surveys will be explained below. Two surveys were held; during summer 2019 and spring 2020.

For the needs of the project ADRIREEF and the implementation of the monitoring phase over the natural reef Plićina Konjsko the following equipment was purchased and used:

- side scan sonar (Side scan sonar Humminbird Solix 12 CHIRP MSI+ GPS G2 and software Autochart Pro Humminbird)
- underwater drone (model Blueye Pioneer),
- diving equipment (diving bottles, fins, dive computers, manometers Apex, etc.).

With using high quality side scan sonar Humminbird Solix 12 CHIRP MSI+ GPS G2, mapping of the reef has been carried out. Additionally, software Autochart Pro Humminbird was purchased for the needs of project. This sonar combines tournament-ready technologies like MEGA Side Imaging+, MEGA Down Imaging+, Dual Spectrum CHIRP Sonar, AutoChart Live and intuitive Cross Touch control. Solix has the power of wi-fi, Bluetooth, Ethernet and NMEA 2000 connections built in and allows for up to four customizable viewing panes so it is possible to view multiple technologies at once. Below are explanations for some of the most important features. New Side Imaging brings crystal-clear viewing up to 200 feet on either side of a boat, while Down Imaging allows underwater clarity with coverage down to 200 feet below the boat. Dual spectrum offers two ways to search; wide mode for maximum coverage and narrow mode for maximum detail. With AutoChart Live it is possible to create real-time maps of certain spots as well as to map depth contours, bottom hardness and vegetation. Using sonar, it is possible to estimate the hardness of the reef and seabed and the presence of vegetation. The bottom layer can be displayed as bottom hardness or vegetation and you can adjust the transparency to see different layers on the view. Bottom hardness and bottom vegetation cannot be displayed at the same time in Chart View. Bottom hardness shows strong sonar returns resulting from compact sediment, rocks, etc. The range of bottom hardness shown on the chart can be adjusted by changing the minimum and maximum range on the display. The selected range affects how the bottom hardness colours are displayed. Vegetation shows the sonar returns interpreted as vegetation on the Chart View. Vegetation will vary with the season or environment and the vegetation colours are displayed in the same way as bottom hardness.

Figure 1. Side scan sonar Humminbird Solix

Photos of the reef and marine environment, as well as the video recording of the site, was done with underwater drone. Our remotely operated underwater vehicle (ROV), called underwater drone model Blueye Pioneer, is a product of the innovative Norwegian manufacturer Blueye Robotics. In order to achieve high definition video, there is a built-in FHD camera with 1080p / 30 fps wide-angle light-sensitive lens, and powerful 3300 lumens LED lights, which allows shooting at night and at great depths. The maximum operating depth is 150 meters. With four powerful 350 W thrusters, which are protected from possible damage, it allows fast and precise movement in all directions. This ROV is quite easy for handling. It is necessary to lower the drone into the sea and record from the sea surface to the seabed. It is operated via a wireless controller and a selected device on which the application is installed (mobile phone, tablet or computer). While one person is operating the ROV, the other one can be connected to the drone via a wireless network and follow the recording in real time with a separate application.

Figure 2. Underwater drone Blueye Pioneer

Figure 3 Operating undrwater drone on the site

Scuba diving equipment was purchased for 3 persons (diving bottles, fins, dive computers, manometers Apex, etc.)

Figure 4. Scuba diving equipment

Aforementioned equipment was used to execute mapping of the reef as well as to conduct specific monitoring activities. All equipment was buyed using ADRIRREF project funding.

2.2. Survey results

The survey is based on the geographical position of the reef and main morphological characteristics, as well as the characteristics of the seabed. In order to get the best possible picture of the reef and characteristics of surrounding area, the listed features will be explained.

The location of the natural reef Plićina Konjsko is in the northern part of the Adriatic Sea close to the north-eastern shore of the island Krk on western side of Vinodol Channel. The location of the reef is 2.4 km offshore from Crikvenica and about 150 m from the coastline. Reef Konjsko lies SE of the Rt Šilo. The nearest place to the location is Šilo, a small tourist town.

Geographical position of the reef is:

φ = 45° 09.10'N

λ = 14° 40.50' E

Mapping of the reef has been carried out using high quality side scan sonar Humminbird Solix 12 +GPS, G2. Additionally, software Autochart Pro Humminbird, has been used. First explorative survey with purchased equipment was held in September 2019. During mapping operation, the weather was nice, with calm sea. The use of sonar gave us 100% coverage of the seabed morphology and reef area, which was fundamental for proper monitoring process. This high-resolution sonar of 1.100 kHz is suitable for measurements carried out at relatively shallow depths (up to 60m). The size of the measurement area is approximately 416 m x 434m or 180.544m^2.

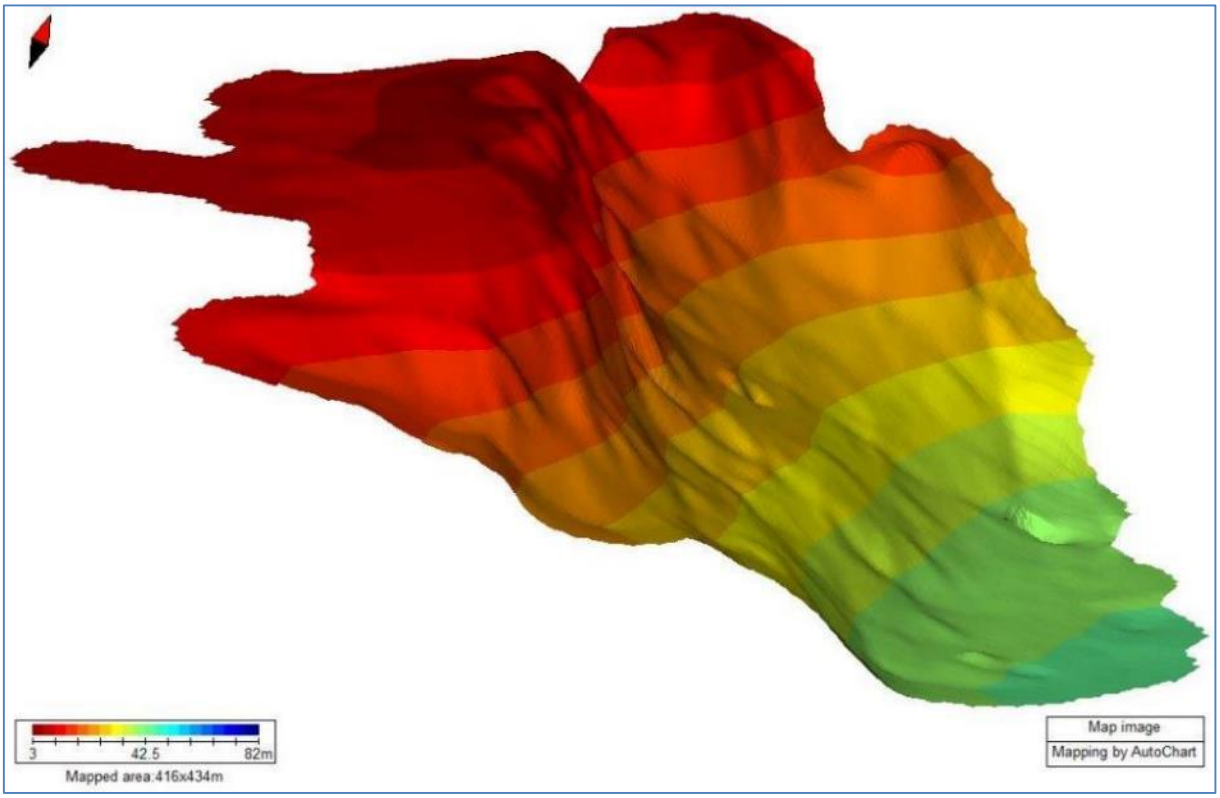

Figure 5 3D depth map of the reef

Figure 5 represents the 3D depth map. With this solution Humminbird Autochart allows to view a novel and different perspective of the depth map. There are several display options when the maps are in 3D being different aspect ratios or True Aspect Ratio (TAR), mesh display, black or colour contours, etc. The figure herein presents the TAR and colour contours (colour and depth legend are displayed next to the map). The highest measured depth is approximately 42 m on the bottom of the reef wall.

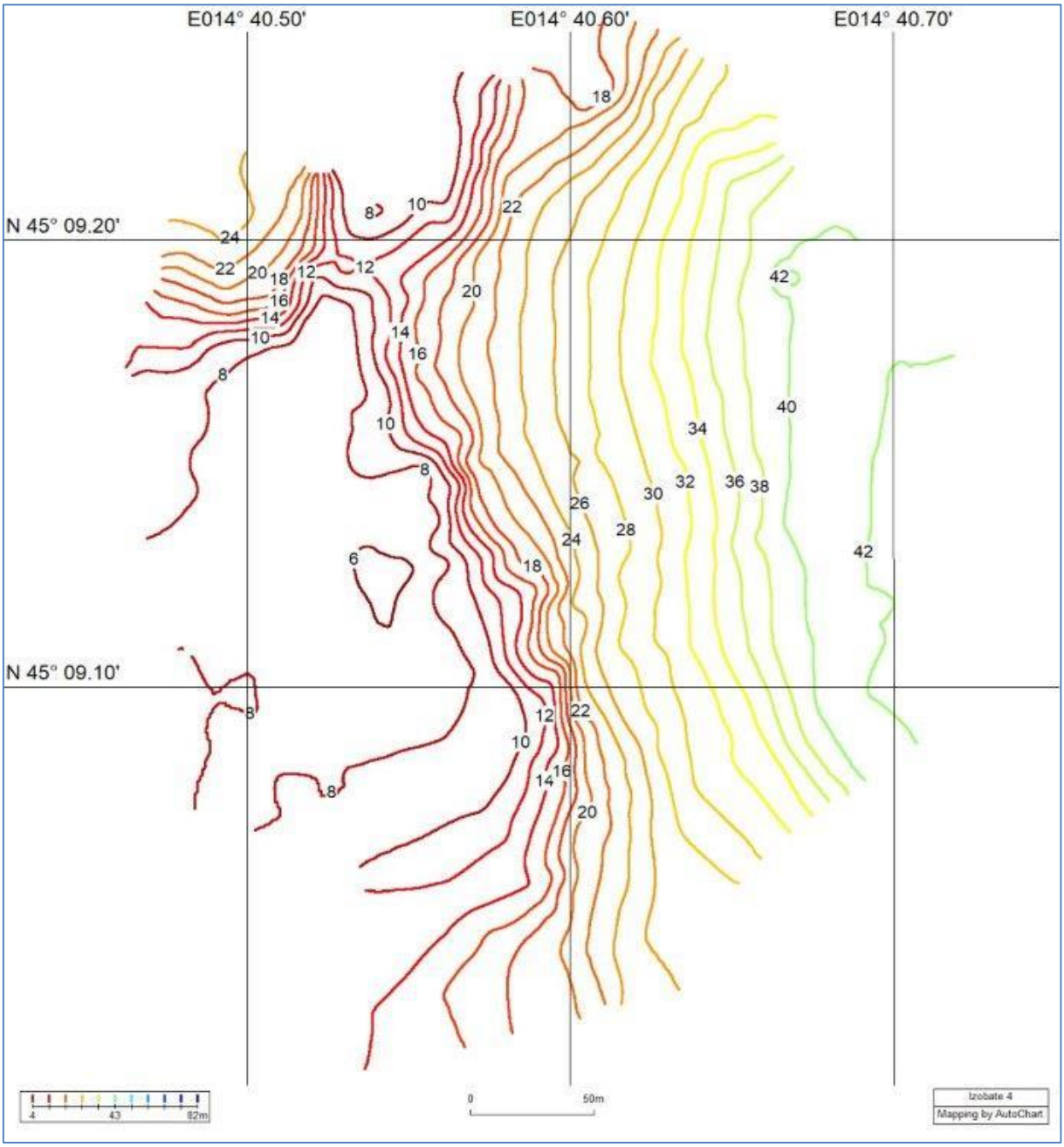

Figure 6 Bathymetric map

Figure 6 represents the 2D depth map with coloured depth contour lines (colour and depth legend are displayed next to the map), displayed depths (depth labels) and grid lines. Each of the mentioned data is actually a layer which can be displayed or hidden based on user preferences. Figure 7 represents another perspective of a 2D depth map, where the depth contour lines are hidden, while colour areas of the same depth range is displayed. The background map may be selected as per built in maps and user preference, like Open Cycle Map, Open Street Map, Navionics Nautical Charts, etc.

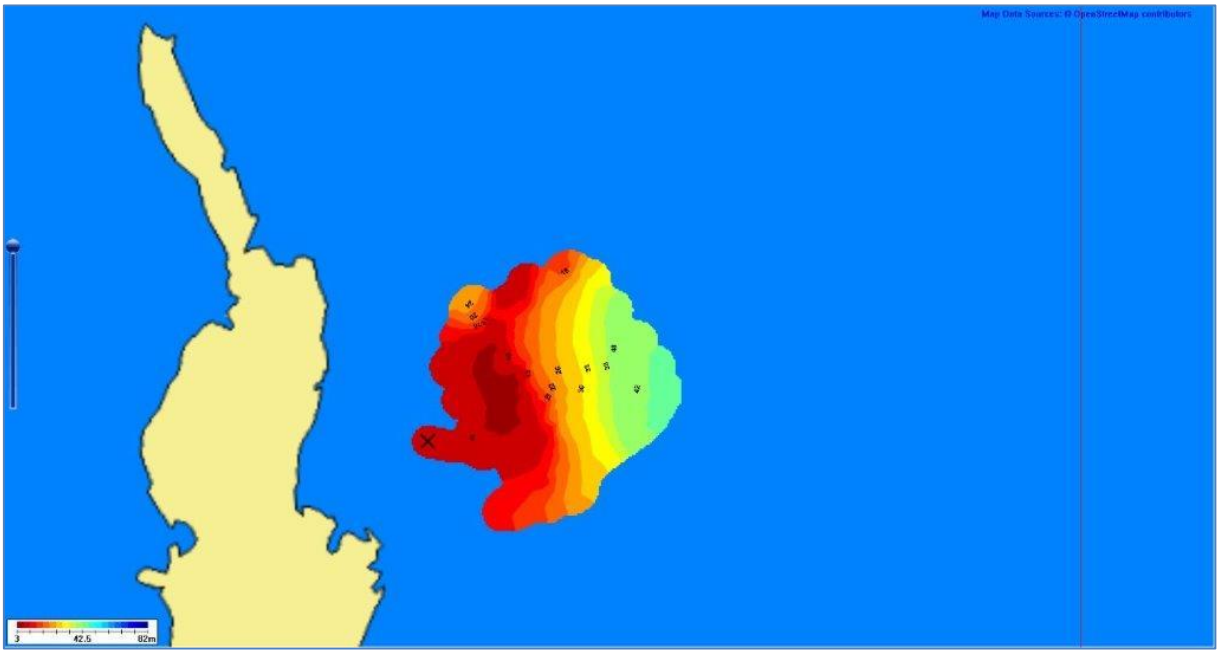

Figure 7 2D depth map

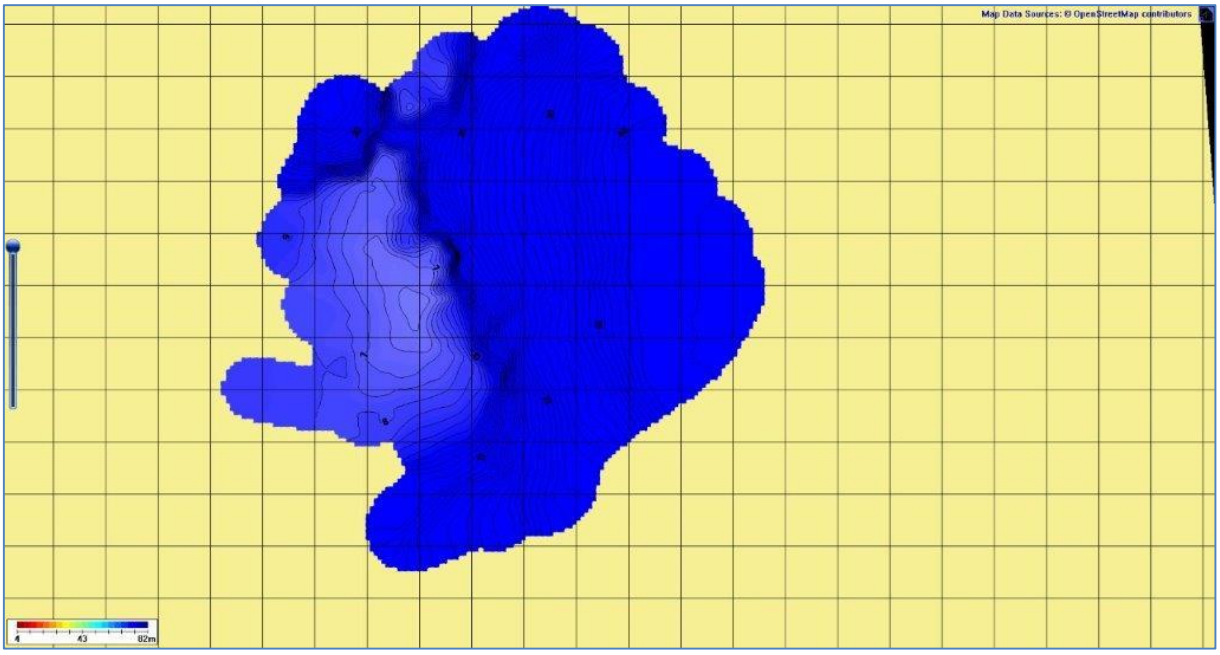

Figure 8 2D bathymetric map with colour and depth lines (reef wider area)

Figure 8 Represents a 2D map using an exaggerated depth offset to show this feature which may be used in case of different sonar vertical distance from sea surface or in case when different tides have to be considered. Figure 9 represents a 2D map where all basic layers are displayed: black contour lines, coloured area of the same depth range and spatial grid lines (colour and depth legend are displayed next to the map).

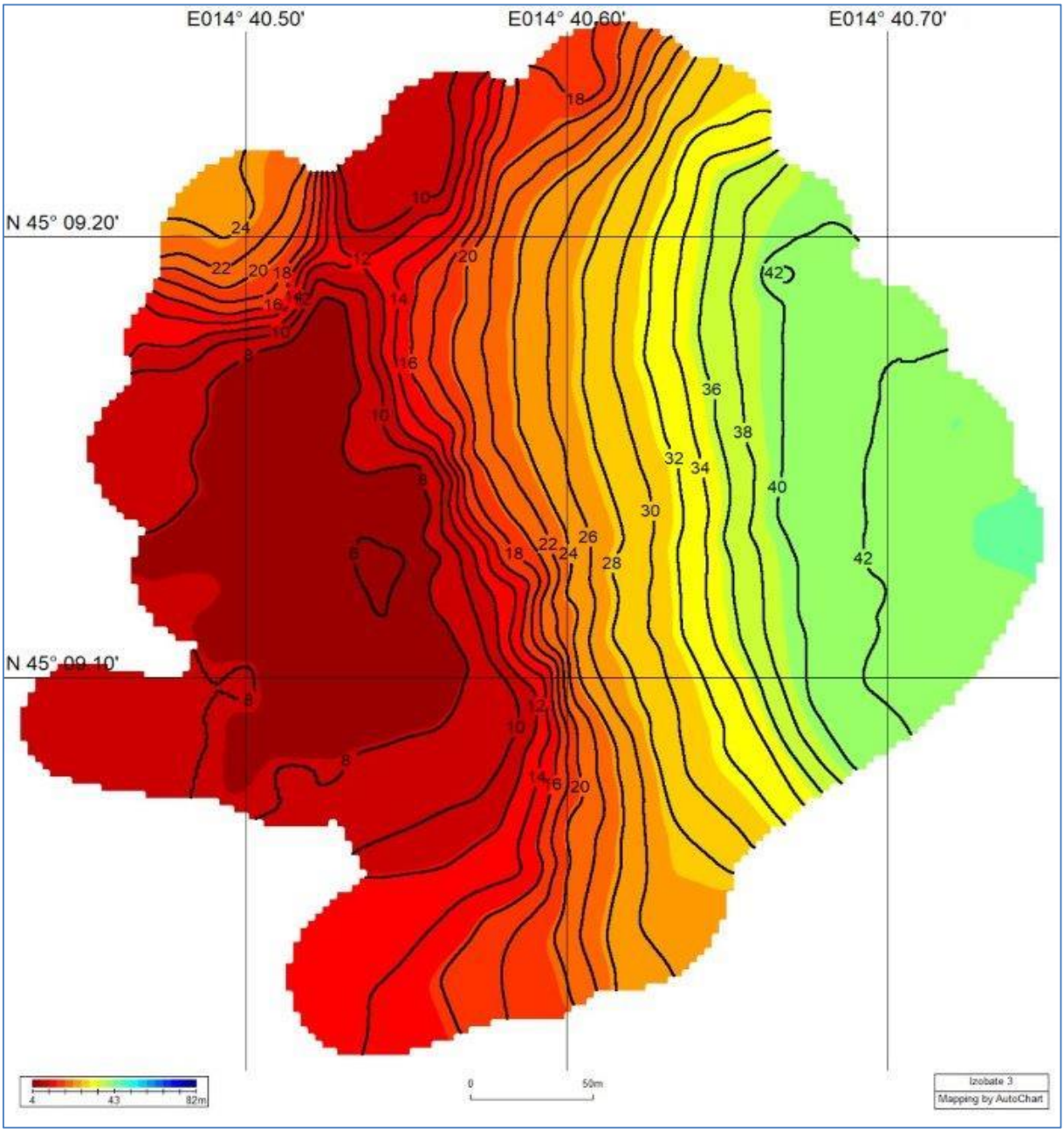

Figure 9 2D bathymetric map (marking range 4-43 m)

Plićina Konjsko is a shoal that drops with a vertical wall to the bottom from the depth of 7 to 18 m, 200 m from the mainland (Rt Šilo). The top of the reef is located at the depth of 5,5 m and at depth of 7 – 9 m there is a rocky plateau. Typical coralligenous communities are covering the wall and sedimentary bottom, with a characteristic detritus biocenosis, spread away from the reef. During our explorative survey, there was calm sea so the mapping was not influenced by wave interaction. The visibility was quite clear and estimated at 20 meters. Sea current was present in NW direction at low speed, less than 0,5 knots.

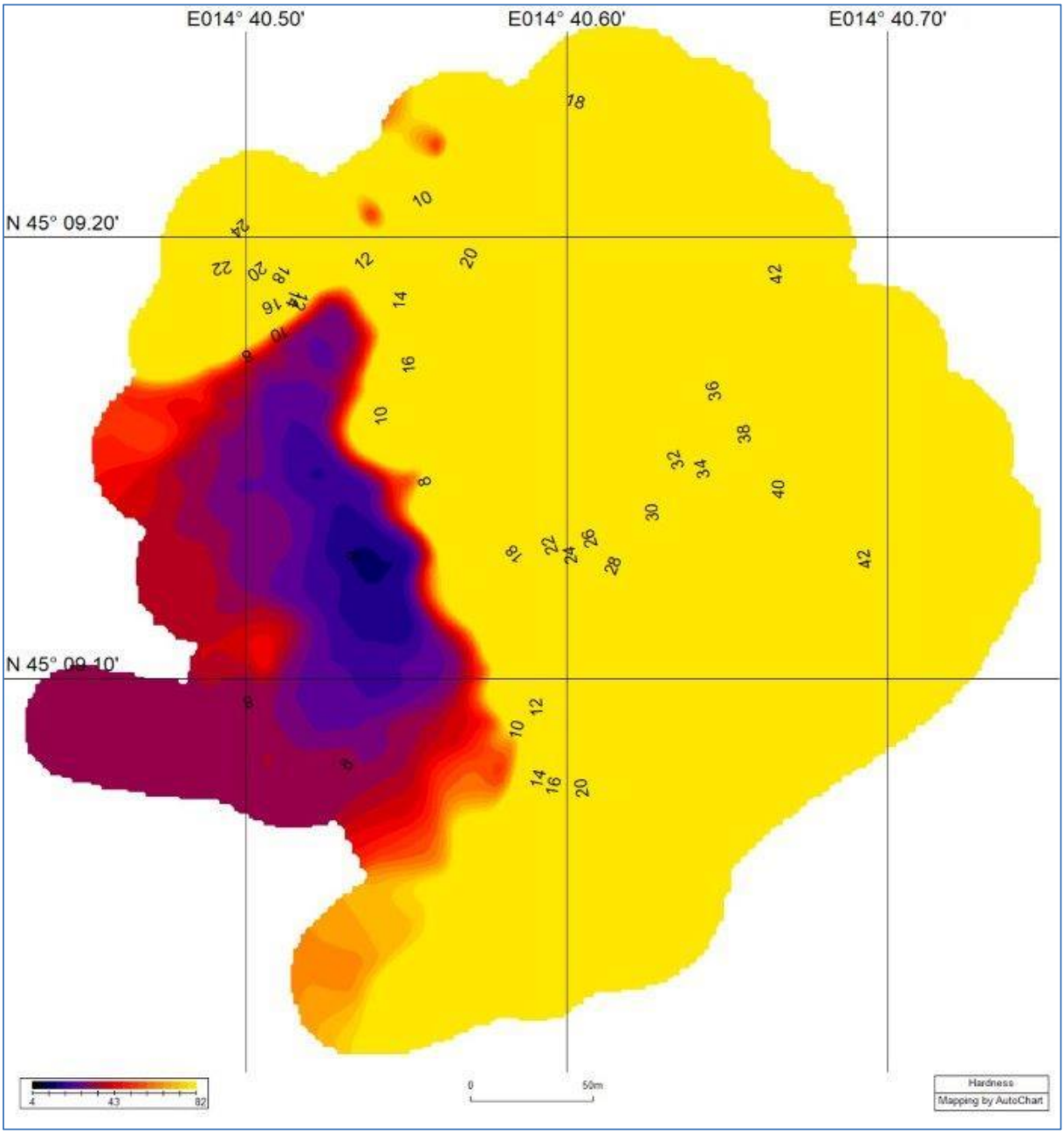

Figure 10 Bottom hardness

Figure 10 represents the bottom hardness i.e. the map shows strong sonar returns resulting from compact sediment, rocks, etc. The range of bottom hardness shown on the chart can be adjusted by changing the scale. The selected range affects how the bottom hardness colours are displayed. On this figure the smaller number (darker colours) represent the bottom with weaker signal return (soft sediment / presence of vegetation etc.) while the larger scale number (yellow colour) represent the stronger signal.

Figure 11 presents the sea bottom vegetation map, showing the areas of less or no vegetation (smaller scale number – dark green) or areas of present vegetation (larger scale number – lighter green).

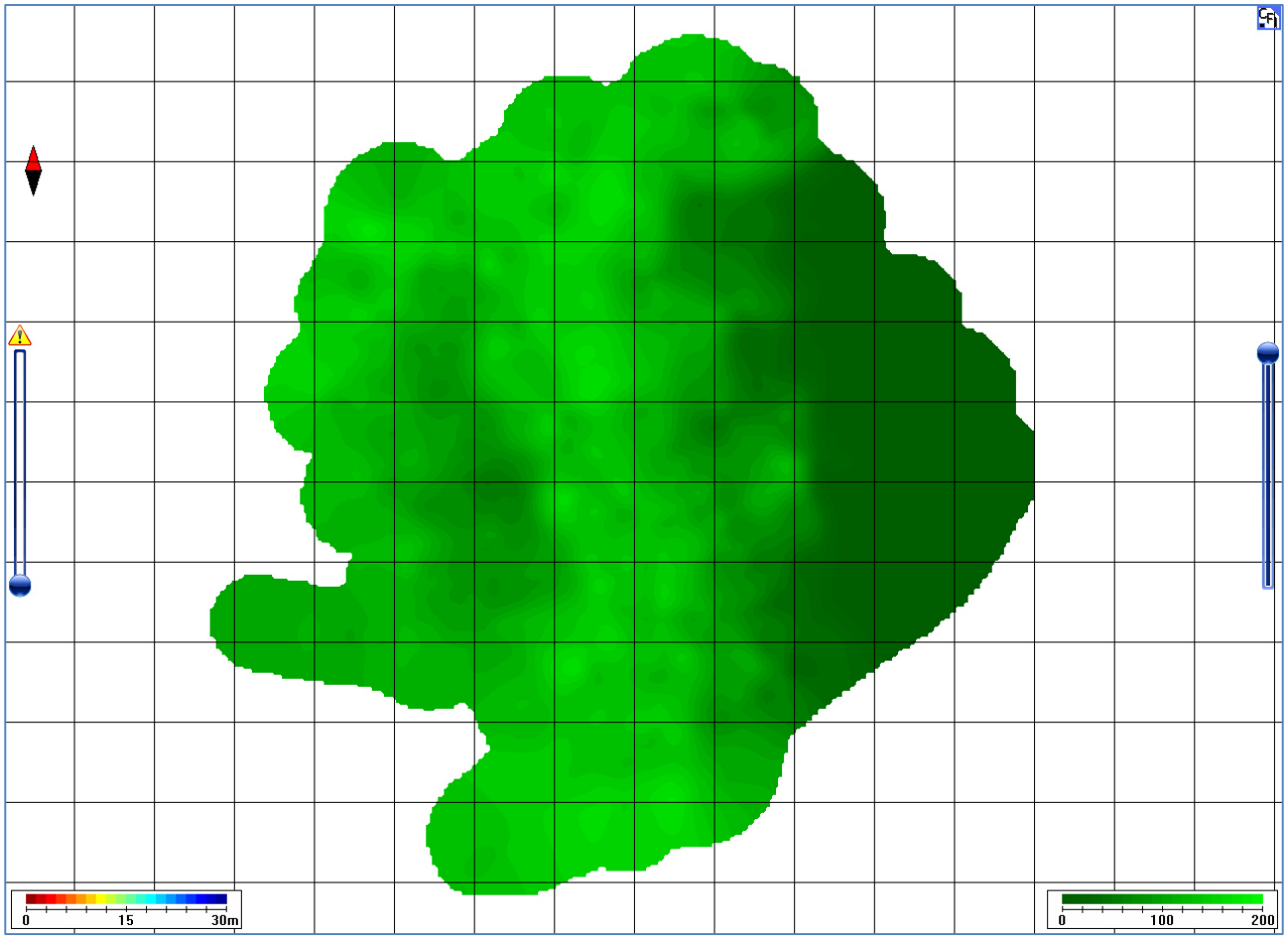

Figure 11 Vegetation map

The following figures show a raw image of the reef with high frequency sonar.

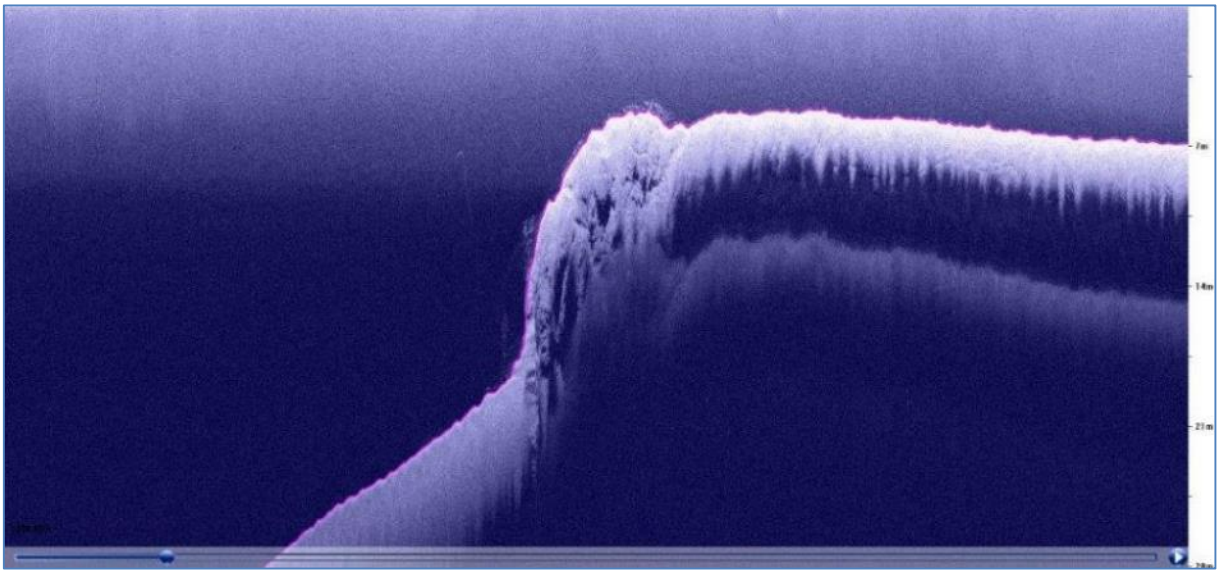

Figure 12 Wall section with sonar (1100 kHz)

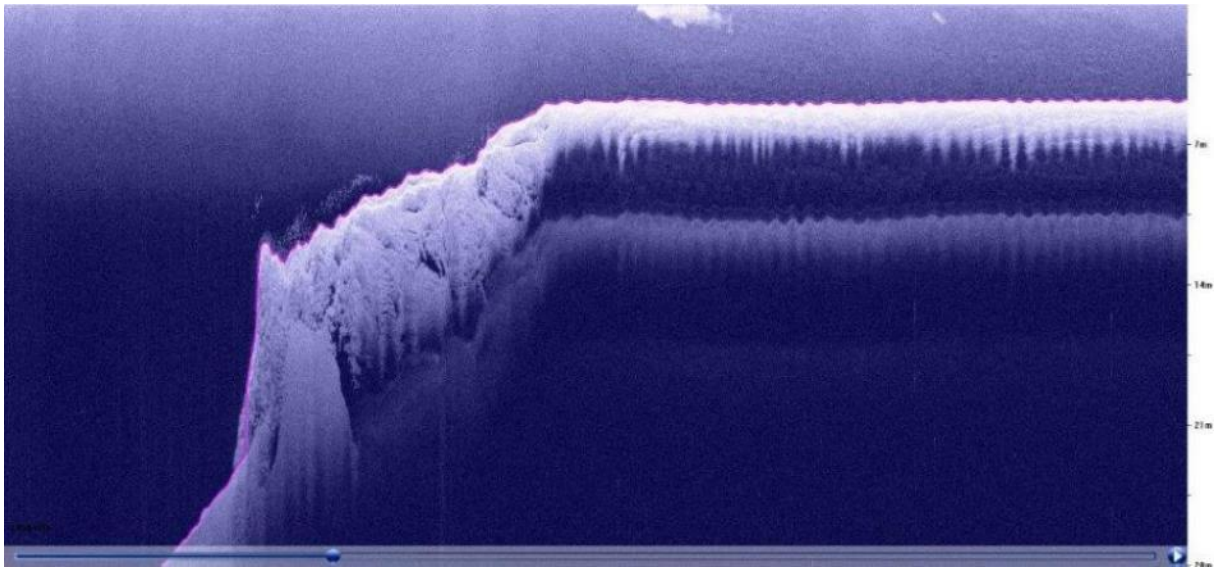

Figure 13 Wall section with sonar (1100 kHz)

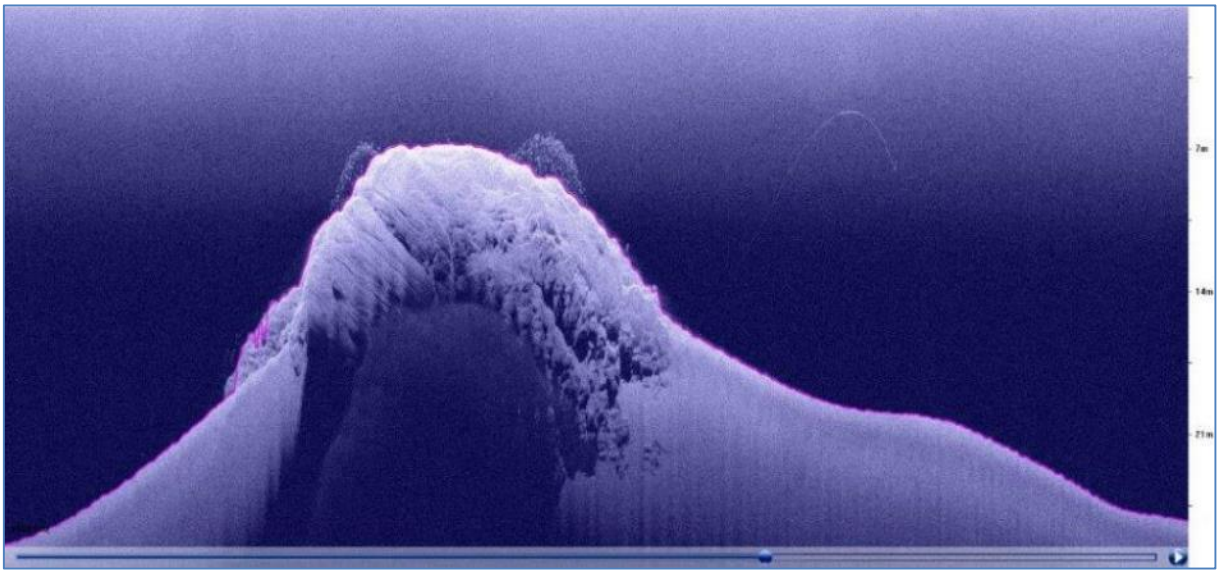

Figure 14 Wall section with sonar (1100 kHz)

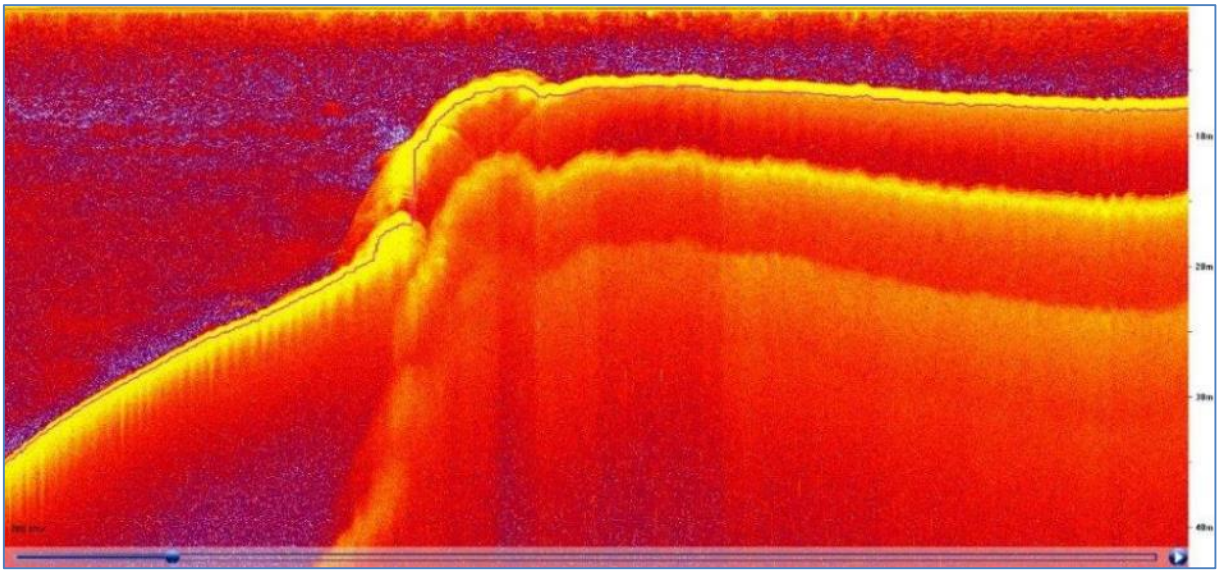

Figure 15 Wall section with sonar (200 kHz)

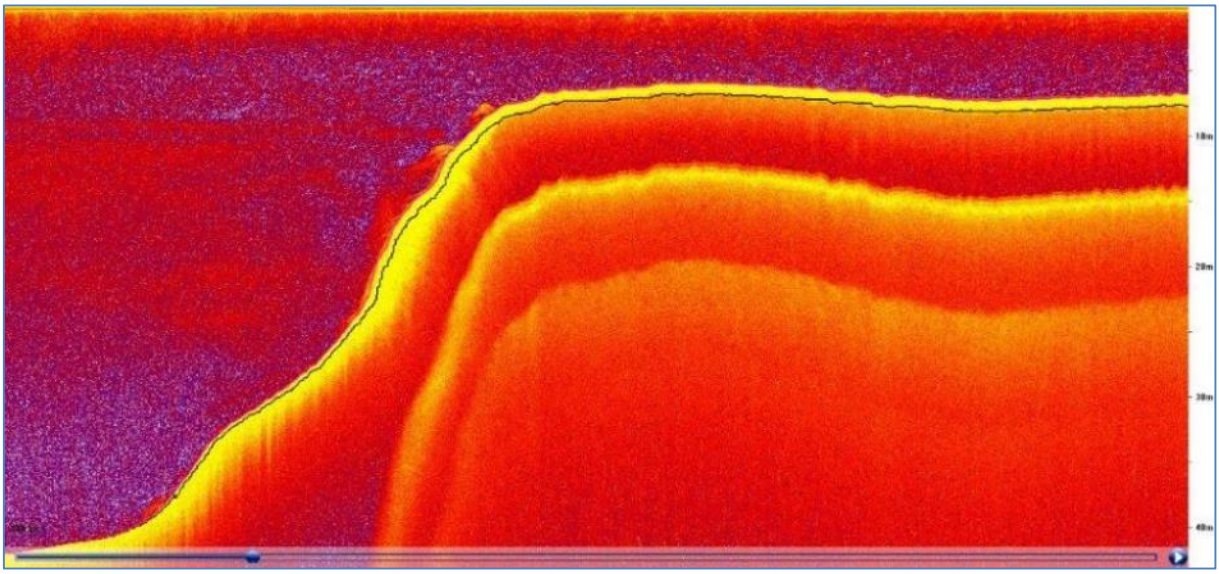

Figure 16 Wall section with sonar (200 kHz)

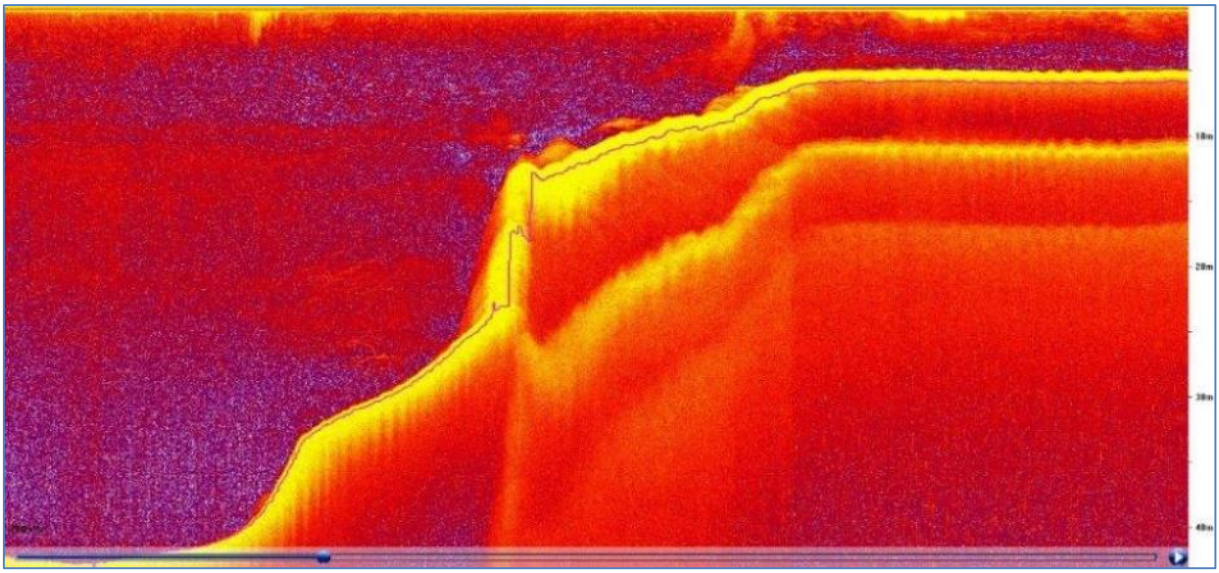

Figure 17 Wall section with sonar (200 kHz)

Figure 12 to Figure 17 are sonar images of different sections of the site. The sections are made navigating perpendicular to the natural extent of the reef (underwater wall), in a way that the shallowest and the deepest parts of the reef may be seen. To create such imaging the sonar was setup to “downimaging”, i.e. the soundwaves are emitted downwards from the sonar (boat). The sonar can use several frequencies (200 kHz / 455 kHz / 800 kHz / 1100 kHz). In general, higher frequencies generate images with higher resolution and a user may recognize smaller objects. However, the range of higher frequencies are smaller i.e. they are used on smaller depths (less than 50 m). On the other hand, lower frequencies generate images with lower resolution but the range of detection is higher i.e. it can be used on greater depths (more than 50 m). In order

to get video recording of the site and photos of the reef and its surrounding environment, an underwater drone was used. As mentioned before, it is quite easy for handling. The survey of the seabed was carried out from a boat that was anchored at the estimated position above the reef. The drone was lowered into the sea and recorded from the sea surface to the seabed. One of our researching methods was operating the ROV via wireless controller, while others followed the recording in real time with separate application. Recording and moving above the bottom, it was confirmed that the wall of the reef is covered with some coralligenous communities and that there is sedimentary bottom further from the reef.

The images taken by the drone can be seen below.

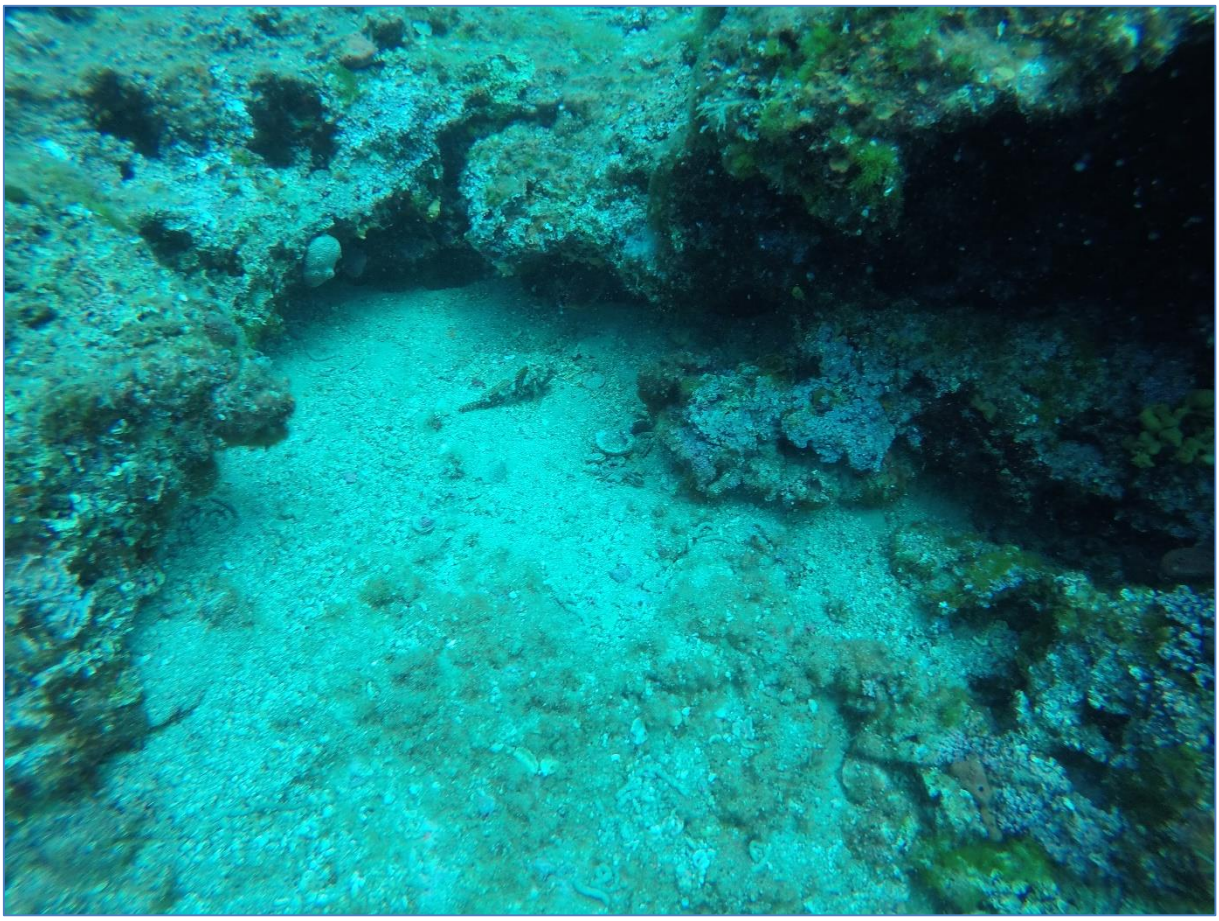

Figure 18 Picture of the seabed

Figure 19 Picture of the seabed

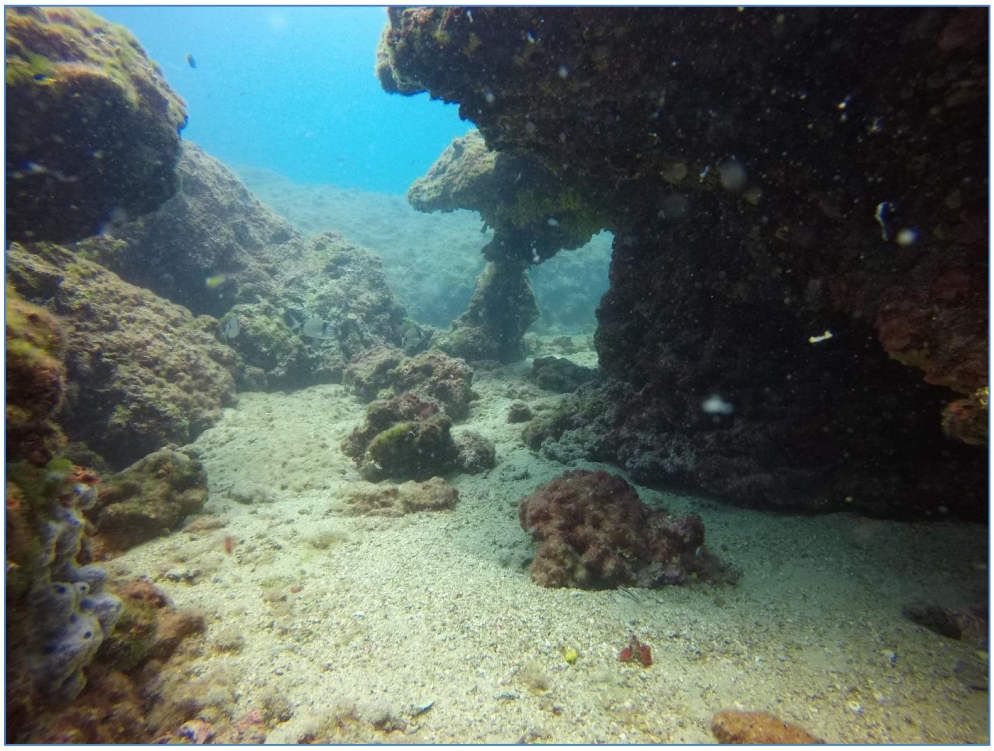

Figure 20 Picture of the seabed

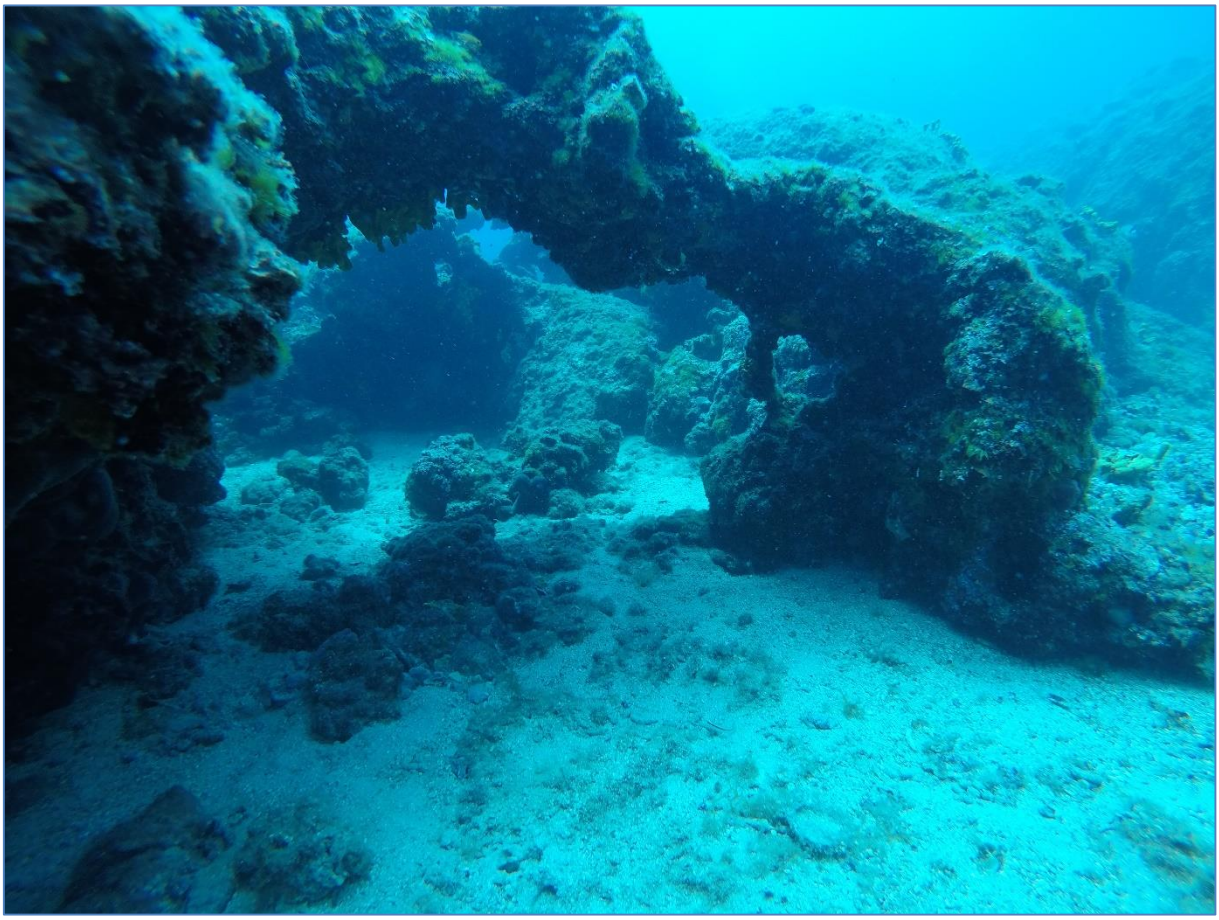

Figure 21 Picture of the seabed

Survey of the reef indicates that the reef is relatively shallow, especially its upper part of the reef, while the lower part extends to the relatively flat seabed at the depth of 42 meters. The wall of the reef is the most interesting part with relatively high density of vegetation.

3. WATER COLUMN PARAMETERS

During monitoring phase of our reef, water quality as well as physical and chemical parameters were analysed. By continuous monitoring we can have better insight in water quality and all parameters mentioned before. Water samplings were taken during our explorative surveys on the following dates: 13.09.2019., 27.05.2020., 09.09.2020., 26.02.2021. and 26.05.2021. in collaboration with scientists from Institute Ruđer Bošković and using their equipment.

For collecting physio-chemical measurements EXO Multiparameter Sonde was used. EXO Multiparameter Sonde has integrated fDOM Smart Sensor, Conductivity / Temperature Sensor, Optical Dissolved Oxygen Sensor and pH Sensor for measuring physico-chemical parameters in the field. The EXO1 sonde is a multiparameter instrument that collects water quality data. The sonde collects the data with up to four user-replaceable sensors and an integral pressure transducer. Each sensor measures its parameter via a variety of electrochemical, optical, or physical detection methods. Each port accepts any EXO sensor and automatically recognizes its type. Depending upon user-defined settings, the EXO1 will collect data and store it onboard the sonde, transfer the data to a data collection platform (DCP), or relay data directly to a user's PC or the EXO Handheld. TOC measuring principle is based on the high temperature combustion of the sample in an air or O2 stream above 680 °C. Totally bound or dissolved carbon is converted into CO2 which is quantitatively determined by means of a NDIR detector.

Figure 22 EXO Multiparameter Sonde

The samples for nutrients: nitrate (NO3), nitrite (NO2), phosphate (PO4) and silicate (SiO4) were frozen (−22 ◦C) and analysed in a laboratory according to Strickland and Parsons (1972). Subsamples for ammonia were fixed immediately after collection onboard with 1 mol L−1 phenol/EtOH and determined in the laboratory according to Ivančić and Degobbis (1984).

Figure 23 Scientists from IRB and Faculty of Maritime Studies prepare the equipment in situ

In the investigated location the lowest temperature was determined in the winter sampling and the highest in summer. Also, the nutrient follows a typical seasonal pattern (lower in winter and higher in summer). A slightly higher silicate contraction could be a proxy of diatom bloom that we have not analysed. The sanitary control of the investigated area was always excellent. The contraction of organic matter was low. PAHs were not detected.

Table 1 First water analysis on 13.09.2019

	Stations			
	WC	S1	S2	S3
ΣPAHs(mg/kg)	0.12	0.30	0.30	0,3
ΣPCBs (mg/kg)	0.001	0.001	0.001	0.001
TOC (mg/kg)	7700	9500	9000	9200
Salinity	37,715			
NO3- (µM)	8,3			
NO2- (µM)	0,34			
NH4+ (µM)	1,5			
SIO4+ (µM)	26,4			
NH4+ (µM)	1,5			
PO4+ (µM)	0.04			
TIN	39,4			

Table 2 Water quality measurements

	27.5.2020	9.9.2020	26.2.2021	26.05.2021.
NO_3 (µmol l^{-1})	1,41086	2,30626	0,73326	3,33718
NO_2 (µmol l^{-1})	0,051208	0,225419	0,032697	0,236664
NH_4 (µmol l^{-1})	0,844787	1,367899	0,795203	2,428376
PO_4 (µmol l^{-1})	0,037114	0,015424	0,027474	0,02651
SiO_4 (µmol l^{-1})	4,00064	2,786001	2,27164	4,175804
TOC (mg l^{-1})	1,014	1,234	0,9382	1,293

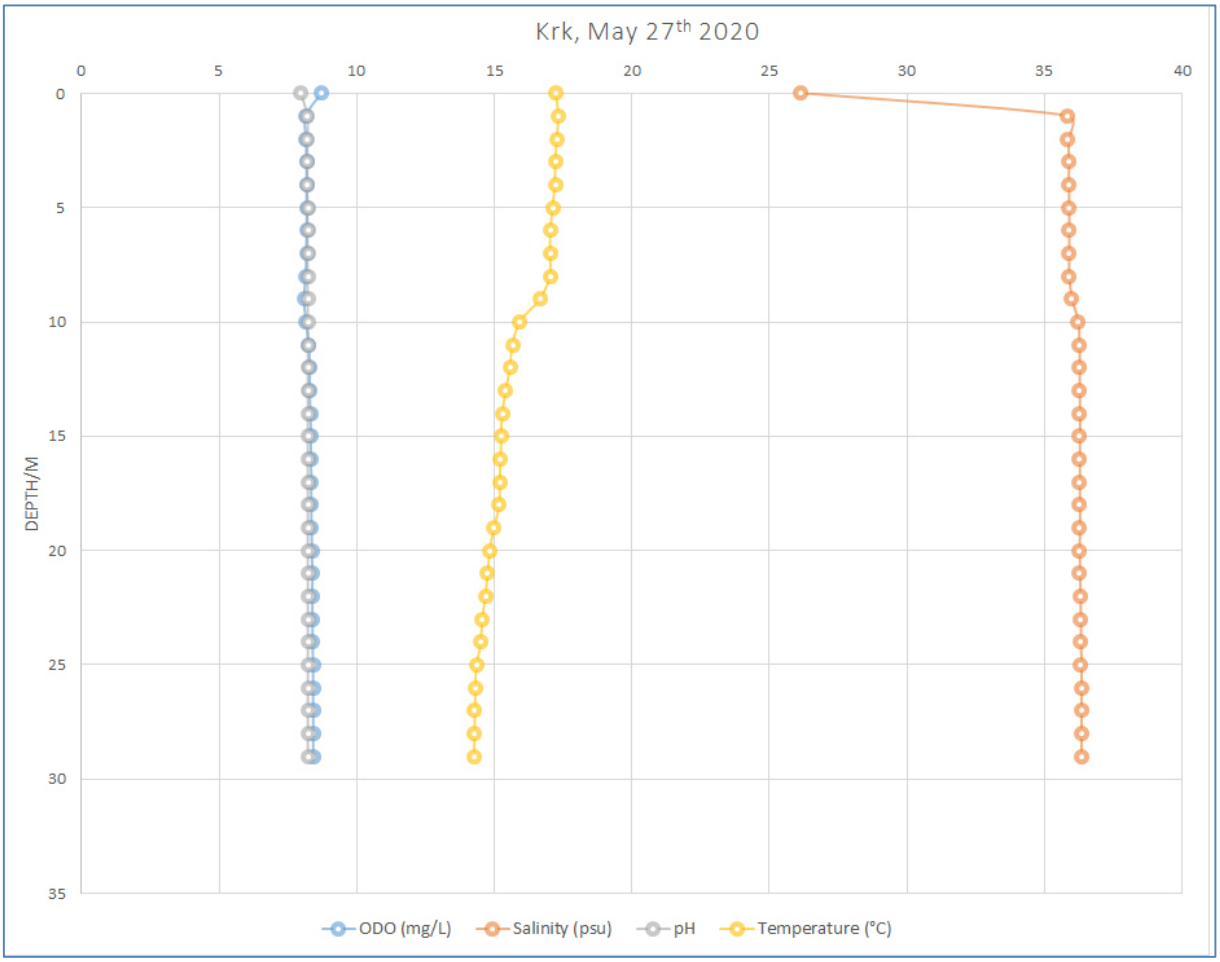

Figure 24 Water quality analysis on 27.05.2020

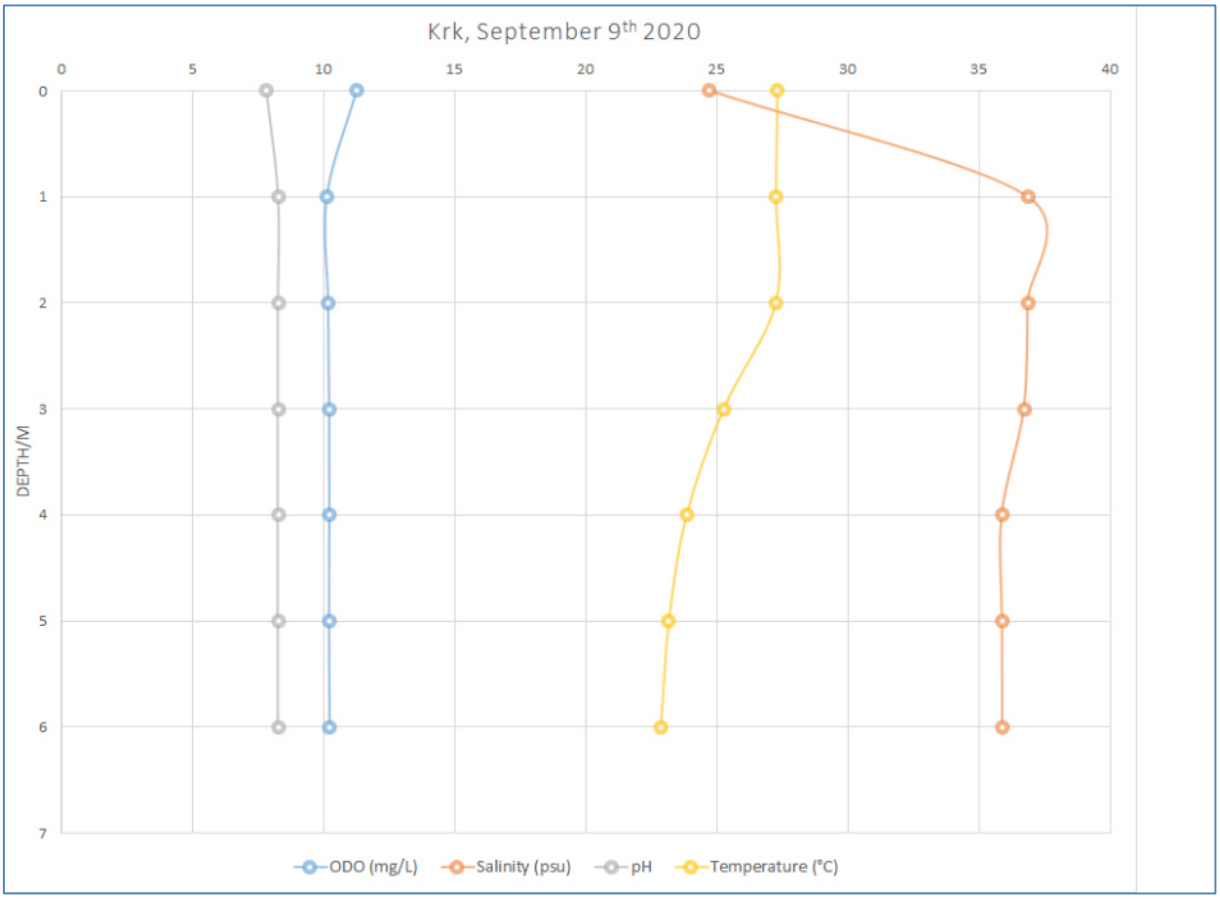

Figure 25 Water quality analysis on 09.09.2020

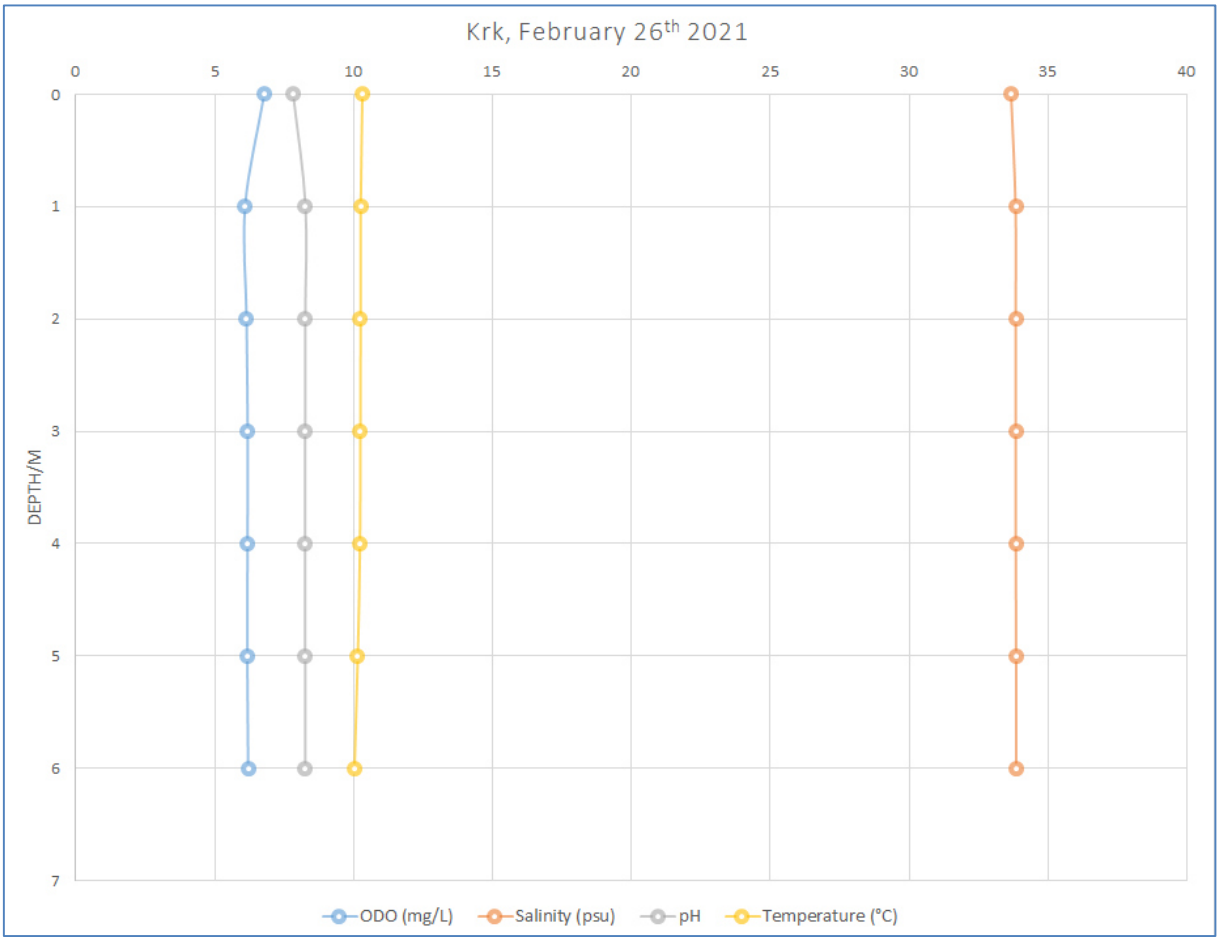

Figure 26 Water quality analysis on 26.02.2021

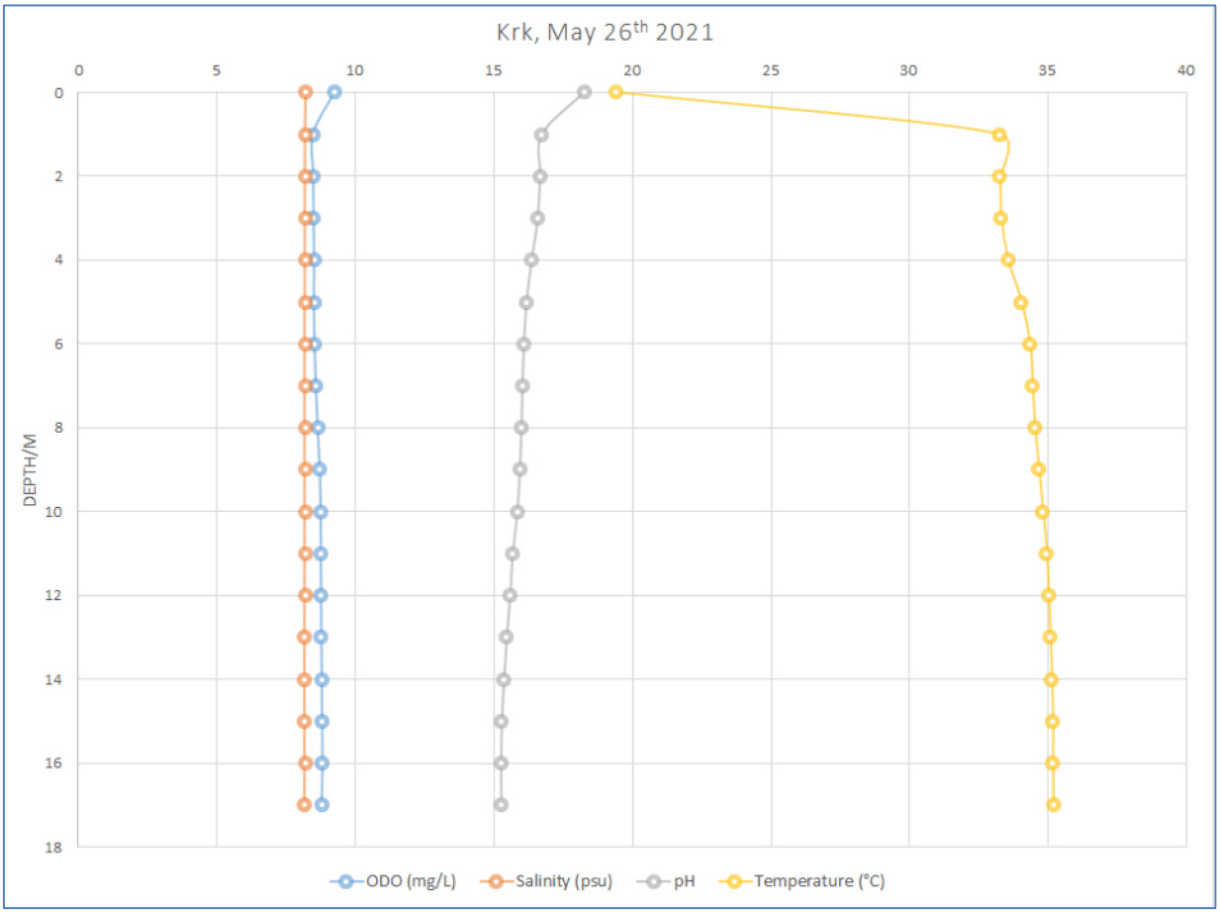

Figure 27 Water quality analysis on 26.05.2021

Water samplings were sent in the laboratory for further analysis in the Institute Ruđer Bošković. Data comparison on the sensors and the DOC machine is to identify if the faster methods could be used as a proxy for anthropogenic load.

Figure 28 Equipment in IRB

E. coli analyses were performed according to ISO 16649-1:2013 (recently replaced by ISO 16649-1:2018) for Escherichia coli determination method, filtering 100 mL of sample and transferring the membrane filter to a petri dish with Trypton-Galle-X-glucuronid (TBX) Agar (Merck, Darmstadt, Germany) and incubated at 44.5 ◦C for 24 h. E. coli was not detected by laboratory analysis, as well as the faecal coliforms.

Faecal coliforms analysis was performed on mFC Agar (Difco) incubated at 44°C for 24 h.

Table 3 Water column - sanitary quality

Date	CE/ 100ml	E. coli/ 100ml
27.5.2020	<60	<100
9.9.2020.	<60	<100
26.2.2021.	<60	<100
26.5.2021.	100	<100

For PAH analysis, filtrated water samples (dissolved organic matter) were extracted 3 times using the mixture of 20 mL of hexane and dichloromethane (1:2). Collected extracts were transferred through analytically pure anhydrous sodium sulphate (Sigma Aldrich, anhydrous, ACS reagent, ≥ 99%). The extract was concentrated to nearly dry by rotary evaporation, then solvent exchanged into hexane around one mL. The extracts were cleaned up using a five mL 2:3 (v/v) alumina: silica gel chromatography column. PAHs were eluted with 10 mL of n-hexane/dichloromethane (1:1 v/v). The fractions were concentrated to one mL under a stream of pure nitrogen and stored at 4 ◦C prior to instrumental analysis. A concentration of PAHs was determined using the gas chromatograph Shimadzu GC-2010 Plus with the Flame-Ionization Detector (GC-FID) and the Shimadzu 7683 Auto-sampler.

Table 4 Concentration of PAHs and PCB

	S1	S2	S3
Σ PAH (mg/kg)	0.30	0.30	0.30
Σ PCBs (mg/kg)	0.001	0.001	0.001
TOC (mg/L) or %	1,8	1,6	1,8

In the sediment, very low PAH and PCB contractions were detected. The sanitary quality of the sediment was excellent.

4. BENTHIC COMMUNITY SETTLED ON THE REEF

The observed reef has a vertical wall and a sedimentary bottom is spread with a typical biocenosis. The area is quite shallow and is very popular for divers who are beginners. The attractiveness of this area, especially for divers, is a result of biodiversity and sea quality. Analysing the sedimentary bottom; fecal coliforms and E. coli were not detected.

In accordance with study [2], monitoring of benthic communities was carried out and has additional information. The most significant ones are presented in the upcoming paragraphs.

The protocol was focused on sessile benthic macroinvertebrates and its aim is to reveal the conservation status of surveyed population. Target species are the ones sensitive to climate-related stressors. They are easy to identify underwater and are sufficiently abundant in the surveyed area. After the inspection of the actual abundance of sessile macroinvertebrates at the Konjsko reef, sponges *Petrosia ficiformis* and *Aplysina* spp. were selected as target species as well as scleractinian solitary corals *Balanophylia europaea* and *Leptopsammia pruvoti* and the yellow cluster anemone *Parazoanthus axinellae* (now considered as a species complex, Ocana et al. 2019). Observations were made along the imaginary transect at the selected depth. Observer counted each specimen of selected species and noted if it is affected, i.e. if any tissue necrosis is present or polyps of hard coral are bleached/dead. Besides visual census *in situ*, data were collected also by photographs.

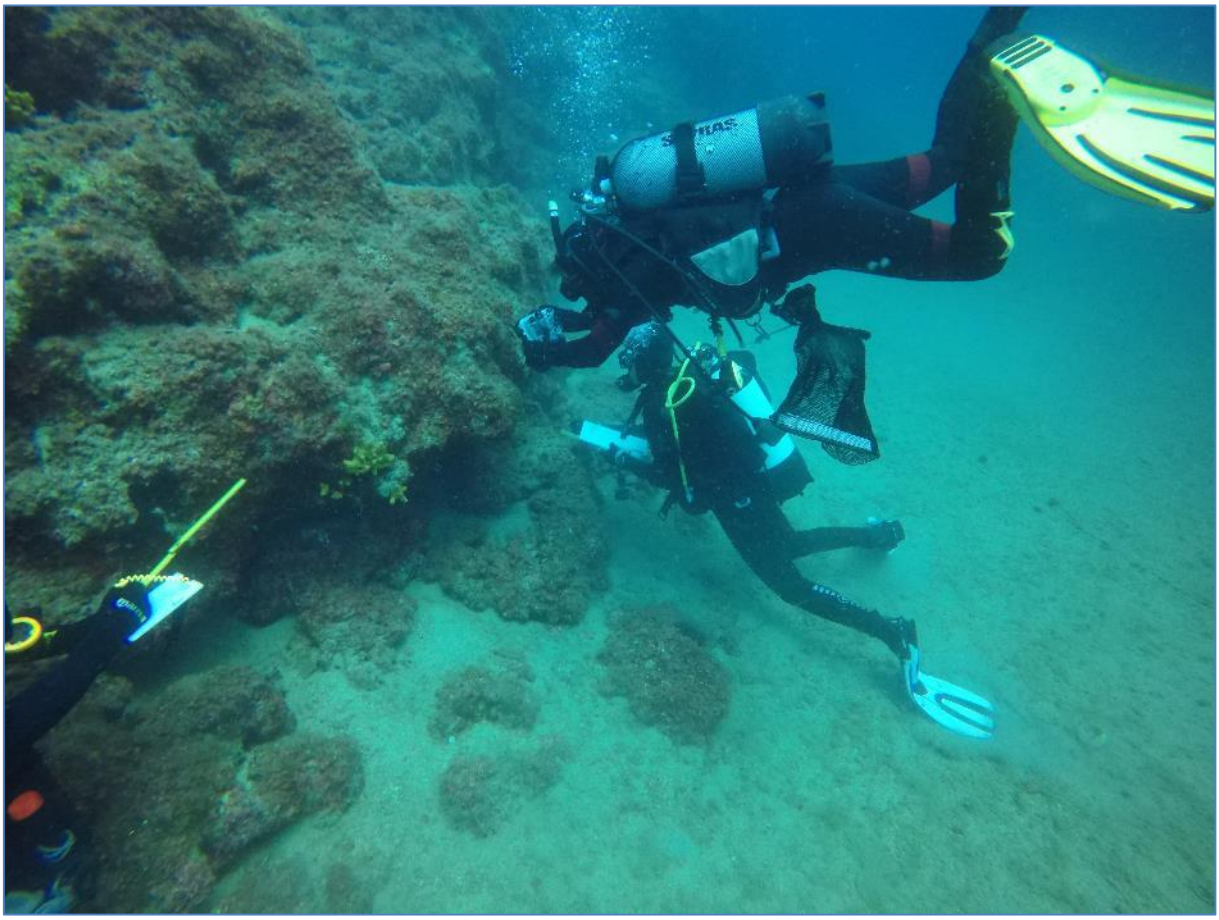

Figure 29 The divers from SUNCE collect data about benthic population settled on the reef

The sponge *Aplysina cavernicola* included in Annex II of the SPA / BD Protocol and listed in Annex II of the Bern Convention is a strictly protected species and most likely present at the location Konjsko (especially within deepest crevices, holes and overhangs), due to its morphological similarity to *A. aerophoba* and the fact that sponges were present both on the cascading walls and within holes and crevices between 12 and 18 m depth, SUNCE decided to record it at the genus level as Aplysina spp, presented in the following figures.

Figure 30 Sponge Aplysina spp

In the bathymetric range of 12-18 m, sponge *Aplysina* spp. was present within more sciaphilic crevices and overhangs, as well as on well-lit vertical walls and it was even observed on a mobile substrate. Following Pfannkuchen (2018), as signs of injury in this sponge are considered blue tissue discoloration and visible spongin skeleton exposure. Brownish spots on the tissue (seen on the Figure 28) of healthy-looking sponge were not considered as a damage. Taking this in consideration, its conservation status was generally good, and the proportion of specimens where some damage could be identified did not surpass 20%.

Figure 31 Sponge Aplysina spp on the reef

Relatively low number of targeted sessile macroinvertebrates were on the reef at depths below 12 m, a bathymetric range in which most of them were assessed stretched from 11 to 18 m at the Konjsko site. The exception was the assessment of solitary hard coral *Balanophyllia europaea* which was examined around 5 m depth at the Konjsko reef.

At studied sites, sponge *Petrosia ficiformis* was present both on the well-lit cascading walls as well as within more sciaphilic crevices and overhangs. In stark contrast to other examined species, it showed the highest proportion of affected specimens. Between 42 and 61% of individuals were damaged. Instead of a smooth, intact pinacoderm (i.e. the outermost layer of body cells, pinacocytes), purple-brownish in colour due to its symbiosis with cyanobacteria and free of any epibionts, damaged sponges were partially covered by a "crust", sometimes forming a greenish carpet or the pinacoderm was missing and spongin fibers were exposed.

Figure 32 Sponge Petrosia ficiformis (healthy sponge presented on the left side and damaged ones on the right) [2]

The last examined sponge in the report - ADRIREEF Project: the assessment of reefs on the location Konjsko (the Krk Island) [2] was *Chondrosia reniformis* and it showed excellent conservation status, with no injured or sick specimens observed at 3 m depth and in a depth range from 11 to 19 m.

Besides already mentioned sponges, other sponge species such as black keratose sponges, *Ircinia* spp. and *Dysidea avara were presented at* Konjsko location but in very low number. Additionally, within the study location Konjsko several specimens of sponge *Tethya* sp. were observed.

Out of target coral species, *Leptopsammia pruvoti* and *Parazoanthus axinellae* were present in sufficient abundance over a relatively small area, which made their assessment fairly straightforward. Together with *Balanophyllia europaea* which was assessed on the rocky plateau of the Konjsko site at 5 m depth, all of these coral species showed excellent conservation status at the time of assessment and affected specimens evident as bleached or dead corallites/polyps were not identified. Only few colonies of *Cladocora caespitosa* were recorded at the Konjsko site but it is worth to mention it, as it is an endangered species (according to the IUCN Red list; Casado de Amezua et al. 2015) endemic to the Mediterranean and the only reef-building coral here - hence it has an important structuring role. All observed colonies, although harbouring portions with healthy corallites, were partially dead and parts were overgrown by algae such as *Laurencia* sp., green and red turf algae and red algae *Peyssonnelia* sp. Besides sponges and corals, *Halocynthia papillosa* was the only acidian species assessed. The abundance of this ascidian in the Kvarner region is relatively high, and occasionally several individuals may be found clumped together.

On the location Konjsko, the most commonly observed macrobioeroder was the sea urchin *Sphaerechinus granularis*, present as quite large specimens. Moreover, the presence of nudibranchs such as *Flabellina affinis* and *Paraflabellina ischitana* always offer an additional diving attraction to the site. Out of all examined species, sponge *Petrosia ficiformis* was in the worst state, showing the highest proportion of affected specimens.

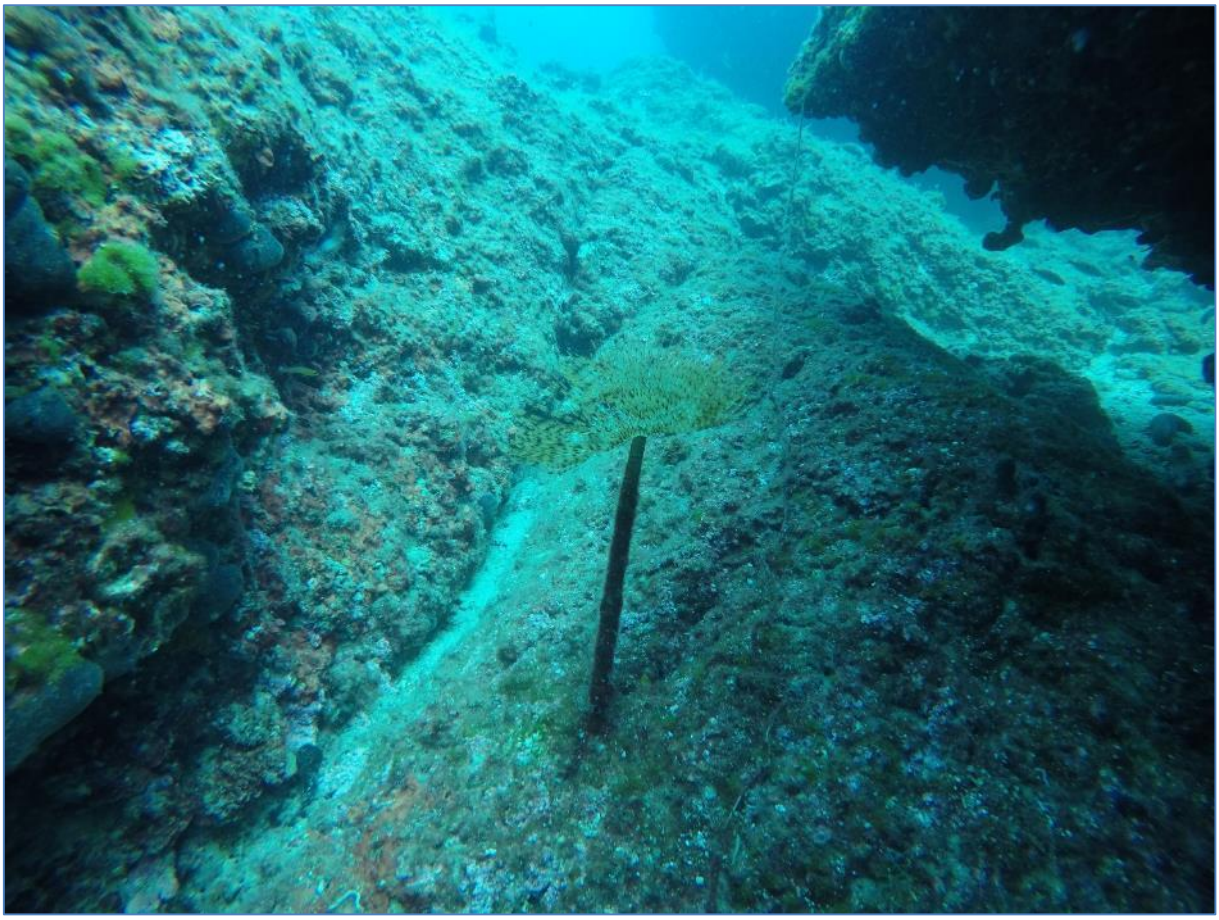

Figure 33 Biodiversity of the reef

An important structural species of the Adriatic reefs is yellow gorgonian *Eunicella cavolini* sensitive to many disturbances. Here, on Konjsko reef it was in very low abundance. For the assessment of its density SUNCE used a transect method – each colony was photographed along a horizontal transect. Conservation status of 68 colonies at the Konjsko reef was evaluated in a depth range from 11 to 19 m. Additionally, scuba divers managed to measure 30 colonies *in situ*. Depending on the presence/absence of different epibionts, three types of injury (related to the time of its origin) can be recognized in the field. The first type refers to a denuded axis, indicating a new injury (up to 1 month). The second type includes overgrowth by pioneering species, filamentous algae and hydrozoans (indicating an approximately 1–12-month-old injury), while the third type includes overgrowth mostly by bryozoans, sponges and/or algae and represents an old injury (approximately ≥12 months) (Linares et al. 2005).

Only the yellow gorgonian *Eunicella cavolini* was present on the Konjsko location. It thrived both on the well-lit walls as well as within more sciaphilic crevices, passages and overhangs. Its upper distributional limit was 11 m depth, whereas the lower limit coincided with the end of the cascading wall at 19.5 m depth at the Konjsko site.

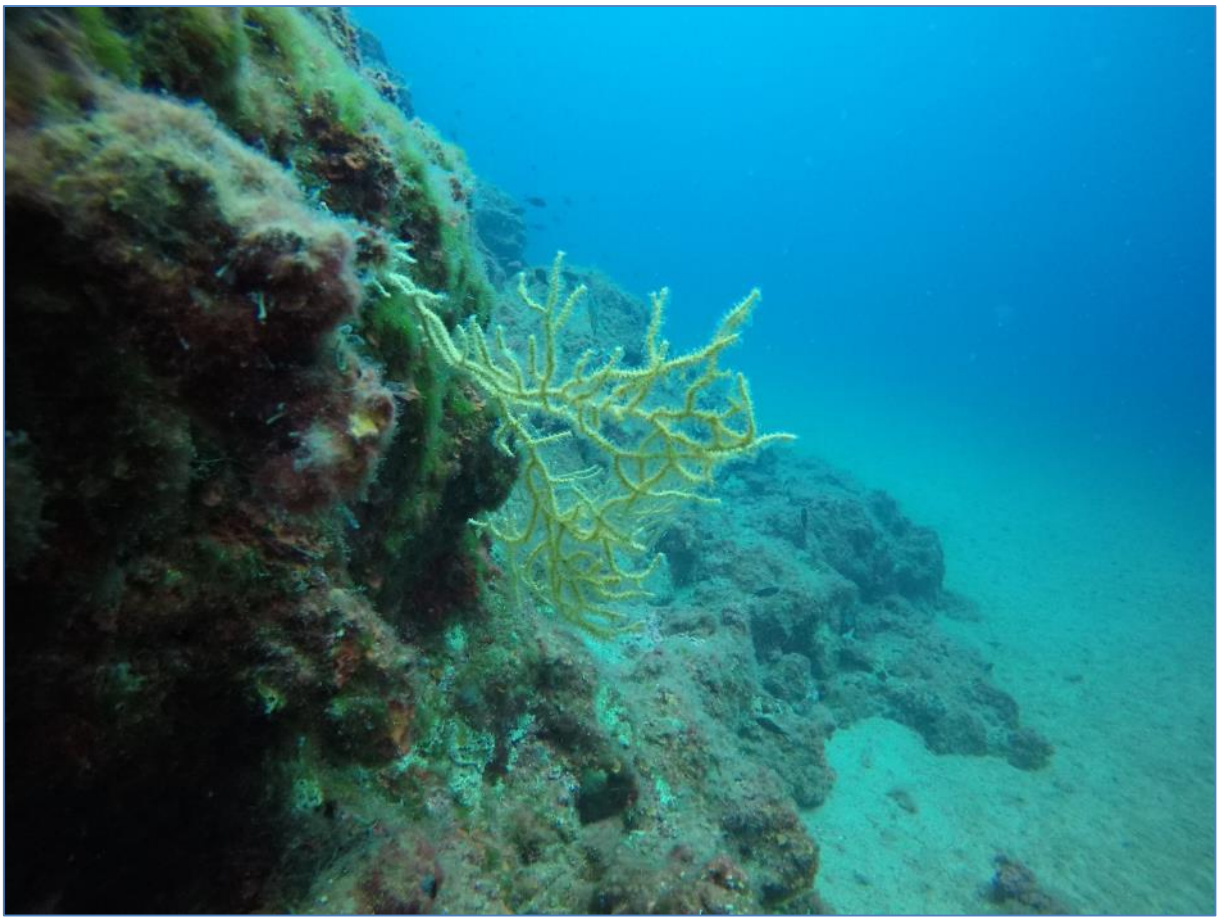

Figure 34 Eunicella cavolini - yellow gorgonian

For demographic study, 30 colonies of the yellow gorgonian *Eunicella cavolini* were measured directly underwater by scuba divers at Konjsko site. The largest colony of *E. cavolini* was 36 cm tall, whereas the smallest one measured 8 cm. Related to the populations' size frequency distribution, 50% of colonies belonged to the size class 11-20 cm, whereas additional 33% belonged to the the next size class 11-30 cm. 10% of colonies were juveniles (<10 cm in size) and 7% were larger than 30 cm (36 cm in height precisely). In the bathymetric range from 14 to 18 m depth at Konjsko site gorgonian density, assessed along 100 m transect, was very low, only 0.17 ind./m^2.

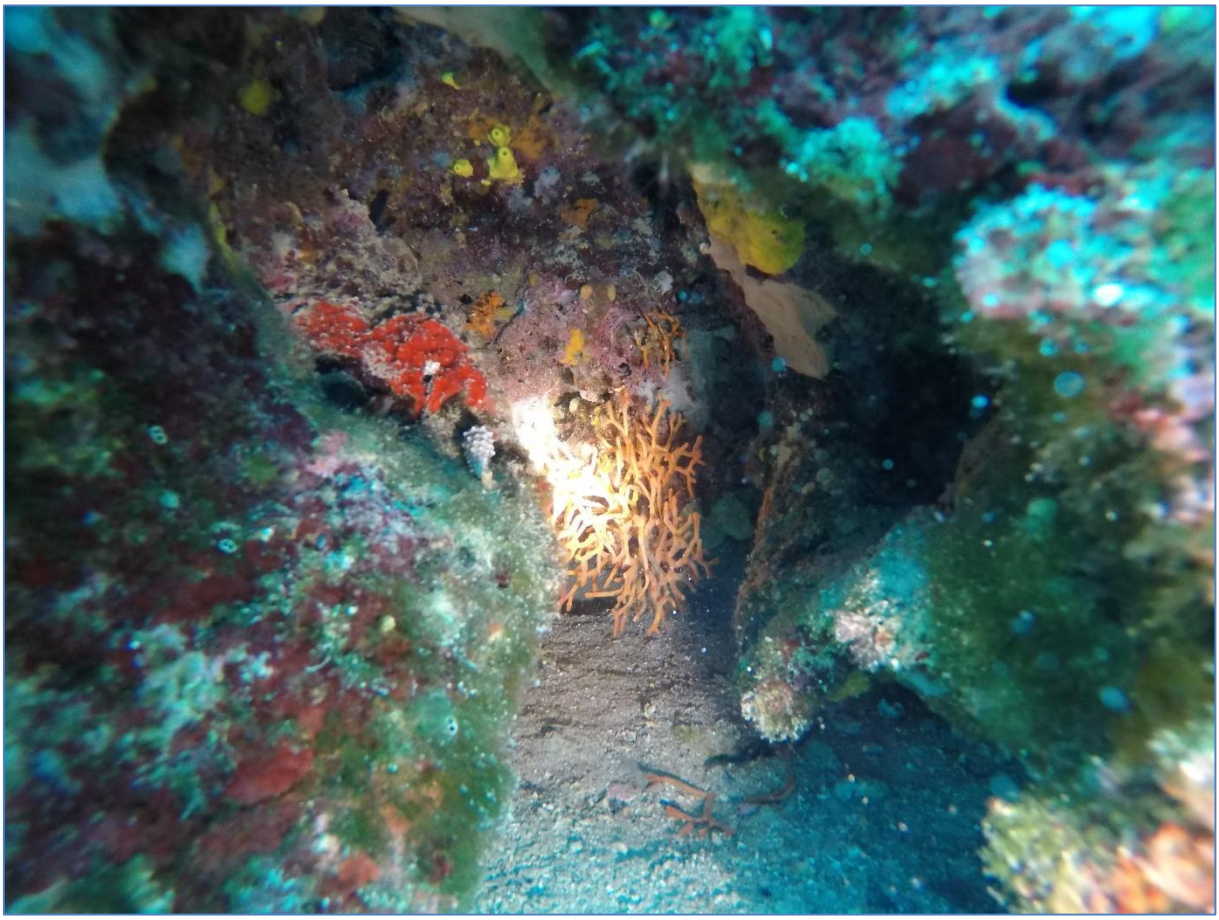

Figure 35 Yellow gorgonian and biodiversity of the reef

Figure 36 Underwater drone photo

Out of 68 colonies recorded along a transect at Konjsko site, 28% was affected (showed more than 10% of injured surface. Only 4.4% of colonies were completely dead. Types of gorgonian injuries SUNCE observed in June 2021 during this study. The majority of affected colonies (with ≥ 10% of injured surface) showed type B epibiosis stage (up to 1 year old), characterized by colonized turf and filamentous algae, as well as hydrozoans (53.85%). Moreover, 30.77% showed an old epibiosis stage, characterized by encrusting algae and bryozoans and an additional 15.38% showed both injuries of type B and C. Recent injury (type A, i.e. denuded axes) was noted in only one colony at the Konjsko and it did not surpass 5% of its surface. At the time of assessment, as major threats to gorgonians on Konjsko were mechanical abrasion by lost/abandoned fishing gear such as longlines and monofilament nylon lines as well as detachment of colonies due to unknown natural or anthropogenic causes.

5. FISH ASSEMBLAGE

Fishermen and recreational divers are usually primary reef users and are identified as the most important stakeholders in the use of marine resources. There are some direct benefits for the local community such as catching fish and other marine organisms, increasing of attractiveness of destination and tourist offer, economic benefits.

The methods used for sampling of fish communities on the reef are all non-harmful. The methods are:

- BRUV (Baited Remote Underwater Video)
- UVC (Underwater Visual Census)
- ROV (Remote Operated Vehicle

5.1. Baited Remote Underwater Video (BRUV)

A fast development in technology over the last 20 years has made the use of cameras in underwater research a common thing. Whether for abundance or length of the fish, deep or shallow water, cameras are now days used for sampling of fish assemblages more than ever (Watson et al., 2005.). There are two basic ways of using cameras, mono or stereo system. Both ways cameras are pointed down or parallel with sea bottom. If the system has a bag with bait then we are talking about BRUV. Those systems can be armed with infrared lights, moving sensors, … The biggest pros of this method are that it can be used on big depths, several times during the day, it is non-expensive and easy to use and it is non-harmful (Langlois et al., 2010., Cappo et al., 2007.).

A comparison was made weather the use of bait increases abundance or not. It is found that the use of bait increases abundance of carnivore and omnivore species but does not decrease the abundance of herbivore species (Harvey et al., 2007). Stereo system is used when we want to have a precise length of the fish using a calibration and a software program for measuring. The program is not precise in MM but a class range of 10 cm can be provided.

In the research a stereo and a mono system were used. Stereo system has two cameras put in a waterproof housing. The housings are attached to the metal frame and are pointed parallel to the sea bottom. Housings are made out of technical plastic and are waterproof up to 100 meters. The cameras used in the case are GoPro Hero 3 Silver, GoPro Hero 4 Silver Plus and a GoPro Hero Black 5. All cameras are high 4K resolution (1920 x 1080) and have a battery life up to 3 hours. In our case we also used BackPack batteries to extend that life span up to six/six and a half hour. The frame of the system is made out of stainless steel. The bar where the cameras are attached is one meter long and the distance between the cameras is 70 centimetres. The housings are moved for 8^{o} to the centre of the system so that the max range of the system in clear water would be around 7 meters. The system has 4 detachable legs that can be armed with leads if the current is too strong so that it can't be moved. On the left and right side, the system is connected to the floating rope and on the other end with a buoy (Figure). For the bait we used fresh sardines. The whole system is 1m tall which is the standard height for BRUV.

Each system had 3 or 6 replicates, depending on the battery lifetime, in duration of 45 minutes. Maximum of 6 systems per day were used.

Also, a mono BRUV system that is consisting of an open box where the camera is placed were used. Camera used on this system was GoPro Hero 5 and is placed in its own housing. The maximum depth range for this system is 45 meters. 4 detachable legs that can, as in the case of stereo system, be placed with weights so that the current can't move it. It is made of stainless steel. The lifetime of a camera on this system is around 3 hours and it depends on water temperature.

Data analysis was carried out in laboratory by the same fish expert so that if there is any mistake it would be the same for every survey. For each species we took N-max (maximum number of individuals for one species per frame). For the fish length measurement in all our research we use SeaGIS event measure. Fish were measured in 10cm range and divided in classes.

Figure 37 Mono BRUV system used in research

Figure 38 Stereo BRUV system used in research

Figure 39 Figure BRUV deployment

5.2. Underwater Visual Census (UVC)

Limitations for using destructive sampling methods, especially in protected areas, have led up to different type of visual census methods. Most of them are conducted in shallow water and with snorkelling with or without the use of cameras. The method of UVC is fast, easy to replicate and can collect data for various parameters as species, abundance, habitat, density… Cons for this method are conditions in the water such as turbidity which can make harder for a diver to recognise the species, especially fish (Lowry et al., 2012.). Biggest difficulties come from mistakes made by the diver. Most of them are related with fish behaviour which is provided by diver himself, ability of the diver to recognise certain fish species, abundance and length of the fish. Different studies indicate that a diver can attract the fish, mostly carnivore species, but also it can scare them away (Langlois el al., 2010.). One of the biggest problems is the observation of small cryptic species in well-structured habitat (Lipej and Bonaca, 2006.).

In the case two methods were used. One was a classic UVC with the use of a lure and the other one was a DOV (Diver Operated Video). UVC with the lure was conducted in shallow water on transects of deferent length and width of 2 meters. Each length was replicated each time the survey was conducted. Beginning and the end of the transect was a well-marked object. The fish count was written on the white plastic ring with a waterproof pen.

DOV used in our research was equipped with two GoPro Hero 4 cameras that were placed in waterproof housings that were attached to the metal frame (Figure 40). It was used only once because the program for stereo system analysis was not working.

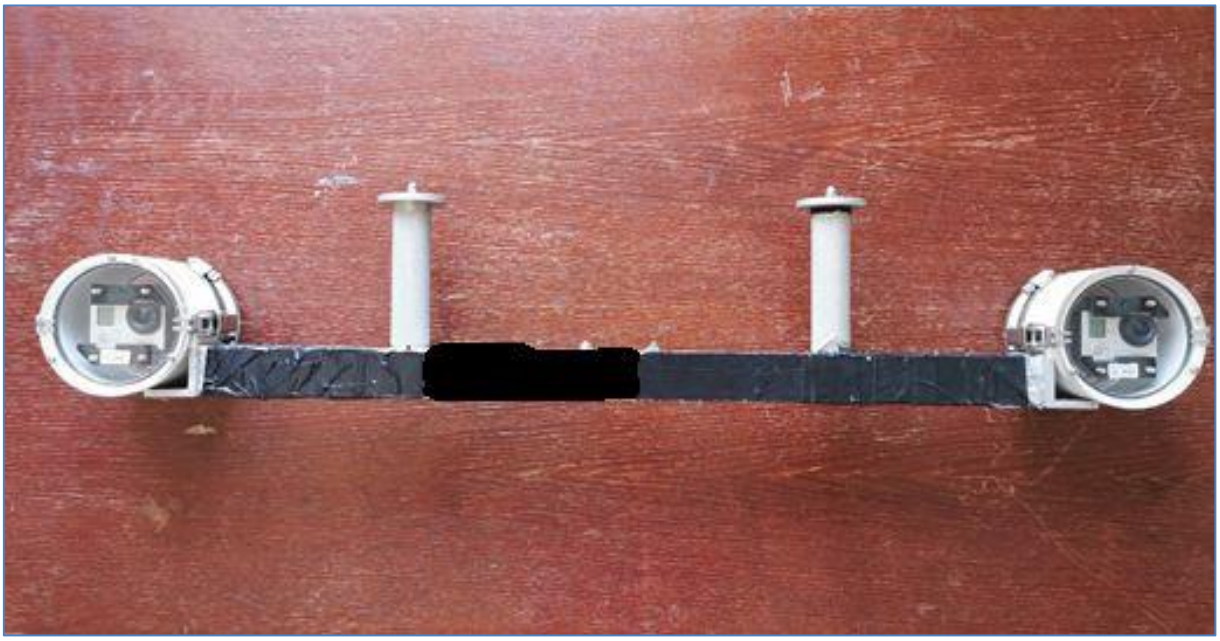

Figure 40 DOV used in research

5.3. Remote Operated Vehicle (ROV)

OV (Remote Operated Vehicle) is every underwater vessel that is operated on distance with crew member. With fast technological development human crews are replaced and ROV can be operated from land or boat by remote control. Biggest advantage of these small ROV's is that they easy to navigate through small spaces such as interior of sunk ships or small underwater caves. In addition, if the ROV is lost there is only material loss. In past this kind of vehicles were expensive if you wanted high resolution cameras and all advantages listed above, but nowadays that is not the case. One of such vehicles is Gladius Mini ROV by French company Chasing (Figure 41).

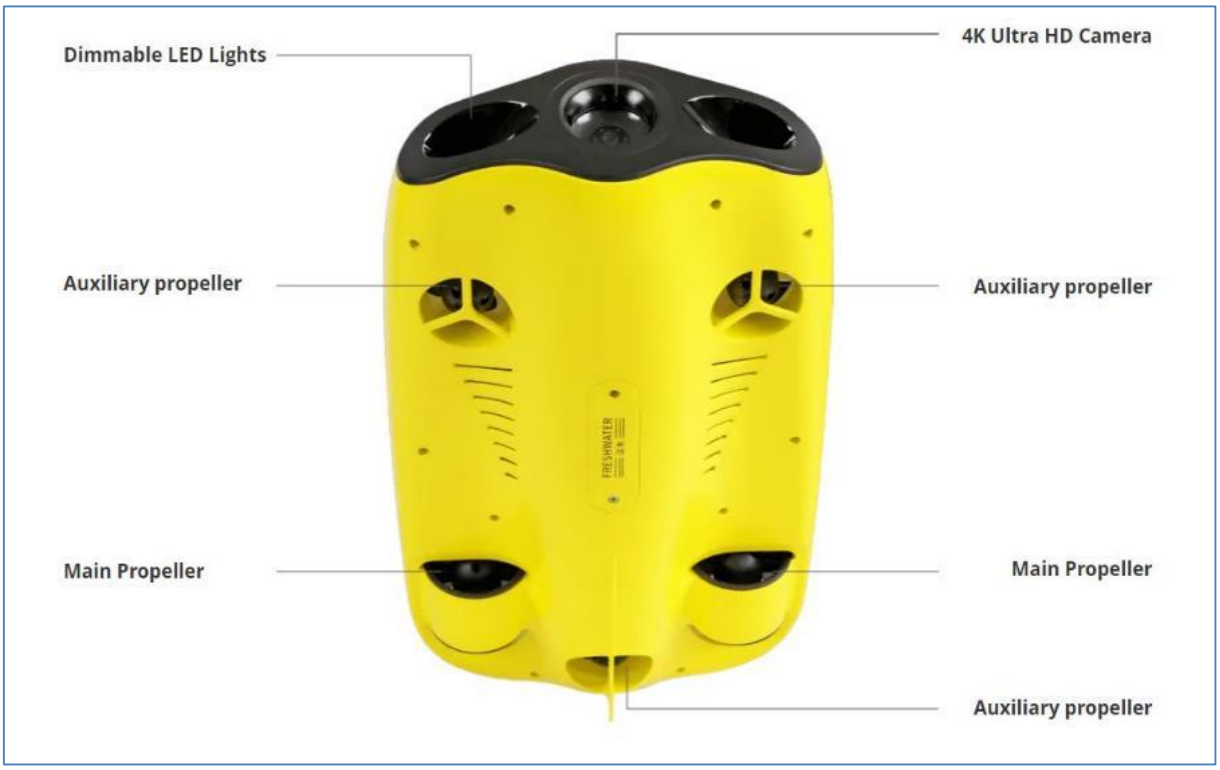

Figure 41 Gladius Mini ROV

ROV's dimensions are 15.1 x 8.8 x 5.4 inches and weighs 2,5 kilos. The colour is yellow so it can be easily found if lost or stuck. It has 5 propulsors that provide stability, direction and speed of the ROV which can be max 4 knots or 2m/s. There are two rear motors that are responsible for horizontal movement. The rest are for moving up and down and stabilization. Namely, when all the motors are turned on the system can be adjusted so that ROV moves 45 degrees regarding to the sea bottom which is the best angle for filming. It has a 4K camera (12 million pixels) that cam film videos or take pictures in high resolution. For working in deeper water, it has two LED lights, each 1200lm of power. The autonomy of the ROV is around 2 hours depending on water temperature and is 100 meters waterproof. The ROV is attached to the base station with 150 meters of optical cable covered in yellow kevlar suit. The base station has integrated memory of 64 GB but additional micro SD card can be added (Figure).

Figure 42 Base station and micro SD card

Inside the base station there is a WiFi antenna that serves for connecting to the drive pad. Tablet or the mobile phone must be put on the drive pad so that the ROV can be operated (Figure).

Figure 43 Drive pad (console) of the ROV

On the screen you can see battery life time, water temperature for the depth on which the ROV is found at that time, picture of the situation in front of the camera and current depth (Figure). The ROV was used for vertical transects on the coralligenous wall and for the Michele shipwreck.

Figure 44 Explorative survey carried out

The total of 13 fish species were found on Konjsko site during two explorative surveys. One survey was conducted during spring 2020. and the other one during spring 2021. The most abundant species by the number of individuals are mesopelagic species that live in schools like *Chromis chromis, Boops boops* but also *Diplodus vulgaris* as representative of batipelagic species. They represent > 70% of all individuals on the site. In species richness most abundant are mesopelagic and bati-pelagic species as listed.

Table 5 Fish community structure at Konjsko site

NAME	DENSITY
Boops boops	**H**
Coris julis	**M**
Diplodus vulgaris	**H**
Chromis chromis	**H**
Diplodus annularis	**L**
Sparus aurata	**L**
Symphodus tinca	**L**
Serranus scriba	**L**
Spicara maena	**M**
Diplodus puntazzo	**L**
Oblada melanura	**M**
Trigloporus lastoviza	**L**
Gobius Cruentatus	**L**

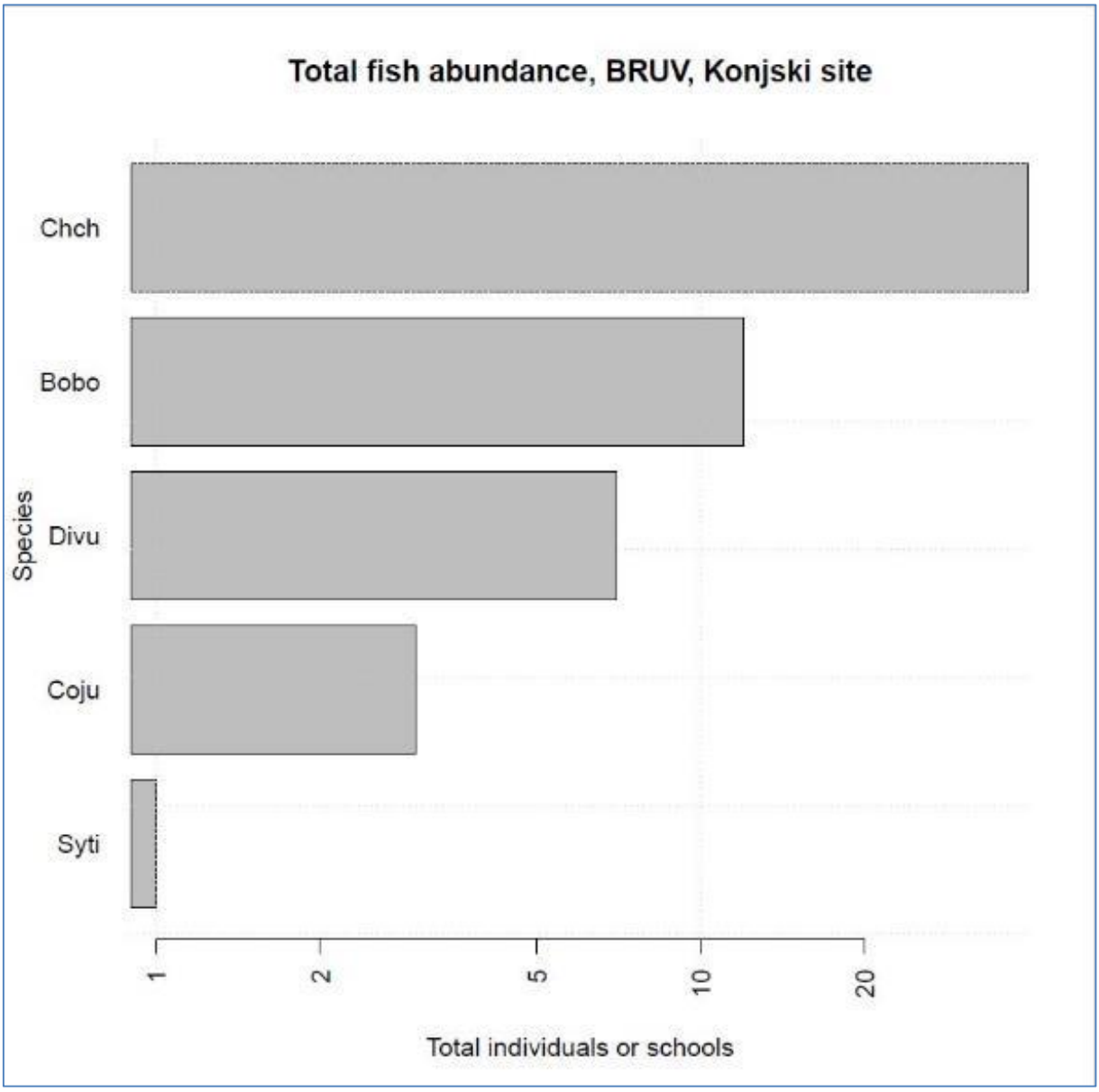

Figure 45 Total fish abundance detected with BRUV

As for the difference between sampling techniques it can be seen that BRUV recorded les species than ROV or UVC. This was a surprise because in all our surveys BRUV was the most dominant sampling technique for fish assemblages. There can be two reasons for this. One is that the site doesn't have a high abundance of individuals for certain species and being BRUV is a stationary technique there is less chance that some will interact with bait and the system. Other reason could be that fish wasn't attracted by the type of bait we used (mashed fresh sardines). In our past research a certain type of bait doesn't attract the same species of fish and on some locations different species prefer different bait.

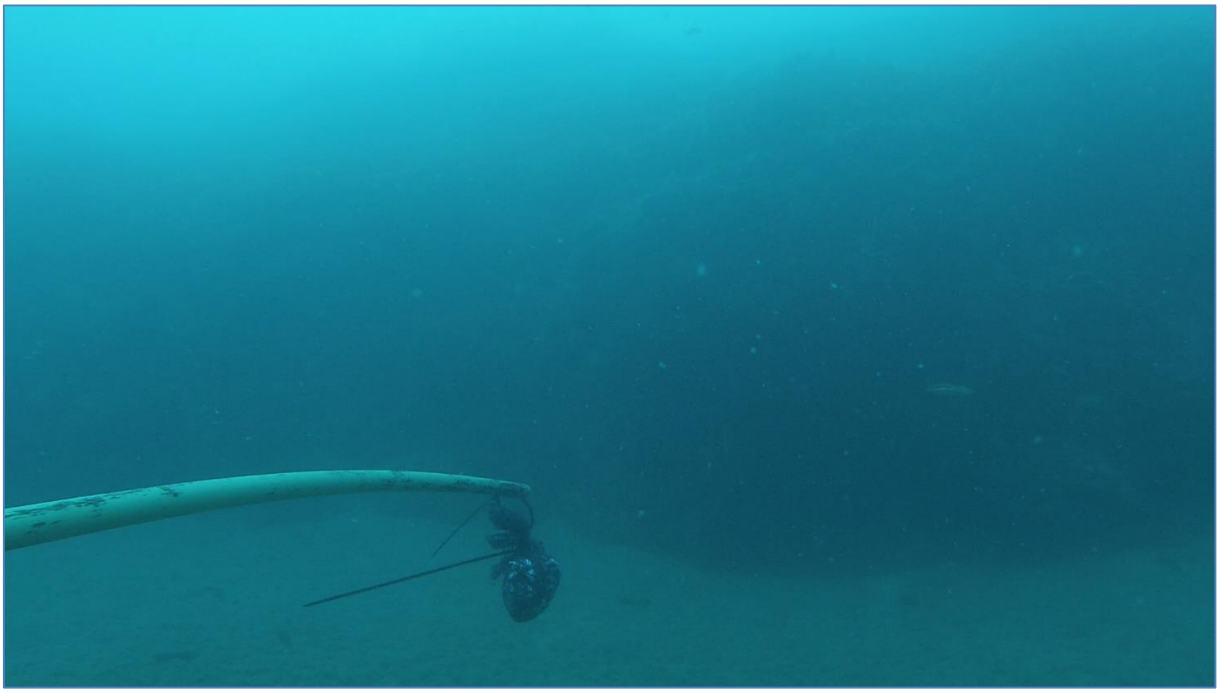

Figure 46 Coris julis *recorded by BRUV on the bottom of the reefs vertical wall*

Figure 47 School of Boops boops *and* Spicara smaris

Figure 48 Small school of Diplodus vulgaris

Figure 49 Serranus cabrila *in feeding proces*

No aberrations were found in species length structure. All species were in their normal distribution range for this kind of habitat. Most species are between 10-20 centimetres range and mesopelagic. Therefore, they represent no real potential for scuba diving or photo-safari. This location potentially can be used for fishing tourism and sport fishing tourism.

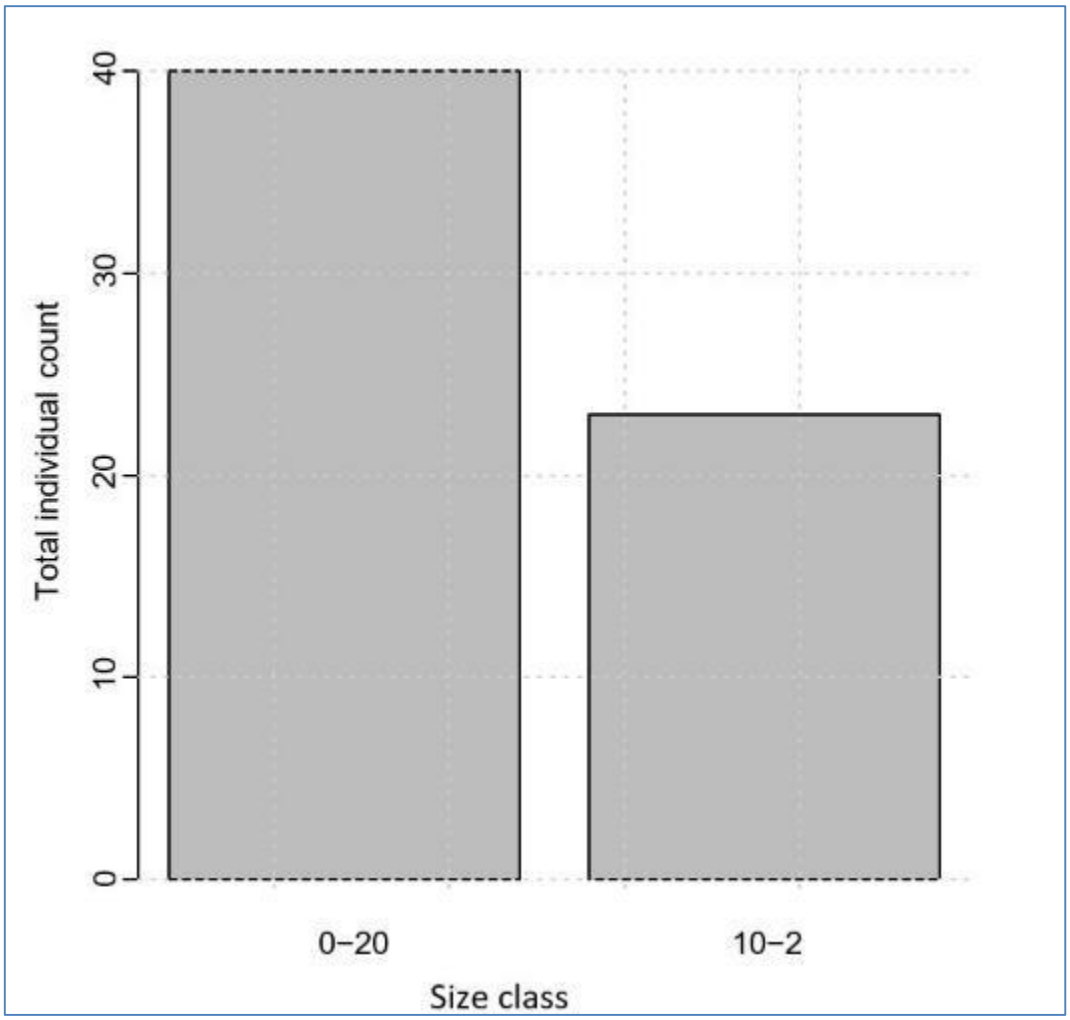

Figure 50 Fish size class for Konjsko site

Figure 51 Fish population around the reef

Figure 52 Marine organisms

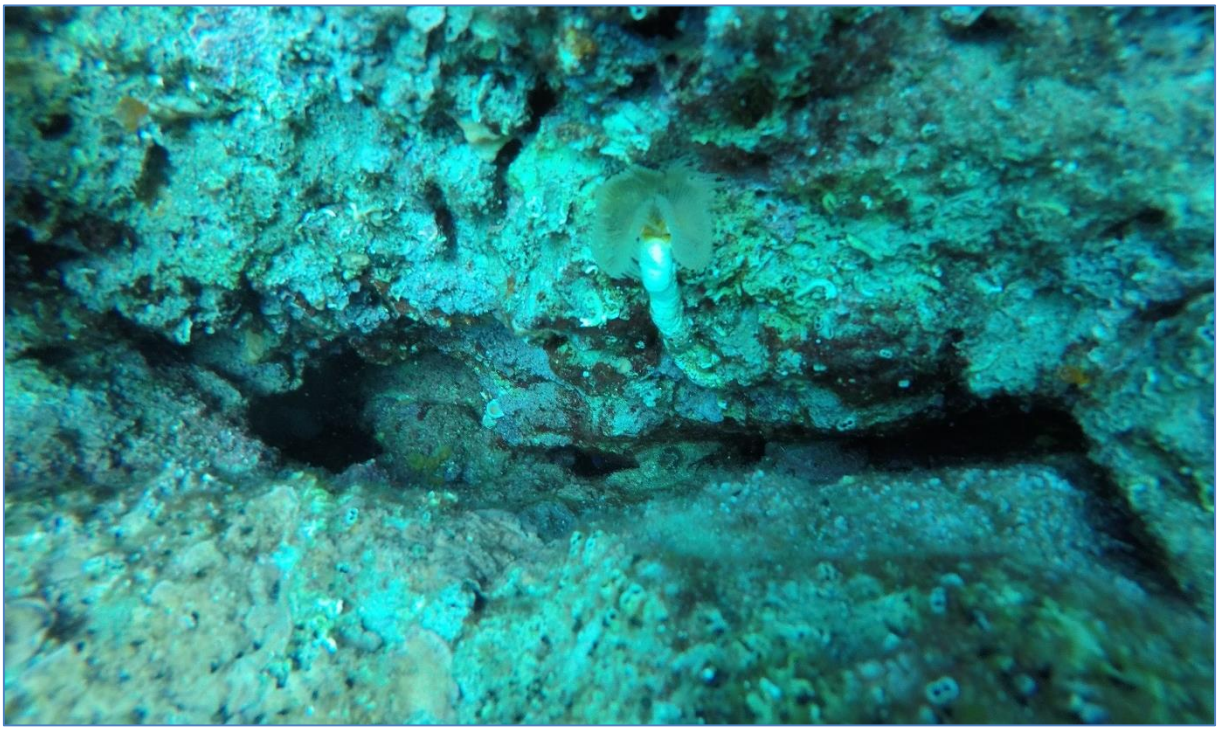

Figure 53 Marine organisms

Figure 54 Fish population around the reef

6. ENVIRONMENTAL LOAD

Fishermen and recreational divers are usually primary reef users and are identified as the most important stakeholders in the use of marine resources. There are some direct benefits for the local community such as catching fish and other marine organisms, increasing of attractiveness of destination and tourist offer, economic benefits. Reef resources are interesting for commercial fishermen with licences for hunting with traps, hooks and lines and other fishing gear permitted to use and fishermen in small coastal fishing. Except the fishermen and divers, other stakeholders are local community, Tourist Board of Dobrinj Municipality (where Šilo belongs), Harbour master's office, tourist resorts and campsites.

6.1. Tourism

As mentioned before, generally island Krk is extremely attractive for tourists. North Adriatic (Island Krk and Crikvenica riviera) represent one of the most popular tourist destinations. The island of Krk is located in the centre of the Kvarner bay and it is the most northerly island on the Mediterranean. Around the island, there are approximately twenty small islands, cliffs and reefs. Good geographical position, Mediterranean climate and variety of natural and cultural heritage contributes to its attractiveness as tourist destination.

The island of Krk is just 30 km away from Rijeka, city which is business, commercial and cultural centre of Kvarner. The connection of the island of Krk with the mainland is very good. From the land it is possible to come over Krk bridge, from the sea by boats in the small ports and by ferry to the Valbiska harbour. Rijeka's airport is located on the island of Krk, close to Omišalj, so there is also a possibility of arrival by plane.

Krk is an island that offers primarily sun and the sea, sport and recreation, cultural heritage and nautical tourism. According to the law on local autonomy, six municipalities (Omišalj, Malinska, Punat, Baška, Vrbnik and Dobrinj) and the city of Krk were founded on the island.

Figure 55 Tourist map of the island of Krk and the position of the Konjsko reef (http://ontheworldmap.com/croatia/island/krk/krk-tourist-map.html)

Šilo is the tourist centre of the area of Dobrinj, located on the north-eastern part of the island, in front of the Crikvenica riviera. It used to be a fishermen's and seamen's village. Now, it is recognizable by its beautiful beaches (sandy, pebble and partly concrete) and recreational diving. A special attraction is a wrecked Greek ship Peltastis which is located near Šilo. As far as accommodation is concerned, there are no hotels in Šilo. Accommodation can be found in rooms and apartments of private houses or in campsites. There are motor boats and smaller boats that travel around the area. Opposite of the Šilo is Crikvenica riviera. Crikvenica is a

town with a long tourist tradition thanks to its excellent geographical position and good road connections. It is actually a seaside riviera made up of four small coastal towns; Selce, Crikvenica, Dramalj and Jadranovo. Crikvenica also stretches into the sea and includes the Vinodol Channel. Also, there are many small ports in Riviera where a boat can be moored, as well as two near marinas in Novi Vindolski (marina Novi and Mitan Marina) which contribute to the development of nautical tourism. In this impact zone (the coastal area of the Vinodol Channel within a radius of 15 km, which includes the cities of Crikvenica, Novi Vinodolski, Omišalj, Vrbnik and Dobrinj), it is evident that the whole area is intended for the intensive development of high-standard tourist facilities. Due to the intensive use of the Crikvenica and Vinodol Riviera, which is about 2,5 km away from the Plićina Konjsko, and that its location is between the Dobrinj and Vrbnik municipalities, it is considered that mentioned cities and municipalities are the wider area of influence.

Table 6 Arrivals and overnight stays achieved by municipalities in 2019. (http://www.krk.hr/Iz_Rada_Turisticke_Zajednice/Statistika)

MUNICIPALITIES	ARRIVALS 2019	ARRIVALS 2018	INDEX 2019/2018	OVERNIGHT STAYS 2019	OVERNIGHT STAYS 2018	INDEX 2019/20182	PART %
KRK	235.008	229.938	102,2	1.325.469	1.317.312	100,62	26,57
BAŠKA	180.075	180.538	99,74	997.763	1.007.224	99,06	20
OMIŠALJ	158.060	144.073	109,71	844.141	807.413	104,55	16,92
MALINSKA	116.327	114.530	101,57	683.609	679.410	100,62	13,7
PUNAT	110.364	108.712	101,52	601.430	603.857	99,6	12,06
DOBRINJ	64.899	64.439	100,71	425.301	426.600	99,7	8,53
VRBNIK	19.543	18.731	104,34	110.832	110.723	100,1	2,22
TOTAL	884.276	860.961	102,71	4.988.545	4.952.539	100,73	100

According to statistical data, the most visited municipality is the city of Krk, which accounted more than a million overnight stays, followed by Baška and Omišalj. The municipality of Dobrinj, where Šilo is located, takes 8,53 % of total tourist traffic in 2019. In comparison with the 2018., the number of arrivals and overnight stays increased in almost all municipalities.

Table 7 Tourist results achieved by municipalities in 2020. (http://www.krk.hr/Iz_Rada_Turisticke_Zajednice/Statistika)

MUNICIPALITIES	ARRIVALS	OVERNIGHT STAYS	PART %
KRK	113.932	691.727	26,22
BAŠKA	86.910	513.167	19,45
OMIŠALJ	65.585	384.997	14,59
MALINSKA	61.274	380.379	14,42
PUNAT	56.906	331.195	12,55
DOBRINJ	39.371	270.539	10,25
VRBNIK	10.899	66.492	2,52
TOTAL	434.777	2.638.496	100

As for the guests that visit Krk, most of them are from Germany, Slovenia, Austria and Italy which can be seen in the following table.

Table 8 Top 10 markets in 2019. (http://www.krk.hr/Iz_Rada_Turisticke_Zajednice/Statistika)

COUNTRY	ARRIVALS	OVERNIGHT STAYS	DURATION OF STAY	%
GERMANY	231.588	1.640.807	7,08	32,89
SLOVENIA	122.479	597.978	4,88	11,99
AUSTRIA	114.937	598.062	5,2	11,99
ITALY	86.398	440.751	5,1	8,84
HUNGARY	57.136	275.149	4,81	5,52
CZECH REPUBLIC	39.419	251.924	6,39	5,05
POLAND	32.204	199.575	6,19	4
SLOVAKIA	30.725	186.074	6,05	3,73
NETHERLANDS	21.059	124.659	5,91	2,5
SWITZERLAND	16.079	72.220	4,49	1,45

6.2. Diving centres

Diving tourism is becoming more popular for the past years. It is specialized form of adventure tourism for the guests of high financial capacity. Diving in Croatia is organized through the Croatian Diving Association, diving clubs, professional associations and diving centres. Most of the diving centres are located in Primorje-Gorski Kotar County. There are many attractive diving locations in the Kvarner area, so every year a number of divers who explore this area increases. In the underwater world you can see the geological and biological richness, the richness of flora and fauna, plenty underwater caves and the wreckage of old ships. While discovering the underwater world, there are numerous diving centres that can help you to organize activities, dives and excursions. In order to assess the potential of using reef resources in diving tourism, as well as the pressure on them, it is necessary to identify diving centres in the vicinity. There are 8 diving centres within 20 km of the Plić Konjsko; two in Šilo and Crikvenica and one in Vrbnik, Selce, Novi Vinodolski and Kostrena. Diving activities and local tourism pressure during summer season could be a threat for the reef. Šilo, a place where Plić Konjsko is located, is being promoted as a dive site. There are two diving centres in Šilo: Neptun and Modrulj. While diving centre Modrulj is seasonal, the other one works during the whole year. The most attractive locations and excursions they offer are Punta Šila, wrecked ship Peltastis, Sika tenki, underwater cave Vrbnik, Kamenjak cliff, Neptun reef. The coastal area of the Municipality of Dobrinj abounds in underwater caves which are nature monuments.

Table 9 Popular diving locations near the Plić Konjsko reef (http://www.kvarner.hr/turizam/sto_raditi/Avanturizam_i_sport/Ronjenje)

LOCATION	SPECIFICITY
Vila Biser	Rare labyrinth of walls
M/b Peltastis	Wreck of a cargo ship that sunk in 1968.
Plićina Tenki	At a depth of 15 m there is a 10 m long tunnel with red gorgonians on the wall
Špilja Vrbnik	Location of the endemic Colombatoivic glacier
Tunel Prvić	The tunnel and the wall with gorgonians
Sika od Fratra	Red gorgonians, a diverse fish world
Rt Šilo	Gorgonies already at 20 m, rich in biodiversity
Rt Jablanac	Two beautiful walls with lots of caves and crags, from one can emerge to the surface

According to data from nearby diving centres, location Konjsko is not so popular like shipwreck Peltastis which is the most popular diving spot in this area. Konjsko is suitable for beginners, it is not so deep and difficult spot. Diving centres agree that they confront with intense traffic during the summer. The spot is near the beach and campsite, a lot of people are there, jet ski passes very often. Those are all reasons why they say that it is not safe to dive here while peak season.

QUESTIONNAIRE FOR DIVING CENTER

1.	**Diving center code**	
2.	**City / Location**	**Kostrena, Croatia**
3.	**Do you organize excursions to the natural reef / wrecks?**	☑ **YES** (go on **question 4.**) □ **NO** (go on **question 10.**)

IF YES,

4.	**Do you organize excursions to the reef/wreck for divers?**	☑ YES	□ NO
5.	**Do you organize excursions to the reef for educational purposes?**	☑ YES	□ NO
6.	**Please provide data on recreational flow**		
EXCURSIONS FOR DIVERS		Trips/excursions (n/year)	Divers (n/year)	Dives (n/year)
2020			600	1600
2019			1800	4200
2018			1700	4000
Percentage of the activity carried out at the reef / wreck of the total yearly activity		_____%	100 %	100 %
EXCURSIONS FOR EDUCATIONAL PURPOSES		Trips/excursions (n/year)	Divers (n/year)	Dives (n/year)
2020			84	420
2019			54	270
2018			40	200
Percentage of the activity carried out at the reef / wreck of the total yearly activity		_____%	100 %	100 %
7.	**Please provide data on human resources involved in your company**			
Do you have employees? ☑ yes □ No				
If yes, please provide the number of employees with the same annual workload (expressed in hours) in 2019				

Figure 56 An example of questionnaires sent to diving centres

6.3. Fishing activity

Reefs help local enrichment and diversification of fish communities because it is often larger fish population around the reef than in non-reef areas. Catching fish and other marine organisms for personal consumption or sale are benefits for the local community around the reef resources. Reef resources are very interesting for commercial fishermen, who have licence for hunting with traps, hooks and lines, stabbing tools and other types of fishing gear permitted to use within 1 M of the coast, as well as for the fishermen in small coastal fishing. In the context of the observed reef, usually its primary users are fishermen and recreational divers. In the zone of influence in the Vinodol Channel, there is a small number of licences issued for commercial fishing and small-scale coastal fishing, while there is no licence issued for fishing tourism in the whole area.

6.4. Maritime traffic

Marine vessels have several impacts on marine environment and habitats. In order to get a complete picture of maritime traffic in observed area, its characteristics will be explained. The analysed navigable area in the northern part of the Adriatic Sea consists of a number of access channels and partially closed seas. The waterway through Kvarner bay is satisfactorily equipped with maritime signals and other objects of navigation safety that allow good recognition of the coastal edge, especially during night. There are no navigational dangerous objects around the area of Šilo and those depths are sufficient for the navigation of smaller vessels, local boats and smaller fishing and tourist boats. As said before, Šilo is a small port where usually can be found smaller boats of local community. So, the traffic is generally of lower intensity due to the size of port. Fishing boats in the observed area can be divided into larger vessels (longer than 30 m) that fish on the open seas and smaller ones (less than 30 m) that usually fish in coastal waters and passages. They are often characterized by departure during the evening hours and entry during the early morning hours. The navigation of other vessels includes the navigation of boats of the local population, primarily from the Šilo, but also from the surrounding places. Those boats are usually 5 to 10 metres long and built from wood or fiberglass. They do not reach high speeds and are mostly stable.

During the summer season, marine traffic is more intense due to tourist boats and sailing of nautical tourism boats of smaller dimensions. In the wider impact zone there are two marinas in Novi Vinodolski: Marina Novi (with 204 berths with possibility of receiving smaller cruises) and Mitan Marina with 180 berths. Ports of nautical tourism should be of great importance in this area and are planned to be in Novi Vinodolski (with capacity of 400 berths), Crikvenica (capacity of 200 berths)[1] and at the island of Krk, for mooring mega yachts and larger nautical boats.

In the Kvarner bay there are 18 ports open for public transport: 10 in Crikvenica, 4 in Novi Vinodolski, 5 in Dobrinj Municipality and one in Vrbnik and Omišalj municipalities.

Port of Šilo is a port open for public transport of county importance. The Port covers an area of 20.398 m^2, of which 1.028m^2 of land area and 19.371m^2 of sea area. It consists of the operational part with length of 90 m for the purpose of embarking and disembarking passengers in occasional coastal maritime traffic, communal part of the port for mooring 48 boats up to 12 meters in length and anchorages in the function of

[1] http://investcroatia.gov.hr/wp-content/uploads/2017/07/Marina-Crikvenica-prosinac-2017.pdf

communal part for mooring 50 boats up to 7 meters in length. The Port of Šilo has secured places for electricity supply and drinking water supply, one tank for solid waste collection, one for liquid waste collection, as well as 10 parking places and 2 stopping places.

Figure 57 The Port of Šilo (https://www.zluk.hr/en/luka/luka-silo)

In Vinodol Channel, there is a permanent county ferry line Šilo-Crikvenica, which runs several times a day.

Maritime traffic in a closely observed navigable area can be considered rare, especially during the winter. The navigable area is mostly used by fishing boats, boats of the local population and less often excursion boats and nautical tourism vessels only during the summer season.

6.5. Evaluation of physical garbage quantities and type on the seabed

Lately, much attention is given to raising public awareness of the problem of waste on the seabed and promotion of sustainable solutions for the preservation of the marine environment. Pollution of the marine environment means introduction of substances that can cause serious consequences to sea life, endanger human health and interfere with maritime activities. Although Adriatic Sea is known as clear sea, every year divers and volunteers extract tons of plastic and other waste from the seabed. The intention of organizing such activities is to preserve the natural heritage of seabed. As mentioned before, the quality of the sea of the observed area is excellent. While doing our explorative surveys with drone, the bottom was looking clean, but still there were pieces of garbage noticed. During our first explorative survey in 2019. the equipment and learning how to use it properly was testing so complete inspection of the bottom and the wall was not carried

out. Reviewing drone videos, garbage seen at the bottom of sea were bottles, cans, plastic and the remains of fishing nets as well as nylon for hunting fish.

Exploitation of marine resources should be in a sustainable way and trying to maintain its conservation status. Healthy environment and biodiversity, as well as the reef in good preservation status, provide benefits to industries like tourism, diving and fishing.

Figure 58 Remains of fishing nets

Furthermore, deliverable report - ADRIREEF Project: the assessment of reefs on the location Konjsko (the Krk Island) [2] give additional information about garbage type and quantity on the reef area. Dominant type of lost/abandoned fishing gear were longlines and monofilament nylon lines, followed by traps. Only one fishing net was observed at the site Konjsko 1.

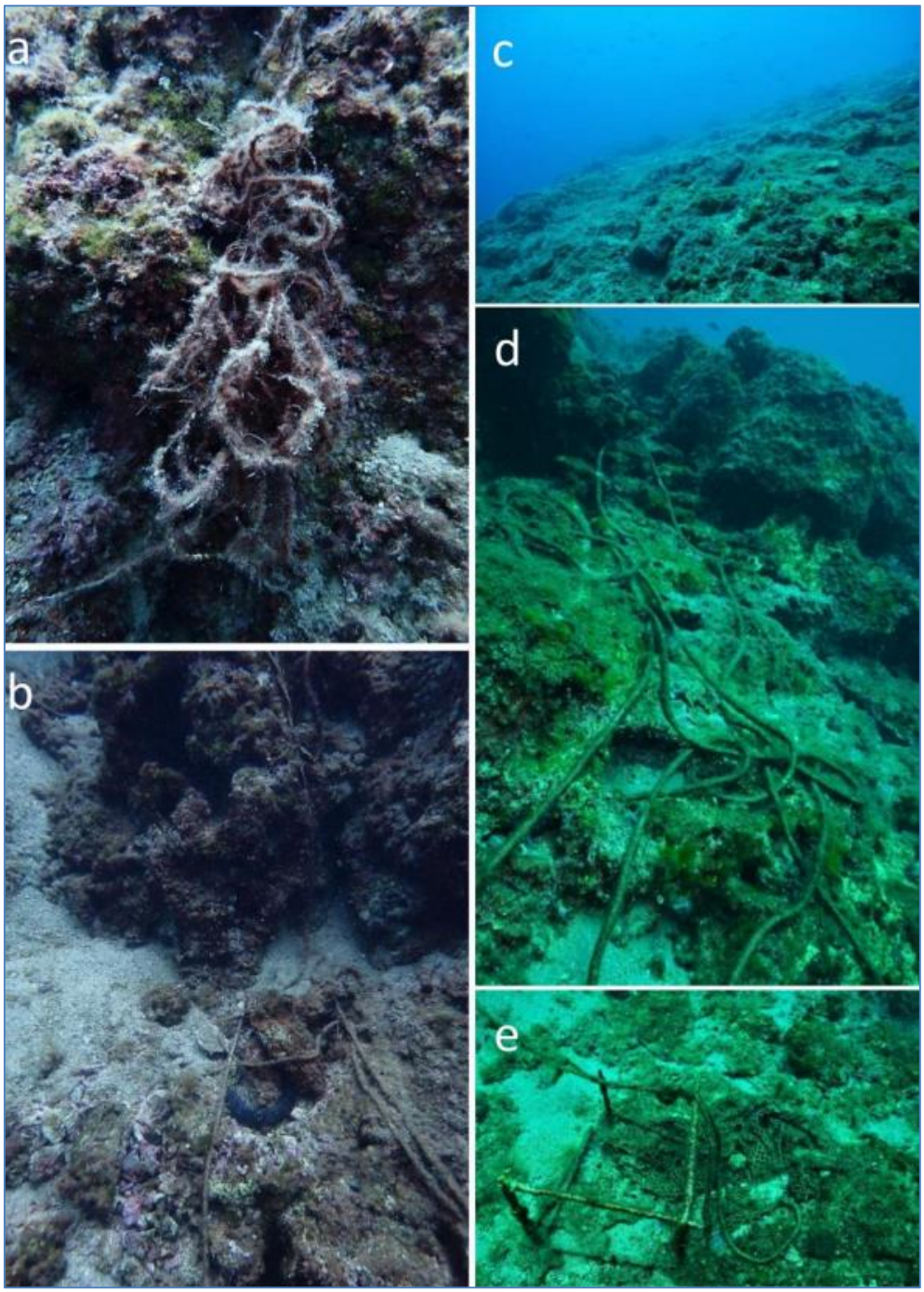

Figure 59 Example of lost/abandoned fishing gear on location Konjsko next to the Krk Island: a) ropes on site Konjsko 1 and b) Druzinin, c-d) ropes on site Konjsko 2 and e) a trap fallen apart

Related to the evaluation of their environmental impact, longlines were overgrown mainly by filamentous algae, except traps that were either colonized by macroalgae or encrusting organisms such as bryozoans, red algae and annelids (stage 2 or 3 of epibiosis according to Ruitton et al. 2020). No trapped, removed or damaged individuals were observed on the Konjsko 1 and 2 sites. There, longlines and/or monofilaments were occasionally entangled around gorgonian colonies, causing abrasion and tissue injuries. Several colonies were [2]. found detached, potentially due to contact with a fishing gear, but this cannot be claimed with certainty. Outstanding species in terms of rare or protected organisms were not associated with LFG or found in their proximity. In the case of one trap, a squid, i.e. a commercially valuable species, was using it as a nursery. Other LFG, being mostly longlines and monofilament lines, did not create additional habitat with a role of a nursery, hideouts or pantry. There was no abrasion impact on the substrate and no obstructed cavities were noticed. Likewise, fishing capacity of predominant LFG found here was nil. Related to the impact on the seascape, since most of observed LFG were longlines and monofilament lines laid down on the substrate, they were moderately visible (from 1-5 m distance) and they did not considerably alter the seascape. For the same reason, they did not substantially enhance the relief (except of several traps found on the nearby detritic bottom) and their impact mainly affected a surface below 5 m^2.

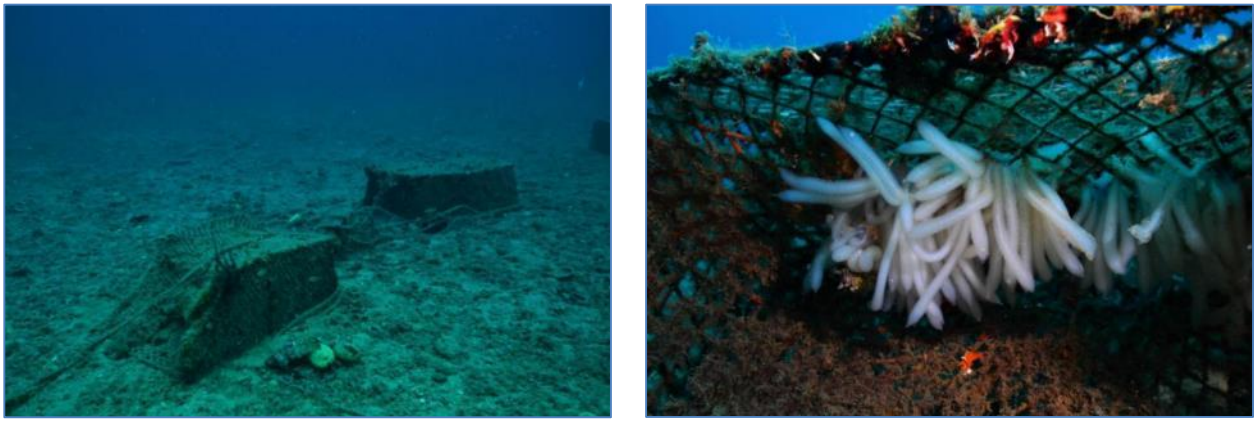

Figure 60 Example of lost/abandoned traps on site Konjsko 2 a) that host encrusting bryozoans, algae and serpulid polychaetes and serve also as a nursery for squid eggs (b)

When evaluating technical risk associated to the potential removal of observed LFG, positive points present the relatively shallow depth range where they were placed (not more than 20 m depth) as well as their fairly loose attachment to the bottom and hence, relatively easy removal.

Related to the site usages, whereas Konjsko sites have been used as fishing grounds (as evident from the LFG found there). Based on all parameters mentioned above, the calculated GRI (Gear Removal Index) ranged from -5 to 3 for Konjsko 1 and 2 sites., whereas removal of traps on the Konjsko 2 site is not recommended (GRI < 0).

7. CONCLUSION

Reef Plićina Konjsko is the natural reef located in the northern part of the Adriatic Sea close to the north-eastern shore of the island Krk on western side of Vinodol Channel at the Geographical position φ = 45° 09.10'N; λ = 14° 40.50' E. The reef is located about 150 m from the coast line close to small tourist town of Šilo on the island of Krk in front Rt Šilo. The reef is shoal that drops with a vertical wall to the bottom from the depth of 7 to 18 m, 200 m from the coast and continue to the depth of approximately 30 meters.

The reef has not been yet explored systematically and it hasn't been used widely for any specific purpose (diving, fishing, …) that was one of the main incentives for choosing the reef for exploration and subject for research and monitoring activities throughout ADRIREEF project. The comprehensive monitoring activities and reef survey was carried out from September 2019 until June 2021.

The monitoring activities include use different types of equipment and methods. The activities were directed to geomorphological mapping of the reef, analysis of sediments, benthic community as well as fish assemblage and environmental load on the reef (tourism, diving activities, fishing activities, maritime traffic, …). In the following paragraph the most important findings of the monitoring activities are elaborated.

Equipment used in monitoring activities for geomorphological mapping was side scan sonar and underwater drone. The results of the mapping are presented in the report based on the surveys were held; during summer 2019 and spring 2020.

Survey on water column parameters shows that the monitored location has the lowest temperature during the winter sampling and the highest in summer. The nutrient follows a typical seasonal pattern (lower in winter and higher in summer). A slightly higher silicate contraction could be a proxy of diatom bloom that we have not analysed. The sanitary control of the investigated area was always excellent. The contraction of organic matter was low. In the sediment, very low PAH and PCB contractions were detected. The sanitary quality of the sediment is excellent.

On the location Konjsko, the most commonly observed macrobioeroder was the sea urchin *Sphaerechinus granularis*, present as quite large specimens. As far as the abundance of sessile benthic macroinvertebrates, target species were sponges *Petrosia ficiformis* and *Aplysina* spp. Relatively low number of targeted sessile macroinvertebrates were on the reef at depths below 12 m, a bathymetric range in which most of them were assessed streched from 11 to 18 m at the Konjsko site. Yellow gorgonian *Eunicella cavolini* was discovered on the reef, but in a very low abundance.

Fish communities on the reef was sampling using non-harmful methods and equipment: BRUV (Baited Remote Underwater Video), UVC (Underwater Visual Census) and ROV (Remote Operated Vehicle).

The total of 13 fish species were found on the reef during two explorative surveys. The most abundant species by the number of individuals are mesopelagic species that live in schools like *Chromis chromis, Boops boops* but also *Diplodus vulgaris* as representative of batipelagic species. They represent > 70% of all individuals on the site. In species richness most abundant are mesopelagic and bati-pelagic species as listed.

The reef Konjsko has been used rarely. Fishermen and recreational divers are usually primary reef users and are identified as the most important stakeholders in the use of reef up to now.

There are 8 diving centres within 20 km of the the reef and they use reef occasionally. According to data from nearby diving centres, location Konjsko is not so popular like shipwreck Peltastis which is the most popular diving spot in this area. Konjsko is suitable for beginners, it is not so deep and difficult spot. Diving centres agree that they confront with quite intense maritime traffic during the summer causing less interest for diving during summer.

In the zone of influence in the Vinodol Channel, there is a small number of licences issued for commercial fishing and small-scale coastal fishing. Reef resources could be interesting for commercial fishermen, who have licence for hunting with traps, hooks and lines, stabbing tools and other types of fishing gear permitted to use within 1 M of the coast, as well as for the fishermen in small coastal fishing.

Maritime traffic in the area can be considered rare, especially during the winter season. The navigable area is mostly used by fishing boats, boats of the local population and tourists during summer time and less often excursion boats.

Garbage seen at the bottom of the reef includes bottles, cans, plastic and the remains of fishing gear (ropes, nets, trap fallen apart, nylon for hunting fish. It can be considered that the location of the reef has low quantity of garbage.

The reef Konjsko is relatively undiscovered reef that was not used much in the past. Continuous growth of tourism in the area following by demands for new diving spots can offer more opportunity for reef exploitation. Also, by continuous methodically monitoring of the reef, that have been started through ADRIREEF project, any future more intense use of the reef can be controlled so the human exploitation will not endanger flora and fauna on the reef.

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ANNEXES

Annex 1 - High tech foto/video and 3D filming for monitoring and communication purpose s (https://www.youtube.com/watch?v=peOd6ussXTU)

Annex 2 - Press release – Presentation of ADRIREEF project
https://www.pfri.uniri.hr/web/hr/arhiva_novosti.php?search=ADRIREEF&rows_per_page=100

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Annex 3 - Article in magazine Burza nautike (01/2020)

Annex 4 – Article in magazine Burza nautike (01/2021)

Annex 5 - Press release – Presentation of ADRIREEF project
https://www.pfri.uniri.hr/web/hr/arhiva_novosti.php?search=ADRIREEF&rows_per_page=100

Annex 6 - Posting video on social media - Presentation of ADRIREEF project
https://www.youtube.com/watch?v=peOd6ussXTU

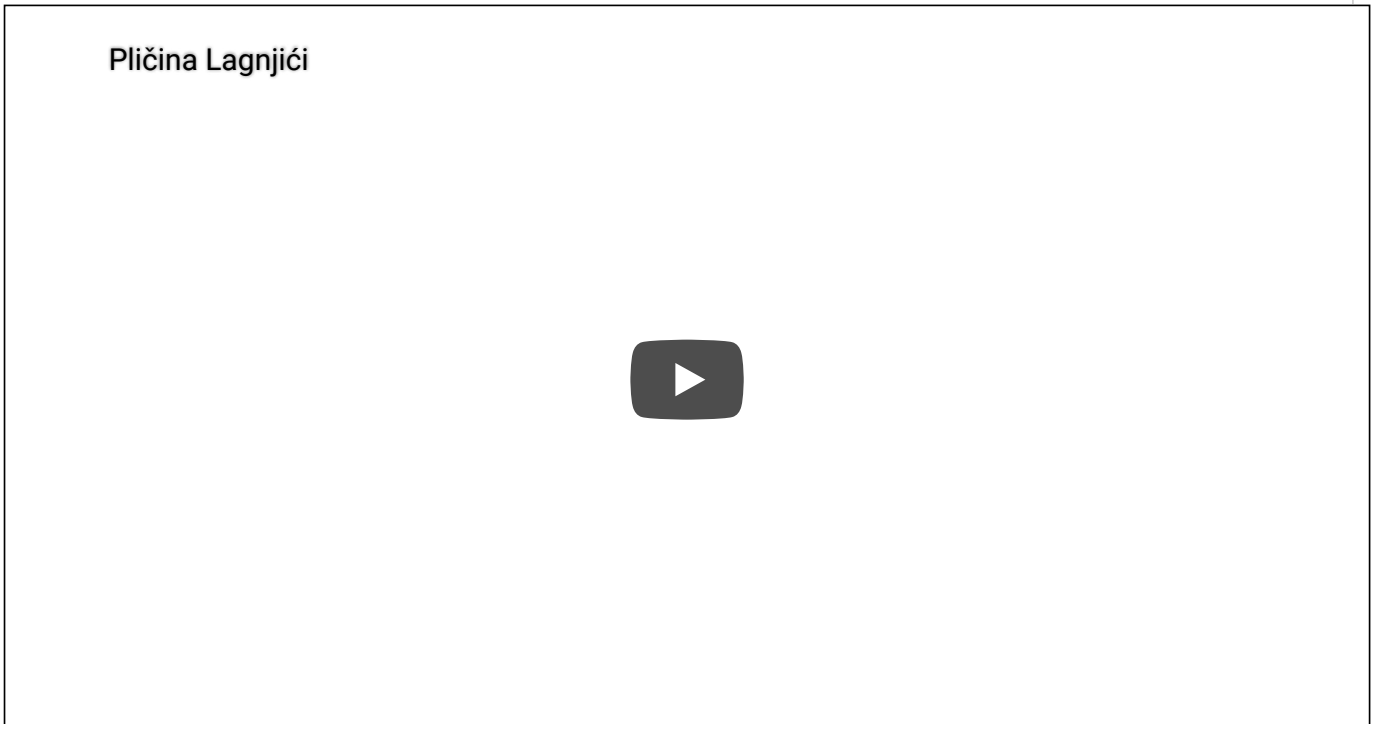
04.12.2020

ADRIREEF PROJEKTNE AKTIVNOSTI – SNIMANJE PODMORJA

Istraživanje Pomorskog fakulteta u Rijeci u okviru projekta ADRIREEF, koji ima za cilj istražiti, ali i zaštiti grebene u Jadranu, te iskoristiti njihov potencijal za razvoj Plave Ekonomije, obuhvaća pličinu Konjsko, podvodni greben u neposrednoj blizini Šila na otoku Krku, pličinu Lagnjići (Dugi otok), te pličinu Seget (otok Vis).

U svrhu istraživanja grebena sredstvima projekta nabavljena je visokokvalitetna oprema: sonar, podvodna ronilica te ronilačka oprema. Upravo su s podvodnom ronilicom – dronom, napravljene visokokvalitetne video snimke navedenih grebena. Snimanje su odradili profesori Lovro Maglić i Vlado Frančić. Detaljno snimanje grebena i podmorja omogućava praćenje promjena na grebenu, bioraznolikosti flore i faune, ali i mogućeg onečišćenja.

Pličina Konjsko



Pličina Lagnjići

Pličina Seget

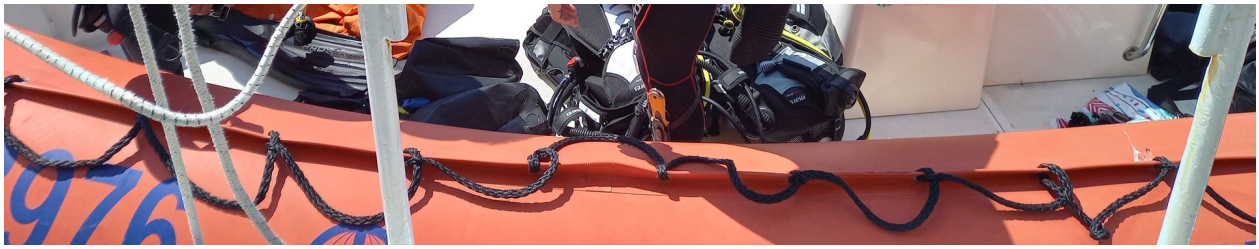
11.06.2021

ADRIREEF PROJEKTNE AKTIVNOSTI

U okviru projekta ADRIREEF, dana 08.06.2021., projektni tim Pomorskog fakulteta u Rijeci nastavio je s monitoring aktivnostima i istraživanjem podvodnog grebena pličina Konjsko u neposrednoj blizini Šila na otoku Krku. U svrhu istraživanja grebena sredstvima projekta nabavljena je visokokvalitetna oprema: sonar, podvodna ronilica te ronilačka oprema. Koristeći ronilačku opremu doc.dr.sc. Livia Maglić, doc.dr.sc. Lovro Maglić i prof.dr.sc. Damir Zec skupa s roniocima iz Udruge SUNCE napravili su uron te snimili predivne podvodne fotografije. Osim monitoringa, svrha zarona je uključivala dokumentiranje stanja biocenoze (brojnost i bio raznolikost) te prisutnost (brojnost i vrsta) otpada. Monitoring aktivnostima prisustvovali su i voditelj projekta izv. prof. dr. sc. Vlado Frančić te istraživačica na projektu Ana Malovrh, mag.ing.logist.

ADRIREEF (Innovative exploitation of Adriatic Reefs in order to strengthen blue economy) ima za svrhu istražiti podmorje Jadrana i potencijale grebena kako bi se ojačalo plavo gospodarstvo. Projekt traje od 1. prosinca 2018. do 30. studenog 2021. godine s ukupnim proračunom projekta od 3.328.175,00 Eur. Projekt je sufinanciran iz INTERREG programa V-A Italija Hrvatska 2014. – 2020.

Projekt okuplja 11 partnera iz Hrvatske i Italije. Vodeći partner ADRIREEF projekta je Municipality of Ravenna, a ostali partneri su Regional agency for prevention, environment and energy in Emilia Romagna (Bologna), Agencija za razvoj Zadarske županije Zadra Nova, Udruga za prirodu, okoliš i održivi razvoj Sunce (Split), Sveučilište u Zadru, Consiglio Nazionale delle Ricerche – CNR (Ancona), Agenzia regionale per la prevenzione e la protezione ambientale della regione Puglia (Bari), Istituto Nazionale di oceanografia e di geofisica sperimentale -OGS (Trst), Javna ustanova Rera Sd za koordinaciju i razvoj Splitsko-dalmatinske županije, Institut Ruđer Bošković (Zagreb) te Pomorski fakultet u Rijeci.



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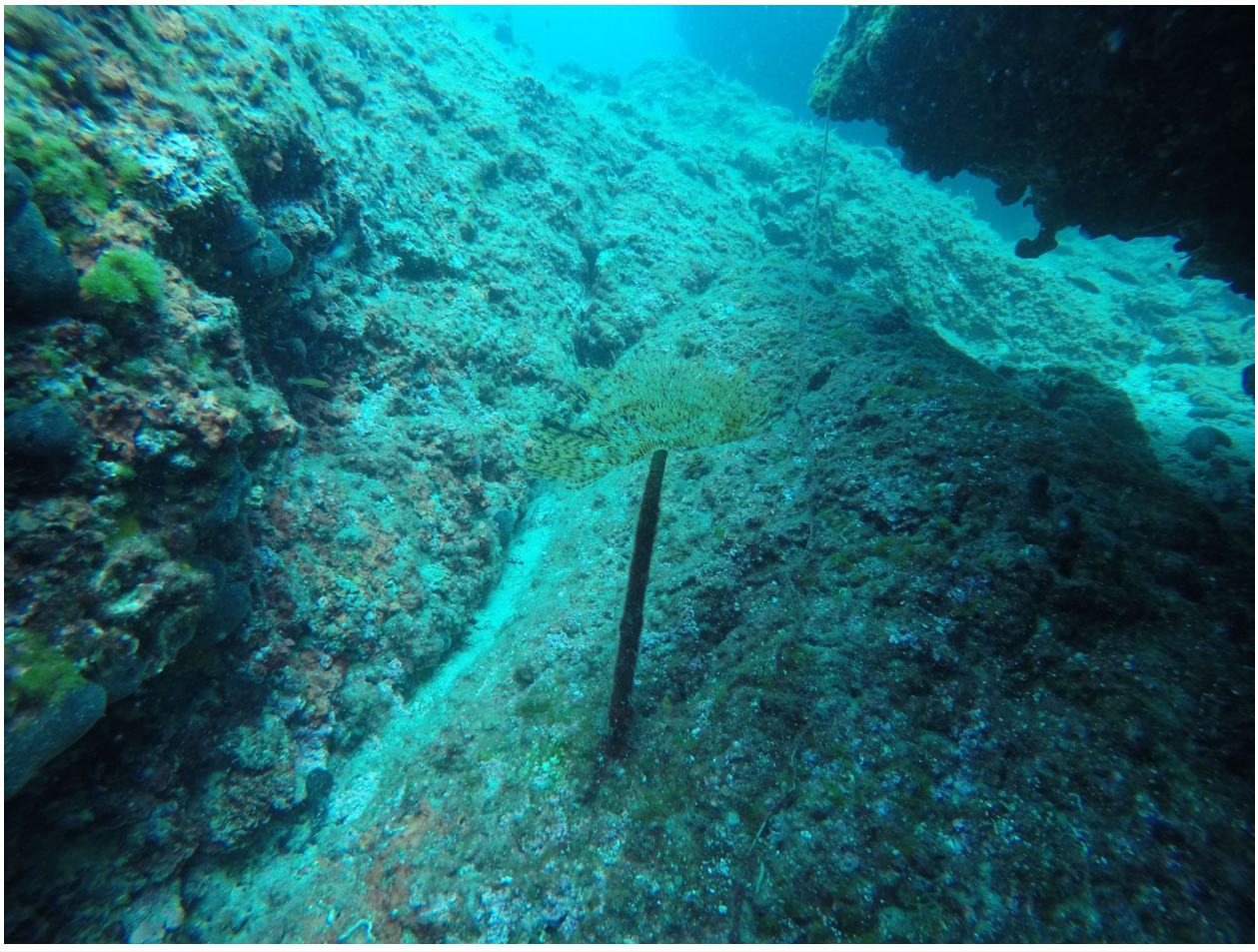

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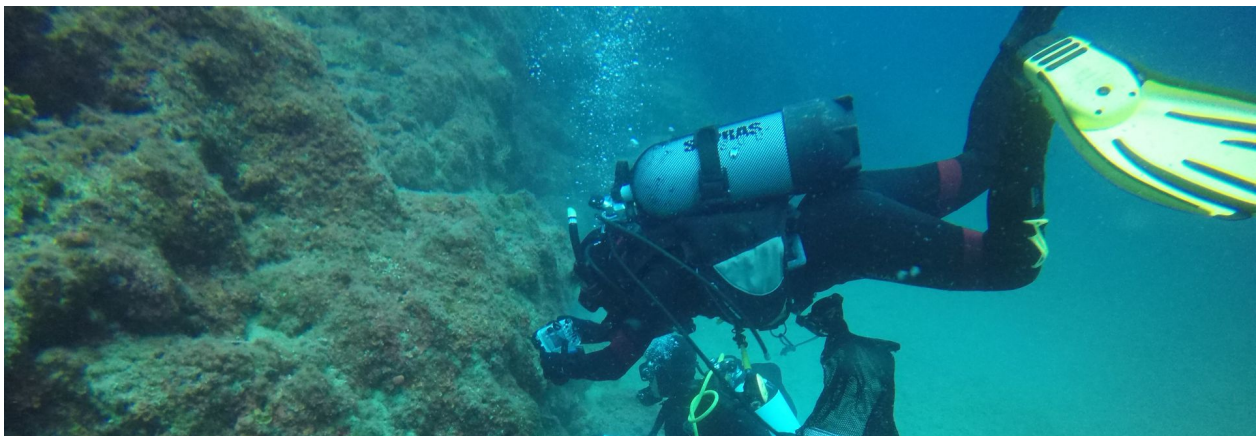

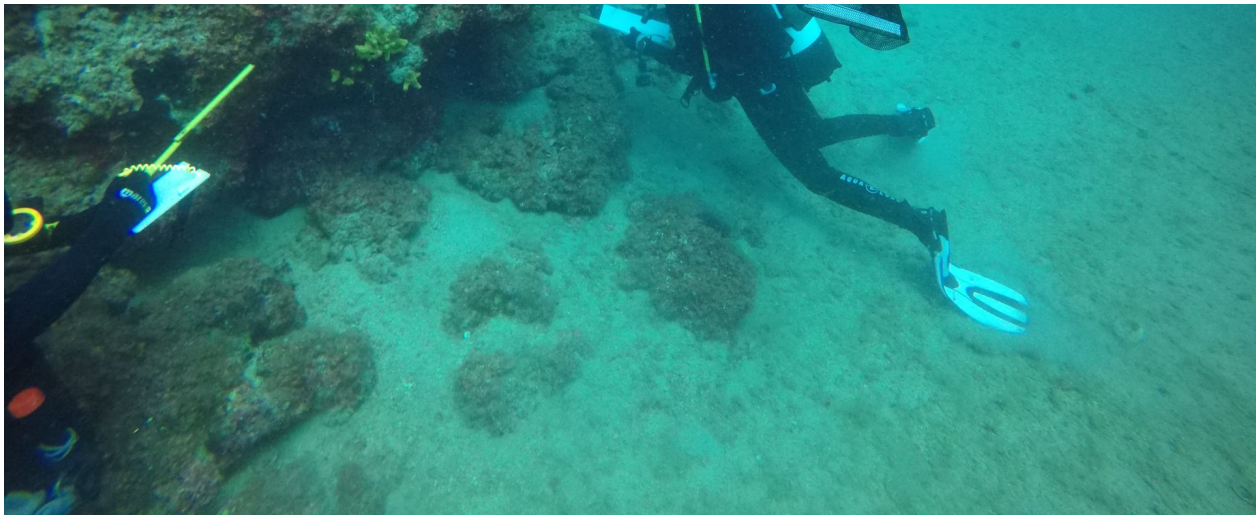

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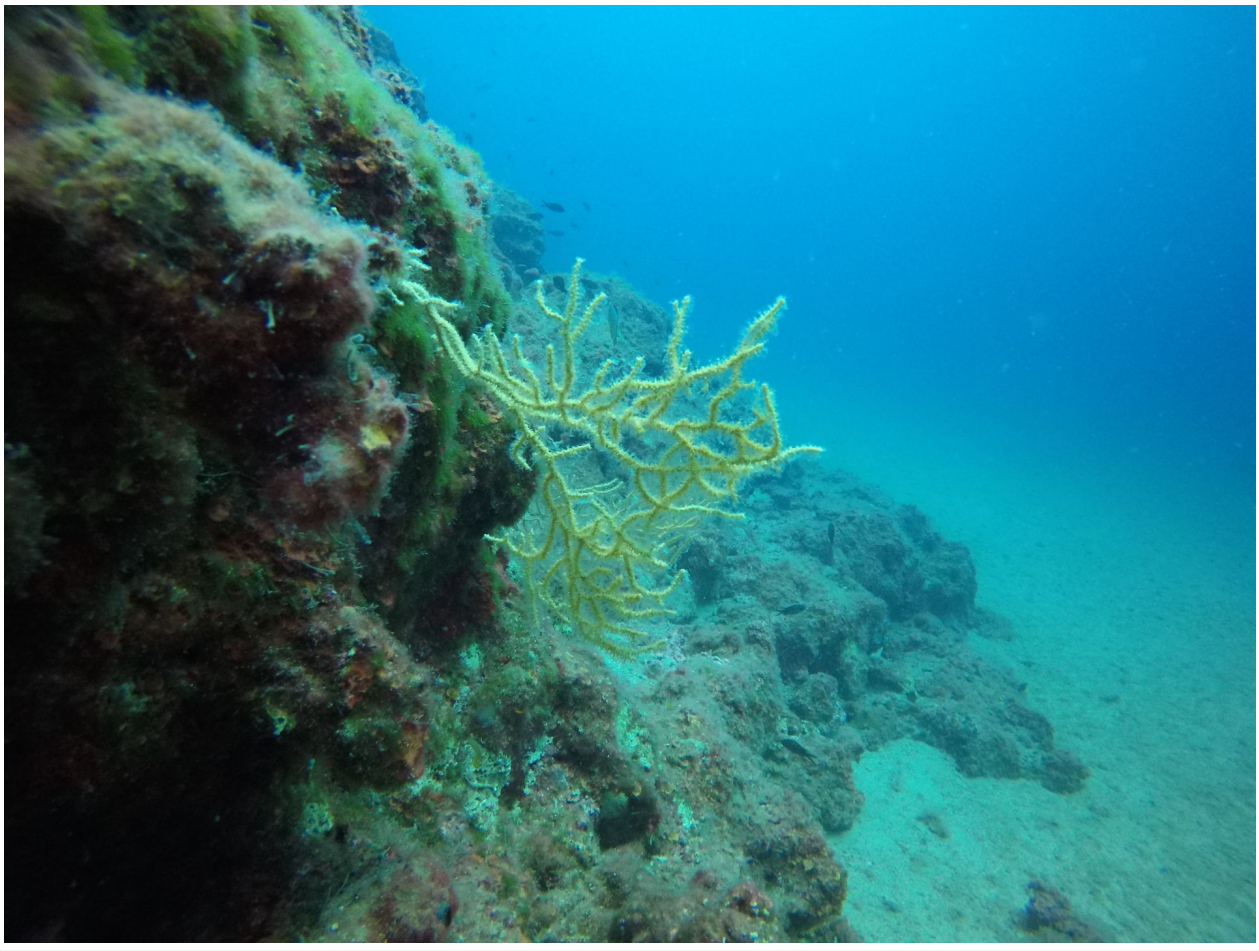

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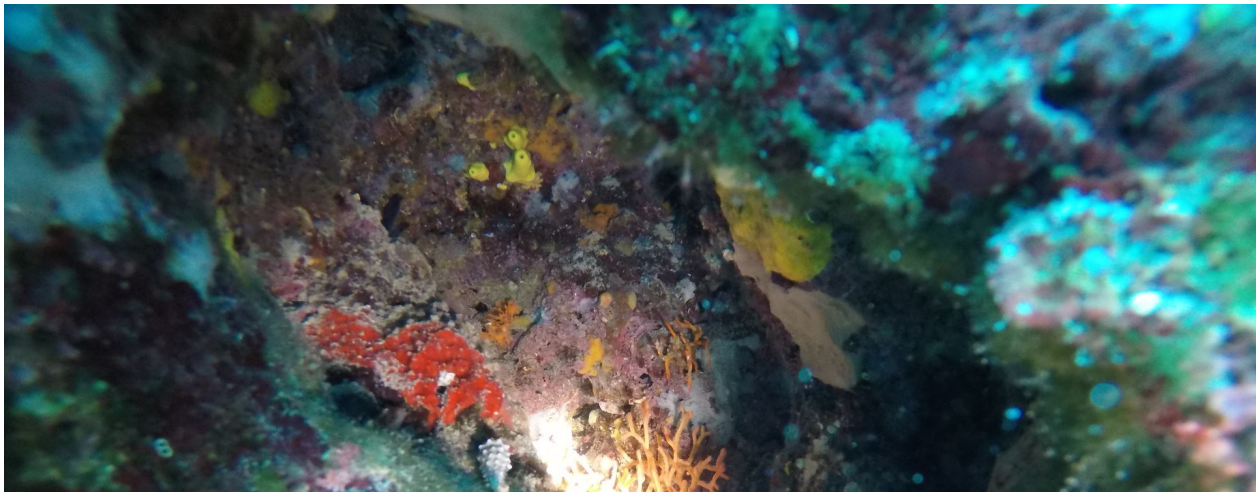

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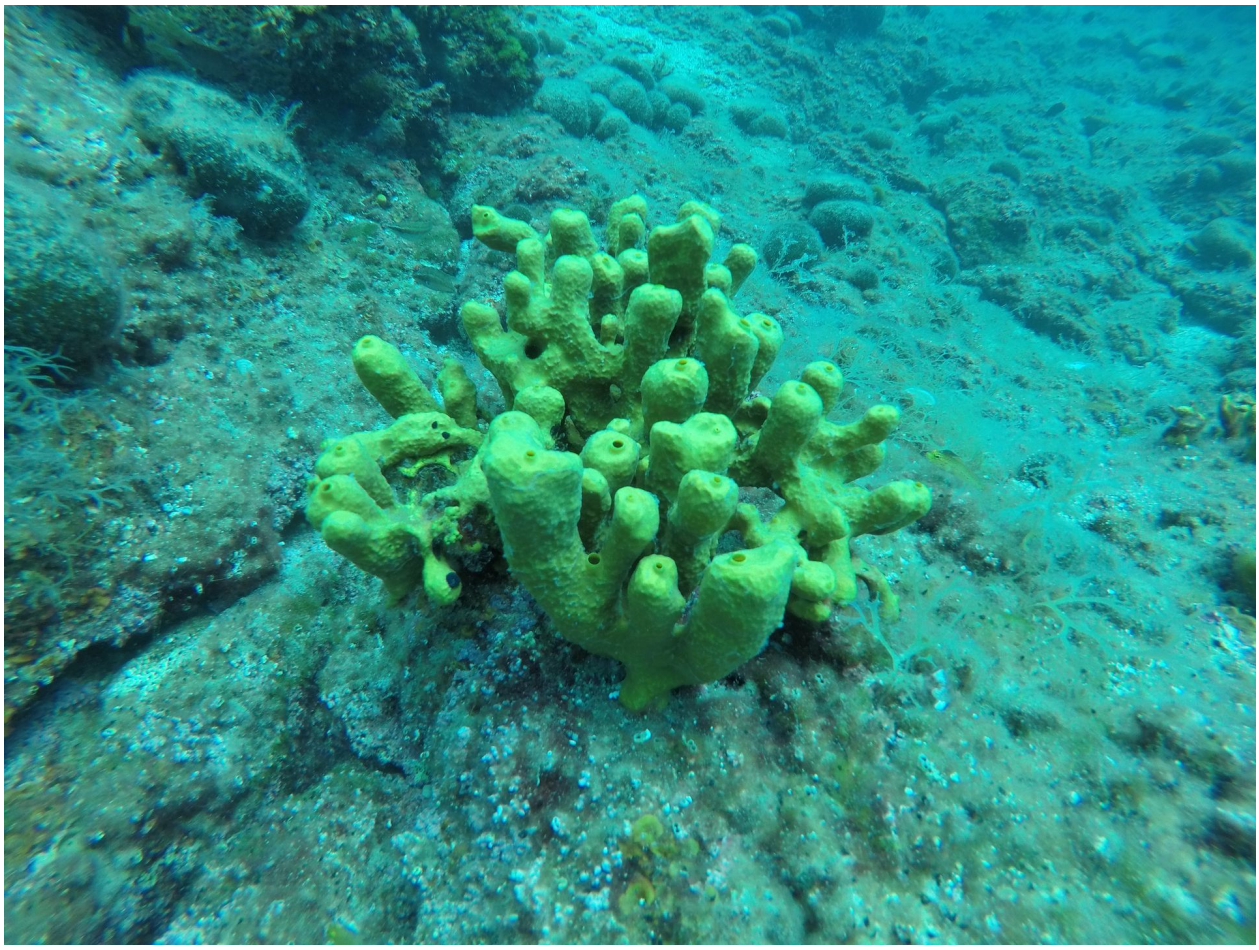

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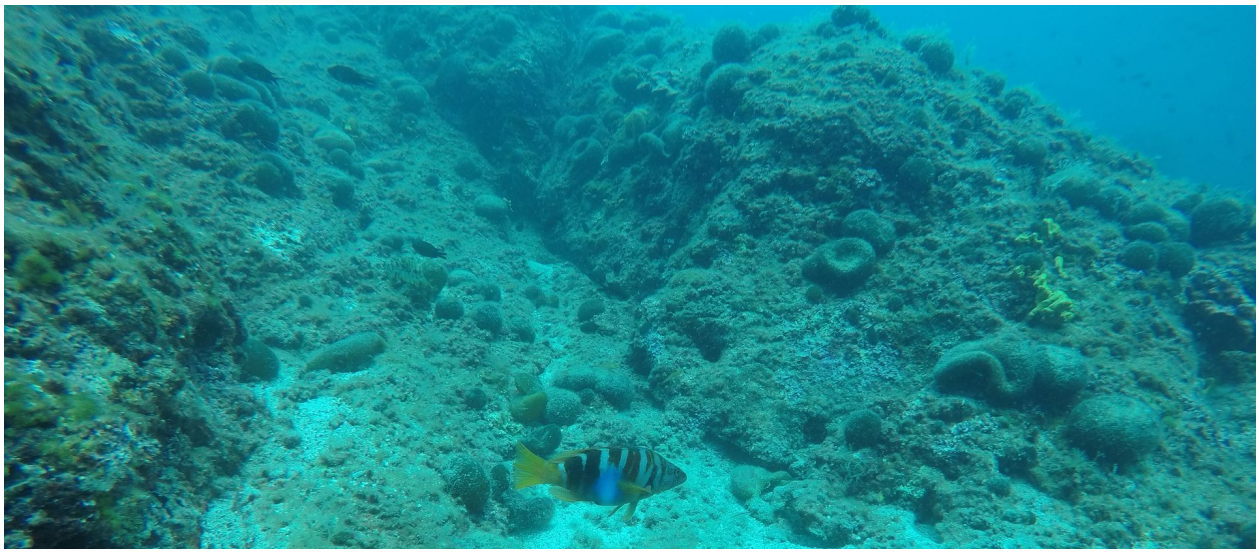

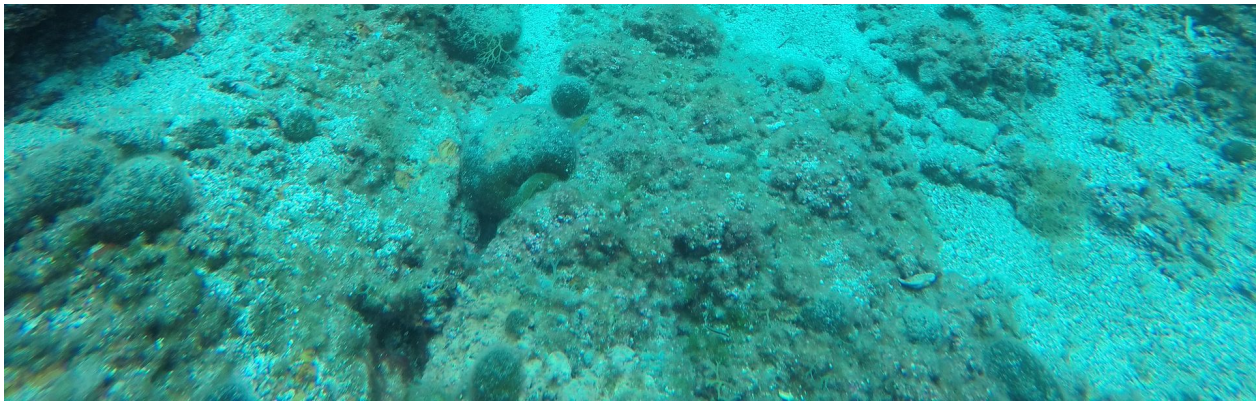

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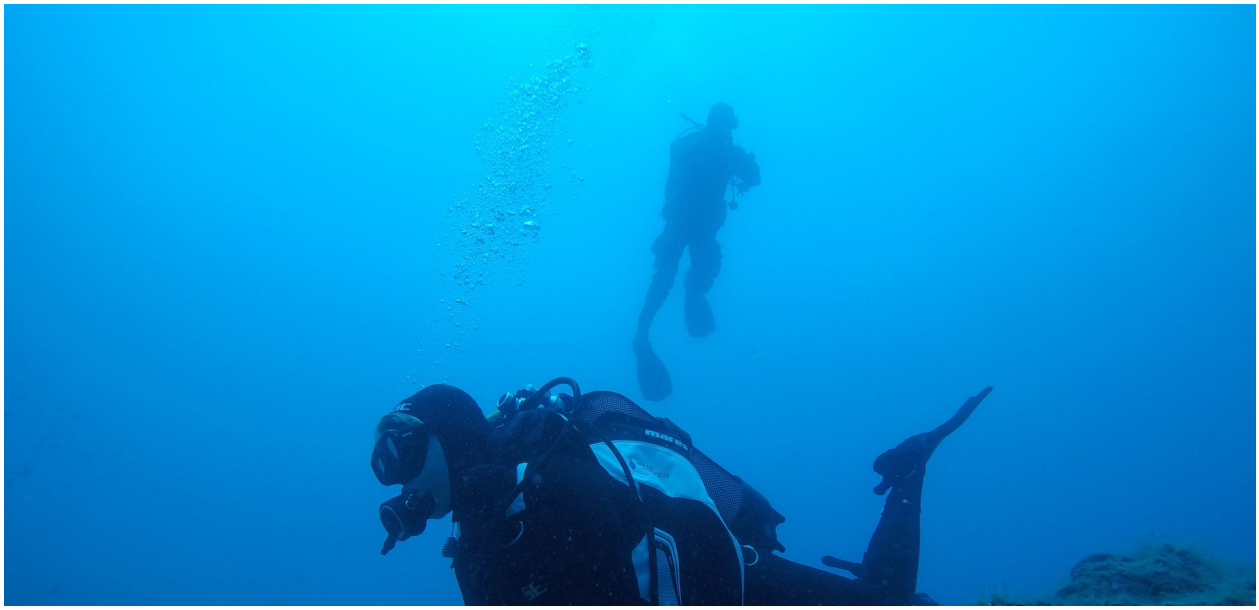

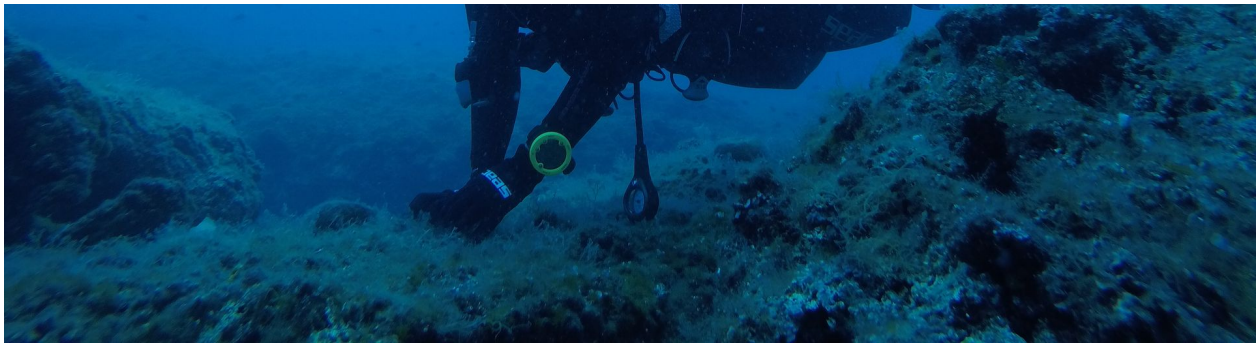

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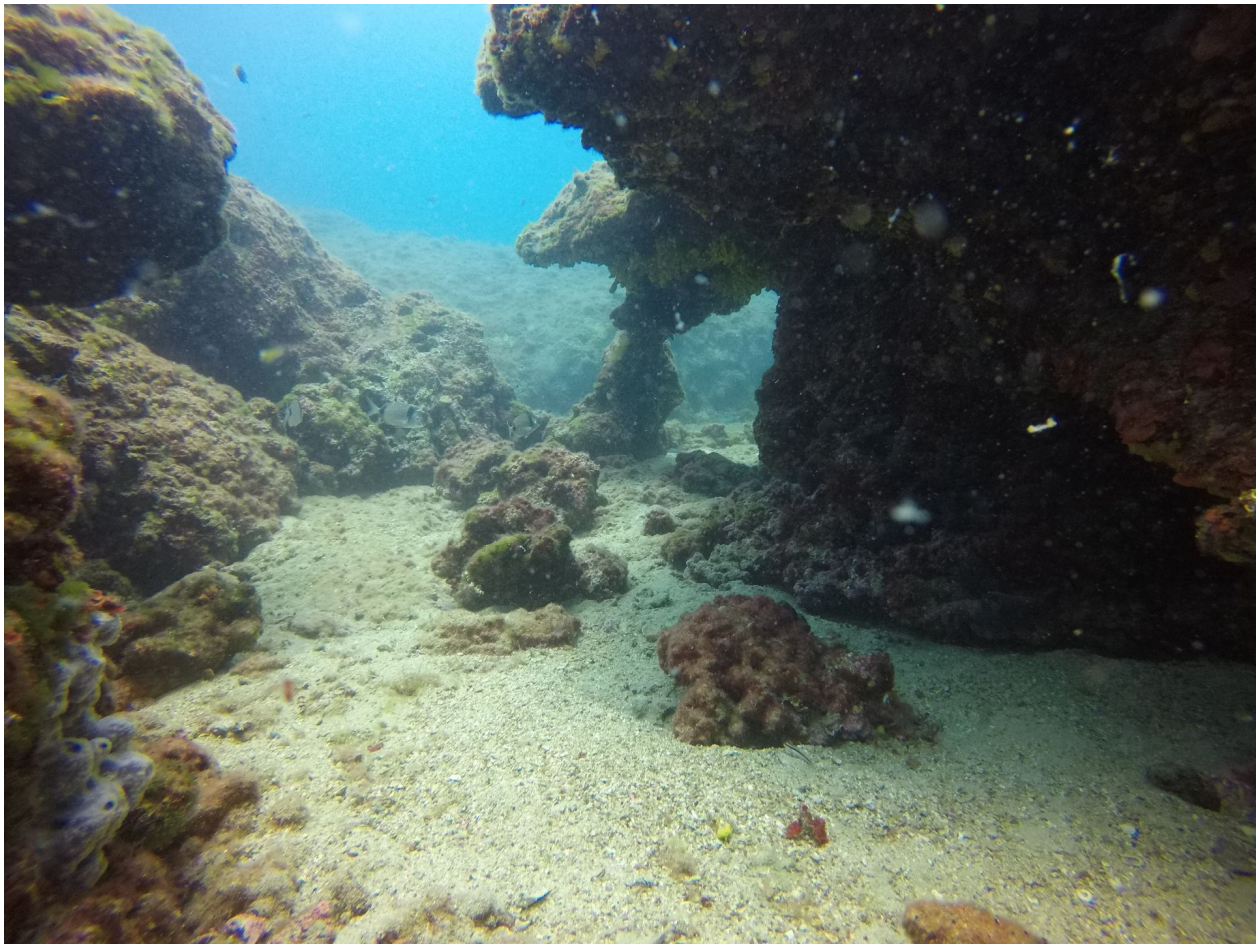

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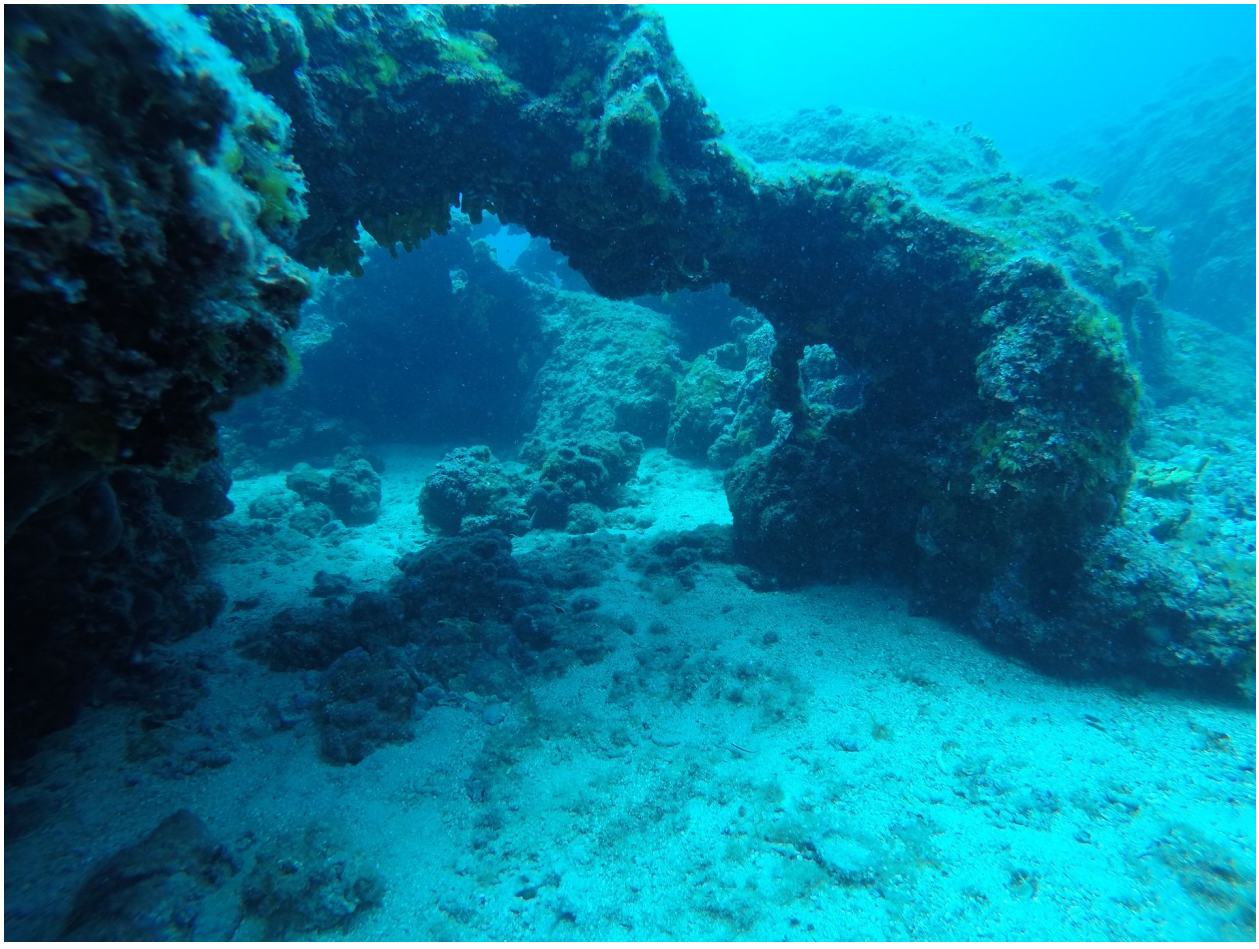

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Odustani

MOTORI KAKO PRIPREMITI MOTOR ZA NISKE TEMPERATURE?

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ELEKTRIKA
SUNČANA ELEKTRANA NA JAVNOJ MREŽI

OPREMA
OSMOSHELL LIJEK ZA OSMOZU

ELEKTRIKA
SVA STANJA BRODSKIH AKUMULATORA

SAVJETI
KAKO PREŽIVJETI PAD U HLADNO MORE?

TESTOVI
JANMOR 33 DRVENI GUC

NAJVEĆI NAUTIČKI fotooglasnik RABLJENIH PLOVILA

Među dvadeset i jednim projektom u koliko sudjeluje Pomorski fakultet u Rijeci ukupne vrijednosti više od 3 milijuna Eura nalazi se i projekt Adrireef. Projekt posvećen istraživanju podmorja Jadranskog mora posvećen je s jedne strane ekonomski isplativijem, i s druge istovremeno održivom iskorištavanju grebena. Projekt ADRIREEF - Innovative exploitation of Adriatic Reefs in order to strengthen Blue economy okuplja 11 partnera iz Hrvatske i Italije, a trajanje projekta je 3 godine, i provodi se u periodu od 1. prosinca 2018. do 31. prosinca 2021. Ukupni proračun projekta iznosi 2.814.830,00 EUR, s udjelom Pomorskog fakulteta od 182.810,00 EUR-a od čega 85% odnosno 155.388,50 EUR-a otpada na bespovratna sredstva.

Cilj projekta je istražiti, ali i zaštititi grebene na obje strane Jadrana te iskoristiti njihov potencijal za razvoj plave ekonomije, odnosno ribolova, ronjenja, nautičkog turizma i sl. Na hrvatskoj strani Jadrana za istraživanje su odabrana tri prirodna grebena: pličina Konjsko kraj mjesta Šilo, pličina Lagnjići (odnosno mjesto potopljenog broda „Michelle") te pličina Seget kraj otoka Visa. Projekt nije zaustavila niti pandemija Covid-19 virusa pa su se aktivnosti odvijale i tijekom 2020. godine u skladu s epidemiološkim ograničenjima.

UDIO RIJEČKOG POMORSKOG FAKULTETA

Predmet istraživanja Pomorskog fakulteta u Rijeci bila je pličina Konjsko, ali i ostali navedeni grebeni u Republici Hrvatskoj. Pličina Konjsko je podvodni greben koji se nalazi u blizini malog turističkog gradića Šilo na otoku Krku. Ovaj prirodni greben dosad nije bio predmet detaljnijeg istraživanja, a uzimajući u obzir njegovu povoljnu poziciju, blizinu turističkih i ronilačkih centara, on nudi značajan potencijal za razvoj aktivnosti u skladu s ciljevima projekta i razvojem plave ekonomije. Za istraživanje grebena nabavljena je sva potrebna moderna i sofisticirana istraživačka oprema među kojima se ističu podvodna ronilica, točnije podvodni dron, sonar i ronilačka oprema. Zahvaljujući nabavljenoj opremi, ali i opremi ostalih partnera na projektu, posebice Instituta Ruđer Bošković iz Zagreba te Odjela za akvakulturu Sveučilišta u Zadru, grebeni su istraženi iz čega su dobiveni osnovni podaci poput obilježja grebena i okolnog područja.

ADRIREEF
PROJEKT ZA ODRŽIVO GOSPODARENJE PODMORJEM

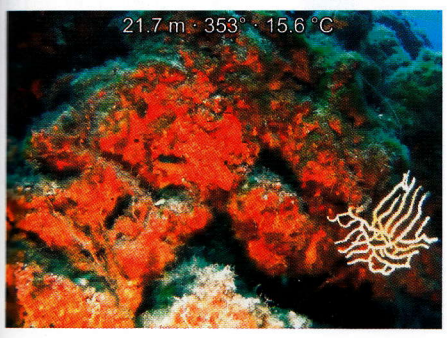
Tekst: **V. Frančić i K. Mihić** Foto: **PFRI**

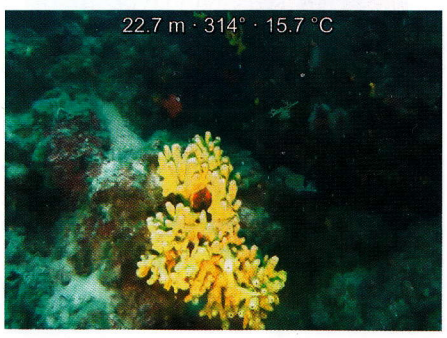
Podaci uključuju geomorfološka obilježja grebena, odnosno mapiranje grebena, analiza kemijskih i fizikalnih svojstava morske vode i sedimenta, bogatstva biocenoze i morskih organizama, ponajprije ribljeg fonda. Dodatno istraživanje koje se provodi usmjereno je na određivanje trenutnog ekološkog opterećenja područja grebena s obzirom na pomorski promet, ribarstvo i turizam.

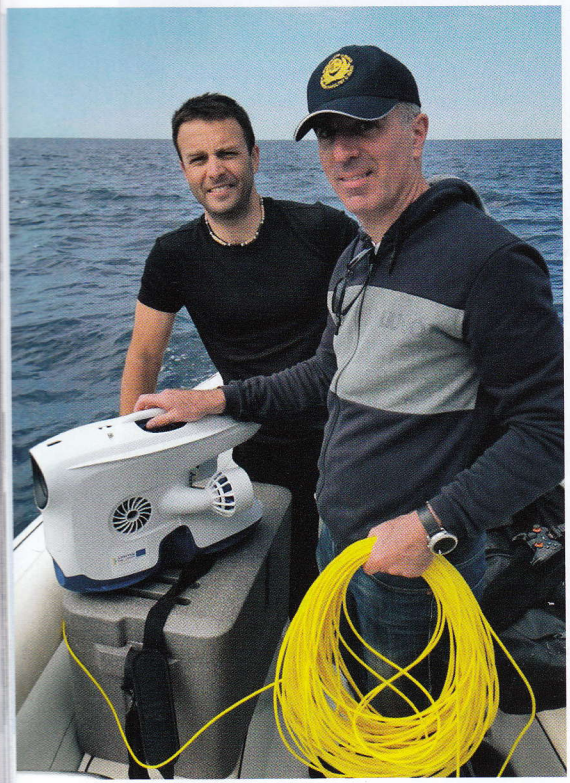
Mapiranje grebena odrađeno uz pomoć Side Scan sonara Humminbird Solix 12+GPS G2 visoke rezolucije od 1.100 kHz. Na taj način dobivena je najbolja moguća slika grebena i njegovih geomorfoloških karakteristika, ali i karakteristika podmorja kao i detaljna batimetrija područja grebena. Korištenjem sonara procijenila se tvrdoća morskog dna kao i prisutnost vegetacije, a snimkama podvodnog drona dobile su se informacije o vegetaciji na grebenu.

Cilj projekta je istražiti, ali i zaštititi grebene na obje strane Jadrana te iskoristiti njihov potencijal za razvoj plave ekonomije

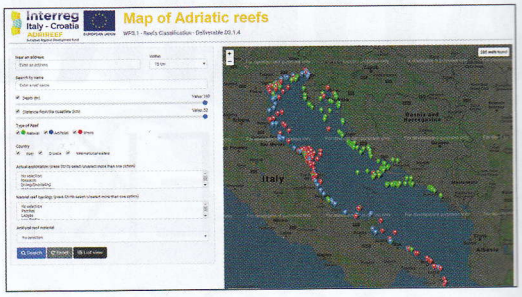
Kao što i samo ime kaže, pličina Konjsko je pličina koja se u jednom trenutku na udaljenosti od oko 200 metara od kopna spušta vertikalnim zidom prema dnu od dubine 7 metara do dubine od čak 30-ak metara. Istraživanjem se utvrdilo da je zid solidno obrastao tipičnim morskim organizmima (koraligenske zajednice), a stjenoviti plato na dubini od 7 do 9 metara obiluje većim i manjim rakovicama i hobotnicama. Dalje od grebena širi se sedimentno dno s tipičnom detritusnom biocenozom. Upravo zbog atraktivnosti zida i malih dubina, može se očekivati bolja iskoristivost grebena, i to ponajprije kao ronilačke atrakcije za završna ronjenja na kraju početničkih tečaja.







INTERAKTIVNA MAPA



Jedan od rezultata projekta ADRIREEF je i izrada interaktivne mape i baze podataka jadranskih grebena s osnovnim podacima o njima. Mapa je produkt zajedničkog rada 11 talijanskih i hrvatskih partnera. Inače, mapi se može pristupiti preko poveznice:

https://adrireef.github.io/sandbox2/

U mapi su prikazani:

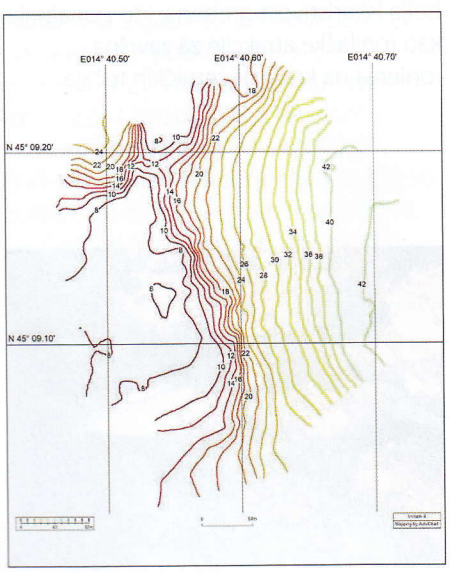
- geografski položaj grebena (prirodnih, umjetnih te olupina),
- dimenzije grebena,
- udaljenost od obale
- trenutna i potencijalna upotreba.

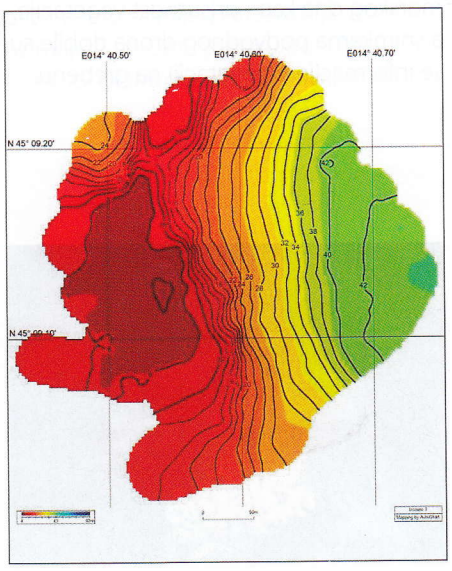
Većina prirodnih grebena nalazi se na hrvatskoj strani Jadranskog mora , dok svi umjetni grebeni, ali i većina olupina pripadaju talijanskom dijelu. Cilj projekta je da se ova znanstvena istraživanja iskoriste za gospodarski razvoj grebena u okviru plave ekonomije.

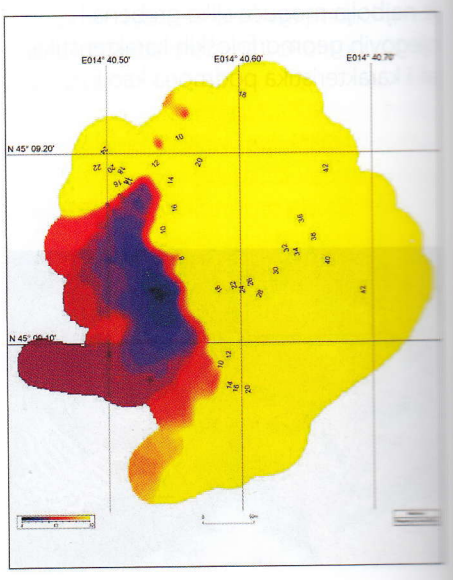
REZULTATI PROJEKTA ADRIREEF

Podvodne snimke grebena napravljene su pomoću daljinski upravljane ronilice – drona. Detaljno snimanje podmorja omogućilo je tijekom trajanja projekta praćenje promjena na grebenu te motrenje bioraznolikosti biljnog i životinjskog svijeta kao i moguća onečišćenja. Koristeći dron Pomorskog fakulteta u Rijeci snimane su i druge dvije lokacije: plič Lagnjići i plič Seget, u suradnji s hrvatskim partnerima Sveučilištem u Zadru i Institutom Ruđer Bošković iz Zagreba.

Trenutno je u tijeku završna faza monitoringa aktivnosti na grebenima nakon čega će se pristupiti analizi podataka i predložiti moguće održive modele ekonomske eksploatacije grebena. Krajnji cilj projekta je izrada smjernica za sudionike, te pisanje tzv. Bijele knjige za ekonomsko i održivo eksploatiranje grebena u koju će biti upisane sve posebnosti i potencijali jadranskih grebena. BN







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LJUDI, MORE, BRODOVI (HTTPS://WWW.BURZANAUTIKE.COM /HR/LJUDI_MORE_BRODOVI/57)

ADRIREEF - trajna zaštita i održivo gospodarenjE Jadranom

BN 220 (https://www.burzanautike.com/hr/nbn/broj,220) | 1.1.2020 | Piše: **Burza Nautike** | Foto: **Pomorski fakultet u Rijeci**

TAGOVI

ljudi-more-brodovi (https://www.burzanau /hr/tag/ljudi-more-brodovi)
projekti (https://www.burzanau /hr/tag/projekti)

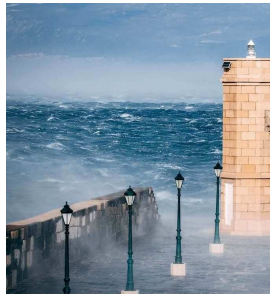
VEZANE VIJESTI

(/)

Za potrebe provedbe projekta AdriReef Pomorski fakultet Sveučilišta u Rijeci nabavio je visokoperformansnu ronilicu

Na Pomorskom fakultetu u Rijeci, jednoj od vodećih ustanova po broju projekata Sveučilišta u Rijeci, trenutno se vodi 16 međunarodnih projekata financiranih iz europskih fondova. Jedan od takvih je i InterReg projekt Italija-Hrvatska pod nazivom ADRIREEF - "Innovative exploitation of Adriatic Reefs in order to strengthen blue economy", koji okuplja ukupno 11 partnera. Svrha projekta je ispitati mogućnosti održive ekonomske eksploatacije umjetnih i prirodnih grebena u Jadranskom moru bez negativnog utjecaja u biološkom i ekološkom kontekstu. Glavne aktivnosti projekta uključuju analizu nacionalnog i međunarodnog pravnog okvira prvenstveno s ciljem definiranja grebena, klasifikaciju i mapiranje grebena, ispitivanje odabranih lokacija (kemijska i fizikalna analiza morske vode i sedimenata, bogatstvo biocenoza, postojeći modeli eksploatacije i dr.), te testiranje inovativnih metoda istraživanja i nadzora grebena. Upravo ovakve detaljne analize bit će temelj za izradu studija i izvještaja s prijedlogom mogućih održivih modela ekonomske eksploatacije grebena.

Kako je kroz ovaj projekt zamišljeno da se obavljaju terenska ispitivanja, odnosno nadzor i istraživanje podmorja ... (više u tiskanom i CD izdanju) (https://www.burzanautike.com /hr/godisnji_cd/67)



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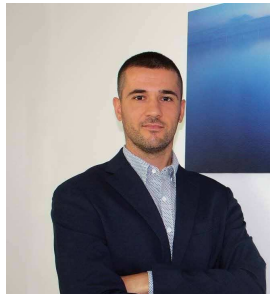
Senjanin Vladimir Biond plovidbe na „strancima“ Lučkoj ka



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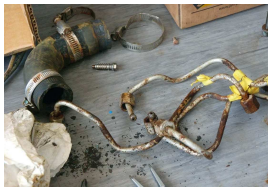

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Osiguranje: Šteta na moto
(https://www.burzanautik /hr/osiguranje_steta_na_m /6314/57)

Vrlo česta priča oko osiguranja motora je on pogonskim štetama na motoru. Svi žele imati ugovoren

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Dugoročna strategija koja

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Do 2050. godine Europa
postati "neutralni" konti
zagađenje značajno sma

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suradnje INTERREG V-A
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02.07.2021

EU PROJEKT „ADRIREEF“ PREDSTAVLJEN U SKLOPU OBILJEŽAVANJA SVJETSKOG DANA POMORACA

Pomorski fakultet u Rijeci obilježio je „Svjetski dan pomoraca“ 25. lipnja 2021. te su u sklopu navedene manifestacije predstavljeni brojni EU projekti koji se provode na Fakultetu, a među njima i ADRIREEF (Innovative exploitation of Adriatic Reefs in order to strengthen blue economy). Svrha projekta je istražiti podmorje Jadrana i potencijale grebena kako bi se ojačalo plavo gospodarstvo. Voditelj projekta izv.prof.dr.sc. Vlado Frančić te istraživačica na projektu Ana Malovrh, mag.ing.logist. prezentirali su temeljni cilj projekta kao i dosadašnje aktivnosti široj javnosti. Svi zainteresirani studenti te posjetitelji mogli su vidjeti snimke podvodnih grebena odabranih case study-a na hrvatskoj strani Jadranskog mora te saznati više o razvoju i trenutnim postignućima projekta.

Projekt okuplja 11 partnera iz Hrvatske i Italije. Vodeći partner ADRIREEF projekta je Municipality of Ravenna, a ostali partneri su Regional agency for prevention, environment and energy in Emilia Romagna (Bologna), Agencija za razvoj Zadarske županije Zadra Nova, Udruga za prirodu, okoliš i održivi razvoj Sunce (Split), Sveučilište u Zadru, Consiglio Nazionale delle Ricerche – CNR (Ancona), Agenzia regionale per la prevenzione e la protezione ambientale della regione Puglia (Bari), Istituto Nazionale di oceanografia e di geofisica sperimentale -OGS (Trst), Javna ustanova Rera Sd za koordinaciju i razvoj Splitsko-dalmatinske županije, Institut Ruđer Bošković (Zagreb) te Pomorski fakultet u Rijeci.

Projekt traje od 1. prosinca 2018. do 30. studenog 2021. godine s ukupnim proračunom projekta od 3.328.175,00 Eur. Projekt je sufinanciran iz INTERREG programa V-A Italija Hrvatska 2014. – 2020. Više informacija o projektu možete saznati putem službene stranice https://www.italy-croatia.eu/web/adrireef (https://www.italy-croatia.eu/web/adrireef).

PRESENTATION OF EU PROJECT “ADRIREEF” AS A PART OF THE DAY OF THE SEAFARERS CELEBRATION

The Faculty of Maritime studies in Rijeka celebrated the Day of the Seafarer on the 25th of June 2021. As a part of the event, numerous EU projects implemented at the Faculty were presented, including ADRIREEF (Innovative exploitation of Adriatic Reefs in order to strengthen Blue economy). The aim of the project is to explore the reef potential in the Adriatic Sea in order to strengthen Blue economy. Project manager Assoc.prof.dr.sc Vlado Frančić and project researcher Ana Malovrh, mag.ing.logist. presented to the general public the basic goals of the project as well as previous activities. Interested students and visitors could see video materials of underwater reefs of selected case studies on the Croatian side of the Adriatic Sea and learn more about the development and current achievements of the project.

This project has 11 partners from Italy and Croatia. Lead partner of the ADRIREEF project is Municipality of Ravenna and the other partners are Regional agency for prevention, environment and energy in Emilia Romagna (Bologna), Zadar County Development Agency Zadra Nova, Association for nature,environment and sustainable development Sunce (Split), University of Zadar, Consiglio Nazionale delle Ricerche – CNR (Ancona), Agenzia regionale per la prevenzione e la protezione ambientale della regione Puglia (Bari), Istituto Nazionale di oceanografia e di geofisica sperimentale -OGS (Trst), Public Institution Rera Sd for

coordination and development of Split-Dalmatia County, Ruđer Bošković Instutute (Zagreb) and Faculty of Maritime studies Rijeka.

Project started in December 2018. and finishes in November 2021. with a total project budget of 3.328.175,00 Eur. The project is co-financed from the INTERREG V-A Programme Italy-Croatia 2014-2020. More information about the project can be found on the official website https://www.italy-croatia.eu/web/adrireef (https://www.italy-croatia.eu/web/adrireef).

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