*Many secrets lie hidden at the bottom of the Adriatic Sea. Numerous archaeological sites bear witness to maritime activity that has extended across millennia. Many such sites still lie somewhere undiscovered, waiting to resurface from oblivion and tell us their stories.*
*Thanks to the efforts made by archaeologists and other experts on both sides of the Adriatic, an idea has been born with the objective of connecting and conceptualizing these sites in the form of a project called UnderwaterMuse.*
*The main idea is to create models which can present the abundant historical heritage of the Adriatic Sea to the general public through various activities.*
*This handbook represents the main findings and recommendations realised within the project.*

# The “invisible” heritage to the challenge of the valorization: the UnderwaterMuse Project

## Transnational Toolkit: Handbook of good practices

ER PAC FVG Regional Institute for the Cultural Heritage of Autonomous Region of Friuli Venezia Giulia

rerasd JAVNA USTANOVA ZA KOORDINACIJU I RAZVOJ SPLITSKO-DALMATINSKE ŽUPANIJE

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KAŠTELA

REGIONE PUGLIA
Dipartimento Turismo, Economia della Cultura e Valorizzazione del Territorio

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Interreg Italy - Croatia UnderwaterMuse EUROPEAN UNION

# *The "invisible" heritage to the challenge of the valorization: the UnderwaterMuse Project*
# *Transnational Toolkit: Handbook of Best Practices*

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**INDEX**

**THE UNDERWATERMUSE PROJECT**

# THE UNDERWATERMUSE PROJECT

## 1. PARTNERSHIP

**ERPAC – Regional Institute for the Cultural Heritage of Autonomous Region of Friuli Venezia Giulia** (Italy; Lead Partner; http://erpac.regione.fvg.it/)

**Ca' Foscari University of Venice** (Italy; https://www.unive.it/pag/16561/)

**Public Institution RERA S.D. for coordination and development of Split-Dalmatia County** (Croatia; http://www.rera.hr/)

**City of Kaštela** (Croatia; https://www.kastela.hr/)

**Puglia Region – Department of Tourism, Economy of Culture and Community Enhancement** (Italy; http://www.regione.puglia.it/)

## 2. CHALLENGE, GOALS & METHODOLOGY

### 2.1. Background and founding principles

The UnderwaterMuse Project (https://www.italy-croatia.eu/web/underwatermuse , https://www.facebook.com/Project-UnderwaterMuse-106106884192806; 1 January 2019 – 30 June 2022), includes parts of Italian and Croatian territories and focuses on **Priority Axis 3 "Environment and Cultural Heritage"-Specific Objective 3.1 "Make natural and cultural heritage a leverage for sustainable and more balanced territorial development"**: conserving, protecting, promoting, developing natural and cultural heritage.

The UnderwaterMuse project aims to enhance and promote the underwater heritage of the regions concerned, through the full involvement of local communities, so that it becomes a strategic resource for the sustainable growth of these territories.

It has the ambition to make submerged heritage and landscapes accessible and to make the invisible, visible: port areas today below sea level, shipwrecks, underwater stratifications produced by continuous landings, settlements and remains of human activity.

How? Through two types of action planning:

- bringing people to heritage, through the implementation of underwater archaeological parks/underwater museums or blue trails for direct use, diving or snorkeling;
- bringing heritage to people, through the narrative and communicative use of virtual/augmented reality and digital methodologies for remote/online use. This second objective of the project, thanks to the immersive and emotional approach of virtual reality, makes underwater sites accessible to a wider audience, including people with different types of disabilities.

By fulfilling these two aims we can generate two outcomes: the preservation of the heritage itself, guaranteed by citizens learning about it

and recognizing it as their own, and a strong economic impact deriving from the development of the cultural, environmental and experiential tourist sector.

These aims are based on important principles resulting from the **Paris 2001 UNESCO's Convention on the Protection of Underwater Cultural Heritage** (Rule 1: *In situ* preservation as first option; Rule 7: Public access to *in situ* underwater cultural heritage shall be promoted, except where such access is incompatible with protection and management; fig. 1) and the **Faro Convention** (Council of Europe Framework Convention on the Value of Cultural Heritage for Society, 27.10.2005; fig. 2); these principles need to be incorporated into the policy work as a guidance for the activities (Rey da Silva 2016), in order to "increase the positive image of underwater archaeology and the involvement of the public in the awareness, the protection and enjoyment of the underwater cultural heritage": "*It is necessary to engage, not only from a research perspective, but also as an ethical obligation to the local communities within the environments that archaeologists work. It is important to recognize the different values attached to the project by ourselves as heritage professionals, and the communities as «providers» of knowledge*" (Roberts, Benjamin, McCarthy 2016).

The Project is also in line with **Blue Growth long term Strategy** (s3platform.jrc.ec.europa.eu/blue-growth) for which culture is a driver of local and regional economic growth, innovation and social cohesion (EC 2010/C 135/05).

Furthermore, it is in perfect compliance with the **Maritime Spatial Planning** (**MSP**) process (fig.

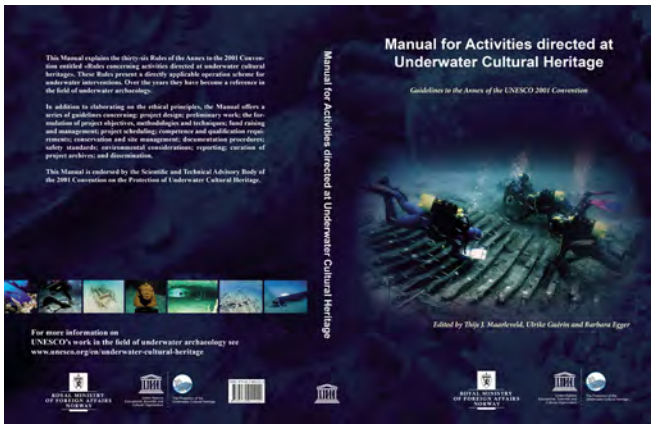



*Fig.1: Manual for activities directed at underwater cultural heritage: guidelines to the Annex of the UNESCO 2001 Convention (https://unesdoc.unesco.org/ark:/48223/pf0000220708)*


*Fig.2: The Faro Convention Brochure (https://www.coe.int/en/web/culture-and-heritage/faro-brochure)*

3): *understanding, recognising, and utilising Underwater Cultural Heritage (UCH) as a sensitive asset in the marine space and reconciling its preservation and promotion within the sustainable blue economy perspective is a real challenge* (New study "How to incorporate Underwater Cultural Heritage into Maritime Spatial Planning" | The European Maritime Spatial Planning Platform (europa.eu)).

Moreover, UCH, according to *UN Sustainable Development Goal 14 (Life under water)*, should be one of the resources to be preserved and developed for a sustainable use of the seas (Transforming our world: the 2030 Agenda for Sustainable Development | Department of Economic and Social Affairs (un.org)).

In addition, when well-preserved and enhanced, the UCH has huge potential in multiple fields. "UCH-Tourism-Nature Conservation" development in the Mediterranean Sea in view of its rich UCH sites, warm temperatures, and clear waters with often low salinity. There are about 3,500,000 scuba divers in Europe, and 70% of them choose the Mediterranean region. Divers expect a variety of underwater landscapes (e.g., shipwreck), thus several Mediterranean countries have already taken advantage of their natural and cultural wealth by setting up underwater archaeological parks (ECORYS, 2013, 30).
How to integrate UCH into MSP?

- Ensure integration and cohesion of UCH planning with the plan of the wider marine area.
- Catalogue, designate and evaluate UCH sites. Determine the level of protection (no go, highly protected, under research, open for recreational/educational purposes ...), the nature of UCH use (for science,

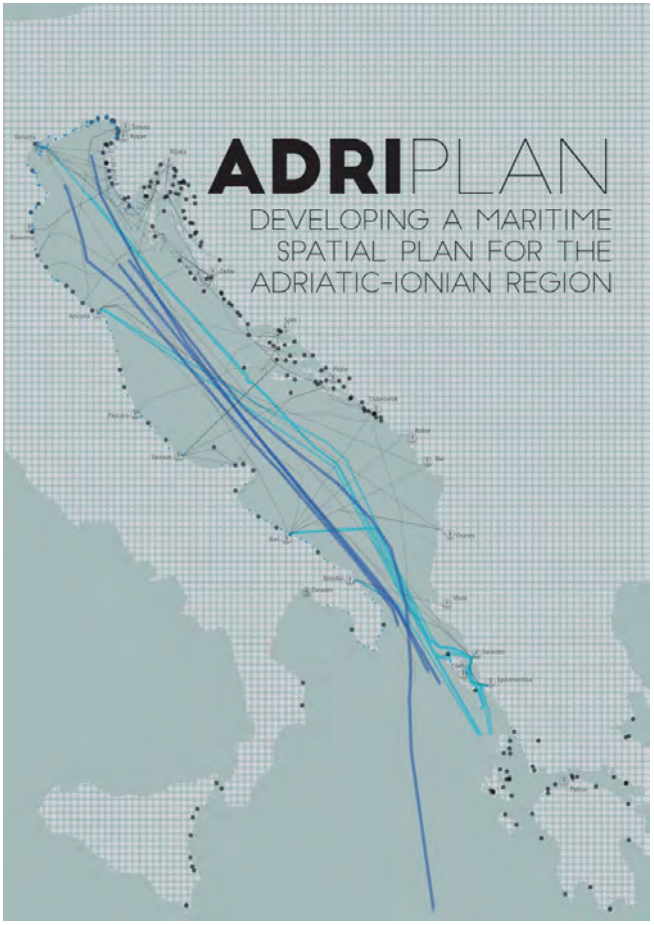



*Fig.3: Maritime Spatial Plan for the Adriatic-Ionian Region (https://maritime-spatial-planning.ec.europa.eu/projects/adriatic-ionian-maritime-spatial-planning)*

tourism, education, other) and the state of the art (under investigation, recommended, potential – introduced and under development, established and regulated, under revision etc.).

- Define conservation priorities through a multi-criteria approach, including economic value of UCH sites.
- Design UCH-driven MU scenarios (with tourism, MPAs etc.) and assess their potential at country and local level.
- Select the most appropriate type of protection and/or management zoning.
- Provide regulations and restrictions for uses within the UCH protection and management zone.
- Enhance cooperation between UCH authorities, diving centres, regional authorities, tourism operators, and business investors in order to:

  a) co-design approaches, guidelines, and training for divers to access UCH sites without damaging them;

  b) co-create 'dry' UCH tourism activities – dry diving to showcase the 'culture of the sea'.

The UnderwaterMuse project has accomplished the various steps provided by the action plan to promote UCH-driven multi-use system in the marine space and has involved all the possible actors / stakeholders (Depellegrin et al. 2019; Kyriazi et al. 2018: UCH in MSP, box 13, p. 32-33).

"*The most important challenge is how to build bridges and synergies between the world of archaeology and the one of Maritime Spatial Planning at the level of both authorities and of individual scientists and practitioners*" (UCH in MSP, p. 40).

In this regard, the Puglia Region - Department for the Environment, in the Management Plans of the maritime area of the Adriatic (A) and the maritime area of the Ionian-Mediterranean Central (IMC), has reported the submerged assets cataloging from the *UnderwaterMuseMap portal* (http://mizar.unive.it/underwatermusemap/) and from the *CartApulia* information system (www.cartapulia.it; fig. 4); planning units and related uses have been identified; the category "landscape and cultural heritage" appears in almost all units as a priority or limited use with the justification "*Widespread presence of submerged archaeological assets*".

## 2.2. UnderwaterMuse specific challenge

From the historical-archaeological perspective, the Adriatic Sea has been an unique basin, for millennia the priority transport link for people living on the seashore, as shown by the numerous traces left on the seabed in the areas covered by these ancient commercial routes, and

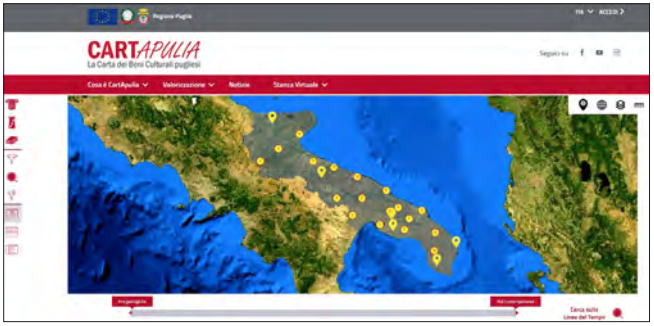



*Fig.4: CartApulia home page (www.cartapulia.it)*

ruins of landing places, harbors or inhabited villages by the sea remain.

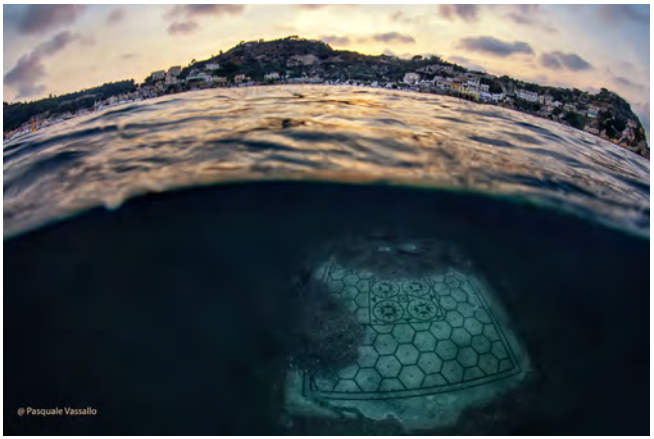
Archaeological sites are an important tourist, economical and historical resource, yet a major gap still remains when it comes to the protection of underwater archaeological sites.

Numerous sites along the Adriatic coasts are currently neglected and subject to constant destructions, illegal depredation, natural or man-made destructive actions (trawling, modern harbour facilities, etc.).

The challenge of the UnderwaterMuse Project — a unique case and a real challenge in the Adriatic area — is to implement joint strategies for developing coherent and sustainable plans that could fill this gap and reduce the lack of accessibility to and knowledge of this heritage, in line to the principles of the 2001 UNESCO Convention on the Underwater Cultural Heritage *in situ* conservation (Maarleveld et al. 2013). This means going beyond the protection of natural and cultural heritage, which must be conceived as a profitable activity with economic impact and new solutions for long-term economic and social prosperity, with the development of new tourist attractions, the diversification of activities in protected areas, the provision of local communities with employment opportunities integrated into the local economy, and the introduction of new management models through robust stakeholder participation.

Practices differ considerably between the two countries, despite they had often work together on the field.

A starting point, unique experience in Italy, are the underwater parks (since 2002) of Baia (figs. 5a-b) and Gaiola (fig. 6) (Naples) which boast a long experience in protection' policy, but only in

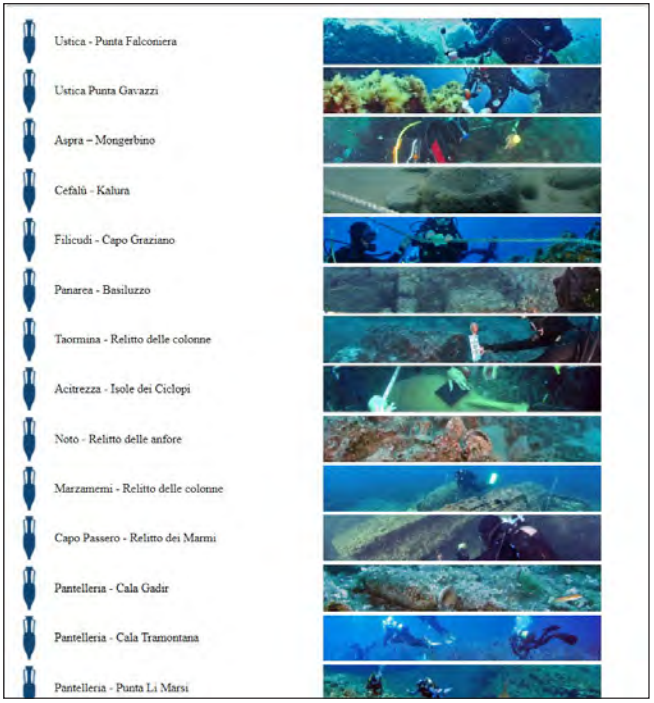




*Figs.5a-b: Submerged Park of Baia (https://www.parcosommersobaia.beniculturali.it/mappa-di-baia-sommersa)*

the last years are improving concrete strategies of protection and development (Davidde Petriaggi, Ricci, Poggi 2016; Ricci, Petriaggi, Davidde Petriaggi 2016; Stefanile 2012; Stefanile 2016 with references; Stefanile, Agizza 2012; Secci, Stefanile 2016; Pagano, Gallocchio forthcoming). Also Sicily Region, which has a Superintendency of the Sea, has encouraged the establishment of numerous archaeological routes (figs. 7a-b) and the publication of scientific papers and informative material, on the underwater tourism (Melotti 2007; www.regione.sicilia.it/beniculturali/archeologiasottomarina/itinerari).

In Croatia, underwater archaeological sites are more developed: parks were created thanks to development projects of the sites through modular protective cages and diving centers


*Fig.6: Submerged Park of Gaiola (https://www.areamarinaprotettagaiola.it/photogallery)*





*Figs.7 a-b: Underwater archaeological trails of the Sicily Region (https://www2.regione.sicilia.it/beniculturali/archeologiasottomarina/itinerari.htm)*

authorized by the Croatian Ministry bring tourists to the sites, greatly increasing cultural tourism (Zmaić 2009; Pešić 2011; Mesić 2008, 2014; see also Koncani Uhač et al. 2017; fig. 8). Some new promising experiences, founded on a wider involvements of the locals, are now being experimented, such as the Straton Project: *in situ* preservation and enhancement without cages (Dorušić, Ćuk forthcoming; fig. 9).

However, acting only at the national/regional level has a negative effect because it involves a range of regulatory and planning efforts that are aimed at what is actually a common and shared resource, the Adriatic Sea.

The UnderwaterMuse Project has sought to overcome this fragmentation in cultural heritage protection policies through cooperation, by pooling resources, exchanging knowledge, sharing practices, and working together to secure accessibility to natural-cultural sites, as well as by offering reproducible solutions, engaging professionals with expertise in transmitting heritage values, and motivating people to improve their knowledge and understanding of the UCH to transform a society's silent past into a captivating story.

The project partners developed and enriched the '*UnderwaterMuseMap*', an innovative promotional GIS tool created for widing research results to the community and promoting underwater sites with accessibility standards (see below). The interactive '*UnderwaterMuseMap*', whereby different regions stand to benefit from an efficient IT tool and sustainable tourist offer, is promoted at transnational, national and local level, in the Adriatic and beyond, guaranteeing its sustainability and transferability during and after its implementation.

*Fig. 8: Koromašno near Žirje: the site under the protective cage (photo Croatian Conservation Institute - I. Miholjek)*

*Fig. 9: Cape Letavica, Croazia: Straton Project (photo Foka Diving Center)*

Reproducibility in different areas is ensured by the different types of underwater sites selected for the Project as well as by the particular context of reference.

The enhancement of the sites in question has contributed to their protection on a large scale, reintegrating them into the local economy as a vibrant and profitable tourist activity. At the same time, a new demand for a different use/enjoyment of cultural heritage is emerging from the younger generations, substantially influenced by the fact that they were born in the information age and globalization.

The demand for VR is also responding to the need for broader inclusion of different

groups of people who integrate creative thinking and innovative ideas into traditional cultural content. An immersive VR approach makes underwater sites accessible to a wider audience, including people with different types of disabilities.

The objectives have been to transform the sites into underwater archaeological parks or eco-museums through innovative and/or experimental methodologies and techniques, reducing the loss of important cultural assets, guaranteeing an economic fallout through the promotion of tourism and culture, targeting local communities as long-term keepers and animators of cultural landscapes, promoting creative partnerships among tourism and cultural actors, public decision makers, creative and cultural companies, citizens associations, facilitating exchange of information.

The underwater archeological sites selected for the pilot actions —Torre Santa Sabina, Grado, Resnik/Siculi – and other interventions (Venice lagoon, Porto Cesareo, Cesine, etc.) — are characterized by strong diversity: we dealt with both single contexts (the amphoras' cargo of Grado 2 shipwreck, for exemple) and pluristratified and complex sites/seascapes, with numerous and heterogeneous pieces evidence not always well readable/visible. The latest have been our best chance to share methodologies and models.

## 3. THE METHODOLOGICAL APPROACH

### 3.1. Research methodology

UnderwateMuse pilot actions applied on those sample areas a methodological and technological protocol based on **research/knowledge**, **documentation/cataloging**, **conservation/restoration**, **enhancement/communication/accessibility** chain, using traditional and innovative tools, such as the holistic/contextual/diachronic/transdisciplinary vision of the *global archeology of landscapes*, in this case coastal and underwater or, better, "waterscapes".

Landscape archaeology or geoarchaeology is "*a coherent sub-discipline of human ecology, neither a form of natural science nor a form of archeology, but an integrated way of understanding humans in dynamic landscapes*" (Barker Bintliff 1999, 207): the primary objective of this systemic vision is being able to tell the story of social groups in changing landscapes, capture their discontinuities, formative processes and identity characteristics.

In this framework laid out by **Seascapes archeology**, the contribution of different techniques and innovative technologies was crucial; **meth-**

**odologies and tools shared** and used in the various **pilot projects** were **Areal mapping** (topographic survey; UAV/drone ortophoto and photogrammetry), **Underwater survey** (direct/auto-optic; metal detector; Multibeam; Side Scan Sonar; Sub bottom profiler; ROV; underwater photogrammetry; video-photo documentation), **Excavations** (stratigraphic excavation and documentation; finds recovery; sampling, flotation and sieving; archeometric analyses; archaeozoological and palaeobotanical analyses; washing, consolidation and restoration of recovered materials, etc.), **GIS implementation** (UnderwaterMuse portal; interoperability with CartApulia-Puglia regional cultural heritage GIS; SIGECweb/VIR-National MiC digital archives; SiRPaC FVG - Geographic Information System of the Cultural Heritage of Friuli Venezia Giulia; etc.), **Data/metadata implementation and elaboration** (cataloging; archaeaological materials study; spatial and regressive analysis; periodization and interpretation of sites and historical events).

The new digital technologies must be considered, not only as an instrument for obtaining 3D models, but as a research method for survey, documentation, research and dissemination. Digital and virtual data represent a powerful source of information for analyzing and studying archaeological sites, especially when the site itself is hardly accessible.

The photogrammetric technique played an important role: the sites have been documented with digital photogrammetry with a professional reflex Nikon, a compact camera Olympus Tough TG-6, a Nikon Coolpix W300 and an action camera GoPro, following the two different acquisition patterns (nadir and oblique) useful for obtaining complete 3D and 2D documentation. The cameras could shoot images and video 4K and the employment of the different cameras and record types are linked to the underwater archaeological and environmental contexts. In some cases, especially in the Venice Lagoon, this operation was a real challenge because of the very low visibility (from 0.50 to 150 cm) and of the strong tidal current which made each phase very complex (Costa 2022). The image or video acquisition phase followed the rules of the multi-image digital photogrammetric survey which is considered the most advantageous documentation technique to obtain a detailed and accurate 3D model (Drap et al., 2007; McCarthy and Benjamin, 2014). Different photogrammetric strips were made: nadiral images orthogonal to the site, just as in aerial photogrammetry, and radial and oblique images at 45° to cover the vertical portion of the site, taking care to obtain complete coverage of the archaeological items with an overlapping of the images at around 60% between photos and 20% between the strips. All the images were aligned with Agisoft Photoscan/Metashape software, realizing a singlewide photogrammetric block. The system can offer precise measurement, but its accuracy is always dependent on camera calibration and topographic survey (fig.10).

Multi-image photogrammetry must be supported by a topographic survey to acquire 3D coordinates of ground control points (GCP); in order to roto-translate and geo-reference the model in a reference system, and to attain accuracy suitable for the application, W/B targets were placed on the structures and were surveyed using a trilateration computed as a 3D topograph-

ic network, following the DSM (Direct Survey Method) technique (Rule 1989) or, due to the shallowness and proximity to the coast, with a total station or DGPS to achieve further control and accuracy (Beltrame, Costa 2017, Balletti et al. 2015, Costa 2022).

At Torre S. Sabina, for example, according to the position of the beached wreck (depth of about 3 m) before the image acquisition, some W/B targets were placed on the seabed and measured using via a topographic approach using a 4 m long pole and a prism, measured by lateral acquisitions from total station surveying from the shore. One scuba diver handled the prism to make it vertical before the total station measurements, with the help of an purpose-made adjustable structure created *ad hoc* (fig. 11).

Given the importance of the legacy data of the Torre Santa Sabina shipwreck, it was interesting to compare the data obtained and the processing techniques followed in the 2020/21 acquisition campaign with a previous survey campaign carried out in 2007. After a pre-processing phase of the images acquired with a Nikon D50 with underwater housing, which showed severe chromatic aberration, we moved on to the generation of a 3D model through a free-net adjustment, using the metric rulers of the archaeological grid that had been set for a manual direct survey. Subsequently, it was necessary to manually link the two ortho-images on the same reference system, using a small overlapping part. This made it possible to produce a complete orthomosaic and a DEM to facilitate an understanding of the shape and extent of the wreck in that excavation phase (see Calantropio et al. 2021 with bibliography).

*Fig.10: Porto Cesareo, Torre Chianca, wreck of the Columns. Underwater photogrammetric survey on (ph. E. Costa, Ca' Foscari University of Venice )*

*Fig.11: Torre S. Sabina, Carovigno (Br). Multi-image photogrammetry and topographic survey (ph. University of Salento – E. Peluso)*

Concerning the photogrammetric survey performed using UAS, it was possible to document the sites and their immediate surroundings thanks to the generation of metric products (orthophotos, digital surface models, and 3D models) obtained via photogrammetric techniques based on SfM (Structure From Motion) algorithms (fig. 12). This was done for the various sites investigated along the Adriatic and the Ionian coasts of Salento, thus allowing for a general overview and subsequent study of specific structures and deposits (see, for example, the beached Roman wreck of Torre Santa Sabina, the late Republican submerged pier at S. Giovanni locality - Le Cesine Nature Reserve, the imperial Roman necropolis of Torre Chianca in the MPA Porto Cesareo).

The use of digital photogrammetry techniques applied to the archaeological survey of underwater sites can consistently speed up the survey operations without neglecting the gathered data's quality and reliability. The implementation of these procedures also provides better conditions for the operators, due to the reduction of the overall diving time. Critical aspects of applying this methodology are mainly related to the preliminary assessment of the camera calibration.

### 3.2. Dry diving methodology and VR/AR applications

The experience gained has shown that the actual multi-image digital photogrammetry is an excellent solution to obtain a three-dimensional model of the underwater archaeological sites. In addition to the importance of a virtual artefact for scientific investigation, this kind of representation of an archaeological site has been used to create a virtual reality promoting knowledge of underwater cultural heritage to a wide public. The creation of the 3D model also allows those who cannot or do not want to dive to use an application that perfectly simulates a virtual dive on the site (Costa, Manfio 2020).

*Fig.12: Torre S. Sabina, Carovigno (Br). Photogrammetric survey performed using UAS at Torre Santa Sabina (ph. University of Salento F. Zongolo)*

Unreal 4 Engine software, a cross-platform developed by Epic Games, was used to recreate the virtual reality of the archaeological sites. The first step of the process concern uploading the 3D elaboration of the archaeological site and of the bottom created on the bathymetric datasets to give to the site the correct environment.

The second step concern the creation of the virtual scene of the underwater environment: animated elements, such as fishes, and static items, such as flora and autochthonous seagrass and seaweed plants have been elaborated and tex-

turized through 3D CAD software, uploaded in UE4 and scattered with the Foliage technique.

In the final stage in order to make the virtual underwater scenario more visually realistic, some graphical effects could be applied, such as refraction, fog, caustics; furthermore, the depth, the visibility of the water and the speed and movement of the diver have to be recreated to keep as close to reality as possible in terms of diving conditions (Costa, Manfio 2020).

In addition, some pop-up and info point have to be created to highlight peculiar characteristics of the archaeological site and to make more interesting and educational the virtual immersion on the wreck: during the "dive", the people could find some written instruction to follow, both for the navigation and for the opening of the info point (fig. 13).

This kind of interface can be upload on a web site to allow the fruition by the public and can be used with 3d visors (Oculus Quest 2, for example), to create multimedia stations designed for museum, as in Caorle Museum (fig. 14). The ability to create immersive experiences to be implemented in museum's environments allows to share knowledge about sites and the past, as already also been the case in the Museum of Kaštela and in the Castromediano Museum (fig. 15).


*Fig.13: Grado 2 shipwreck virtual reality (Ca' Foscari University of Venice - E. Costa)*

*Fig.14: Virtual navigation on Grado 2 shipwreck (Ca' Foscari University of Venice - E. Costa)*

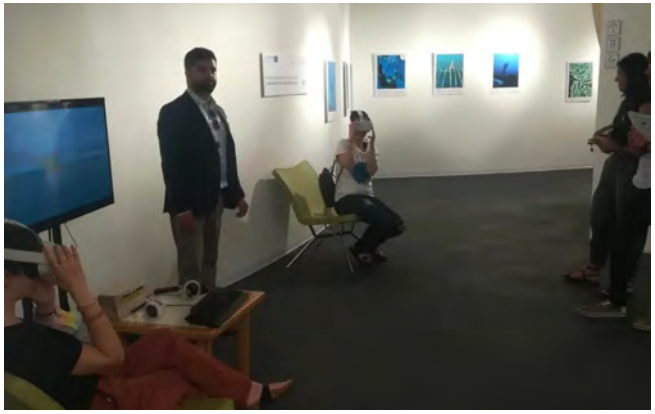


*Fig.15: Immersive use of 3D app with Oculus Quest at the Castromediano Museum, Lecce (ph. University of Salento - E. Peluso)*

## 4. FIELD ACTIVITIES AND APPLICATION OF SHARED METHODOLOGIES: PILOT PROJECTS, SURVEYS, CATALOGUING/WEBGIS

The interdisciplinary partnership from 4 different regions carried on pilot actions focusing on transform sites with a strong potential as experience-based tourist destinations to test a sustainable tourist offer in areas less interested by large tourist flows.

### 4.1. Pilot Project on the shipwreck of Grado 2, FVG

The activities in **Friuli Venezia Giulia** focused on the wreck of a Roman merchantship known as **Grado 2** (3rd century BC), which lies 7 miles off the coast of Grado at the depth of 19 m.

The intervention, directed by the Superintendency, was carried out between August and September 2021 by ERPAC, with the scientific collaboration of Ca' Foscari University (Department of Humanities), University of Salento (Department of Cultural Heritage) and University of Udine (Department of Humanities and Cultural Heritage).

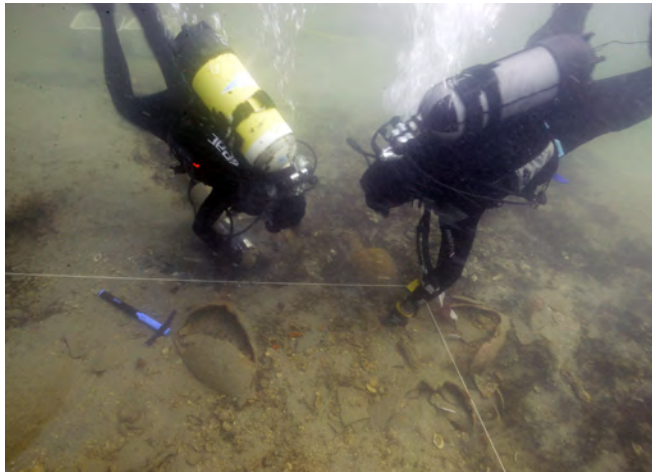
The pilot project achieved the *in situ* enhancement of the cargo of amphorae of the wreck (fig. 16), in continuity with the previous interventions implemented between 2012 and 2015 by the Superintendency itself. The containers, most likely intended for storing wine, date back to the second half of the third century BC: it is the oldest load of amphorae in the north-central Adriatic, predating the founding of the colony of Aquileia (181 BC), a significant indication of the presence of Rome on the Adriatic scene and of its relations with local communities.

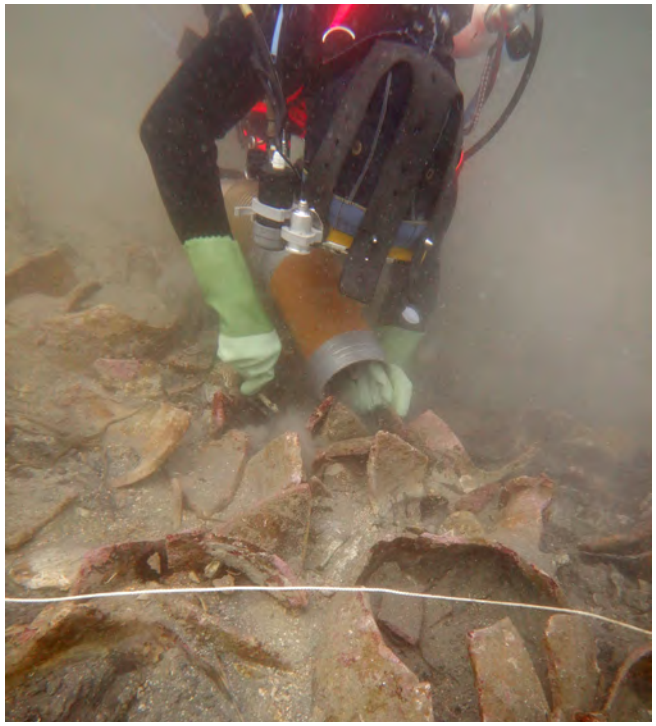
*Fig.16: Grado 2 wreck. Amphorae cargo, second half of the 3rd. century BC (ph. ERPAC)*

The pilot action made it possible to highlight the entire load, document it accurately (figs. 17-18), reposition the existing grids, add identical ones (fig. 19), and cover it to completely, thus ensuring protection and accessibility to underwater tourists. Excavation trenches were made, verifying the consistency of the deposit and the absence of wooden remains of the hull.

The realization of the 3D model through the photogrammetric survey also allows for those who cannot or do not want to dive there in person to enjoy the site remotely, thanks to an application that perfectly simulates a virtual diving on the site, available in the museums involved in the project.

The following step is and will be the development of good practices of "participatory management", to ensure that diving centers, diving clubs and other regional realities can work alongside conservation bodies, as is already the





*Figs.17-18: Grado 2 wreck. Phases of the underwater investigations. (ph. Ca' Foscari University of Venice - E. Costa)*

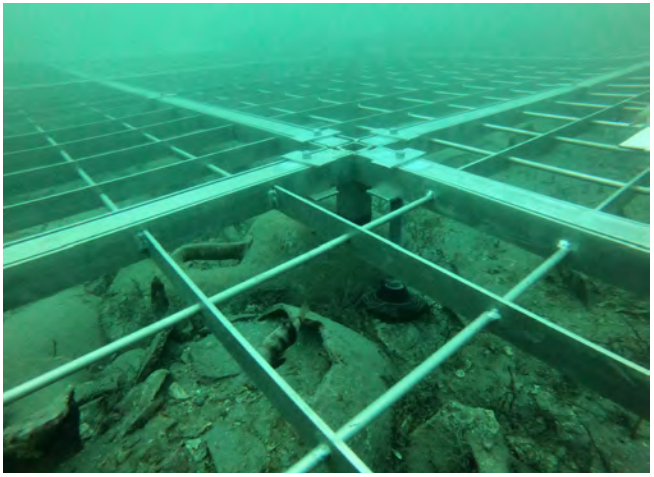


*Fig.19: Grado 2 wreck. The underwater grids for covering, protecting and ensuring accessibility to the site (ph. University of Udine – M. Capulli).*

case in neighboring Croatia, in the enhancement of the site, through underwater guided tours, with modalities and protocols that must be developed in the framework of the Institutional organization.

### 4.2. Pilot Project in Torre S. Sabina, Puglia

**Torre Santa Sabina** (Carovigno, Brindisi) in **Puglia** was choosen for a pilot intervention, due to the quality and variety of the archaeological remains in the bay. The exceptional potential of this millennia-old landing place is an ideal setting for a holistic approach to research, that of the global archeology of landscapes, in this case coastal and maritime, or seascapes. It is a "super-site", with stratifications of events which

*Fig.20. Torre S. Sabina, Carovigno (Br) : aerial view of Camerini Bay, with the base camp (ph. University of Salento - E. Peluso).*

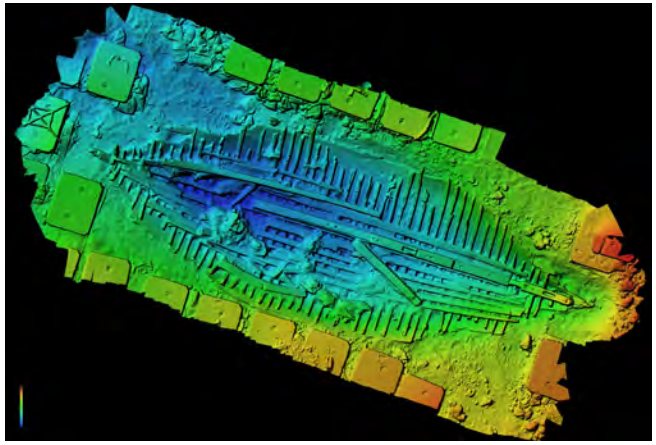


*Fig.21: Torre Santa Sabina 1 wreck. DEM ((University of Salento – L. Coluccia; Polytechnic University of Turin – A. Calantropio))*

are also significant indicators of the coastal landscape evolution: cargos and hulls, but also remains of quarries and settlements (fig. 20).

The fruitful synergy between the various involved actors (Puglia Region; Ministry of Culture, through its Offices, such as Superintendency of Archeology, Fine Arts and Landscape of the Provinces of Brindisi and Lecce, National Superintendency for the Underwater Cultural Heritage, Central Institute for Restoration; Universities of Salento, Foggia and Bari; University Politecnico of Turin; Municipality of Carovigno; Hoteliers Association; A.S.S.O. Association; A. Colucci company) and the support of the community allowed the achievement of the objectives of the two research and enhancement campaigns 2020–2021.

The interventions were focused on the wreck of the Roman Imperial Age Torre Santa Sabina 1 (late 3rd to early 4th century AD), beached and abandoned at the ancient shore and now submerged due to the relative rise in sea lev-

*Fig.22: Torre Santa Sabina 1 wreck. The excavation with two water dredges (ph. University of Salento – S. Notarangelo)*

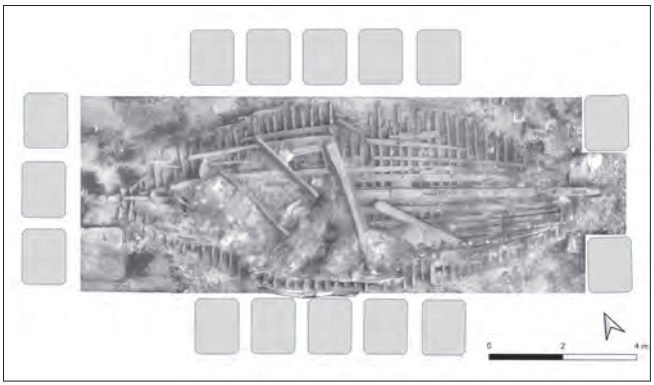


*Fig.23a-b : Torre Santa Sabina 1 wreck. Orthophoto and details of the deck remains (University of Salento; a.: development L. Coluccia; b.: ph. S. Notarangelo)*

*Fig.24: Torre Santa Sabina 1 wreck. NorthAfrican amphora, type Dressel 30 (ph. University of Salento – S. Notarangelo)*

el, a relevant marker of the seascape evolution (fig. 21-22). This wreck, embedded in the sand and covered by a thick layer (mat) of degraded plant materials, is exceptionally well-preserved: it has yielded a few stanchions, deck beams, as well as presumed remains of the hatch, elements that are only rarely preserved in wrecks (fig. 23).

The building features suggest that it was a 25–30 m long merchant ship that came from the Tunisian coast and transported wine or fish products from the North African provinces, possibly to Brindisi or another important Adriatic port. Actually, unlike what usually appears in beached wrecks, the excavations brought to light amphorae (fig. 24), both intact and fragmented, and various objects made of organic material - fishing pots, ropes, baskets, leather objects - used for living onboard or as equipment, as well as food remains, both of animal and plant origin, found in the bilge well. The entire hull was thoroughly documented by photogrammetric techniques to register the day-by-day results and to obtain a complete 3D model, for creating a virtual “clones” of the wreck and the original ship,

with animations and stories capable of allowing the widest use of this precious common good.

Other pieces of evidence have been explored and identified, so that they will be further "spots" of the underwater trails: the scattered remains of the Galea Magna, a Venetian ship that sank at the entrance of the bay on January 1st, 1598 coming from Crete (fig. 25), as well as other wooden remains of ships, but also a dense stratigraphic deposit at the foot of the western cliff, the result of repeated sinking episodes over the centuries and the subsequent ovelapping of the scattered cargos in this "trap bay" (fig. 26).

The seabed of Torre S. Sabina will become into an archaeological park, through the underwater trails' design for understanding the precious traces of the submerged past: cargos of ships that have come to crash against the reefs of this trap-bay over the centuries, but also the remains of settlements and activities (Auriemma 2014, 2015, Calantropio et al. 2021, Auriemma et al. 2022). Furthermore, the GIS technology will make available an interactive map to provide comprehensive knowledge of the seabed.

*Fig.25: Torre S. Sabina, Carovigno (Br). Iron helmets from Galea Magna ph. (University of Salento – P. Pulli)*

*Fig.26: Torre S. Sabina, Carovigno (Br). The stratigraphic deposit (ph. University of Salento – M. Buccolieri)*

### 4.3. Pilot Project in Resnik, Kaštela, Split Dalmatia County

Excavation and training activities of the pilot project were carried out at **Resnik**, **ancient Siculi**, during September 2021 (fig. 27). The research was directed by the University of Zadar, with the participation of the team of Museum of Kaštela; other archaeologists, archaeology students and about twenty members of the Giričić, Rostrum and Spinut diving clubs also collaborated.

Before the start of the campaign, the Tripodij company performed an instrumental survey of the submerged area with multibeam sonar and sub bottom profiler, adopting fully shared methodologies. On the basis of that geodetic survey, the excavation areas were identified.

The oldest and least known part of the site is a Neolithic settlement, located at the mouth of the Resnik stream, at a depth of about 3 m (fig. 28), where wells obliterated by a fire, filled with

*Fig.27: Resnik/Siculi. Aerial view of the site (ph. P. Grgurić)*

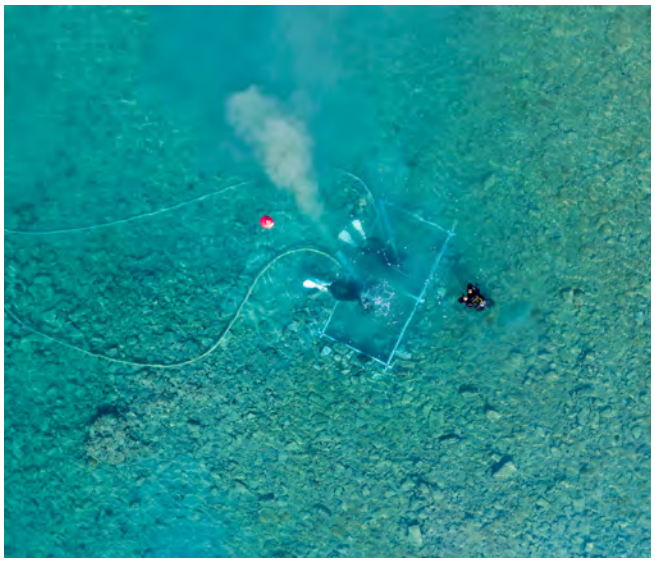


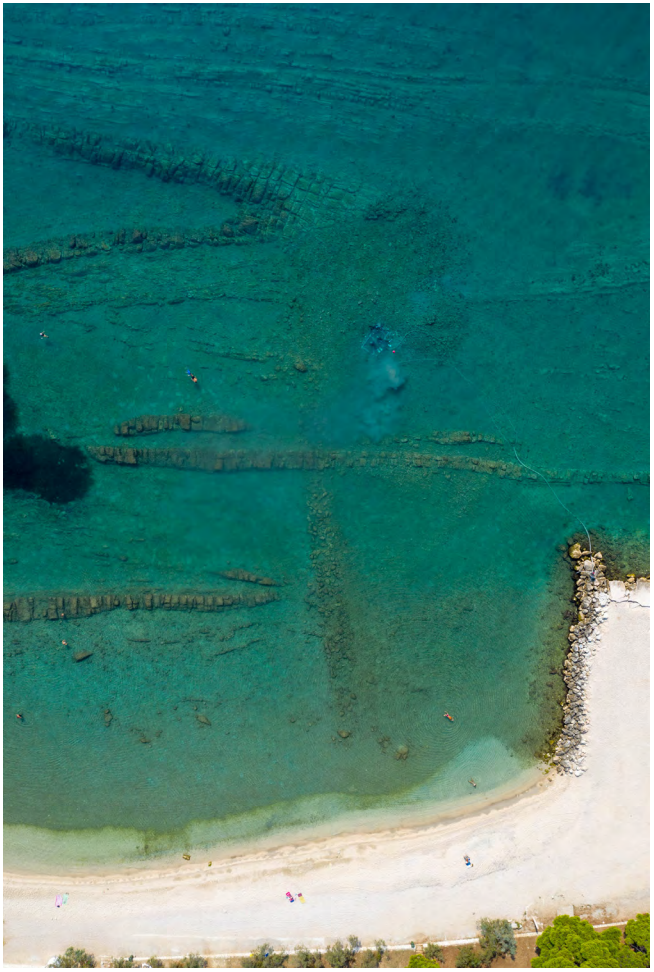
*Fig.28a-b: Resnik/Siculi. Underwater excavation of the Neolithic settlement (ph.28a P. Grgurić; ph. 28b I. Šuta, Museum of the Town of Kaštela)*

stones and other materials, were recovered; above all, ceramic fragments from the Early Neolithic, lithic artefacts and animal bones were found. Research confirms the presence of a Neolithic settlement in this area, which had already been indicted by previous findings.

The other area under study is that of the late Hellenistic settlement (fig. 29), which shows a presence from the 2nd to the 1st century B.C. (Babin 2011; Kamenjarin 2016). The remains of the foundations of the western and southern walls, of one of the roads (also preserved in Roman times) for a length of 10 m, and of 30 wooden poles have been identified. The identification of the wall layout in this area will make it possible to specify the extent and function of the settlement, which was destroyed in the second half of the 1st century B.C., also for its virtual reconstruction; data on the position and shape of the port to the east are known from previous excavations.

The third area coincides with the Roman port. Although the structures are clearly legible in aerial photos, it has never been investigated.

*Fig.29: Resnik/Siculi. Aerial view of the Hellenistic settlement (ph. T. Bartulović)*



This sector has returned most of the materials, datable between the 2nd and 5th centuries A.D. (fig. 30a-b).

The results of the research allowed the implementation of an exhaustive tool of knowledge and enjoyment: an immersive AR experience to be used with Oculus or semi-immersive, displayed on monitor, which tells of the evolution of the seascape and the settlement from Neolithic to the Roman Age.

*Fig.30a-b: Resnik/Siculi. Excavation of the Roman harbour (ph.30a P. Grgurić; ph.30b M. Parica, University of Zadar )*

### 4.4. Surveys in Veneto

The Department of Humanities of Ca' Foscari University made investigations in **Veneto** in the Venice lagoon and sea (figs. 31-32), in collaboration with Superintendency of Archeology, Fine Arts and Landscape for the Metropolitan Area of Venice and the Lagoon and with Idra Srl Company.

The Venice lagoon represents a very interesting case study for the submerged archaeological contexts importance and also for the technical-operational aspects, because it is an "extreme" environment, with strong tidal currents, low underwater visibility and with very sustained boat traffic in certain areas. These conditions make diving particularly demanding and not practicable without adequate experience. In this context, it was possible to test the potential of photogrammetric survey and digital technology for site documentation, which provided excellent results, making visible what remains basically "invisible" in its overall dimension (fig. 33).

The archaeological sites investigated in the lagoon had already been the subject of previous investigations and traditional documentation, carried out through manual surveys and photographs.

The digital approach has therefore implemented the quality of the documentation, thanks also to the speed of execution, which makes it possible to make the most of the short periods of time in which the environmental conditions are optimal, as happens, for example, in the phase of tidal inversion, when the current drops significantly and allows you to safely operate for a short period.

*Figs.31-32: Venice lagoon. Investigations of the archaeological sites (ph. Ca' Foscari University of Venice)*

*Fig.33: Venice lagoon. The poor visibility. (ph. Ca' Foscari University of Venice)*

Actually, the interventions in the lagoon must be carefully planned, sequencing the type of operations to be carried out in relation to the tide and visibility regime, therefore with great attention also to the meteorological evolution. Getting an operational sequence wrong can, in fact, mean losing a large part or an entire day of work.

Among the most significant sites under investigation were the so-called "tower" in the San Felice canal, a massive basement made of bricks, and the remains of a "pier" located in the same canal at Ca' Ballarin. Both sites are located in the Northern Lagoon and date back to Roman times. In consideration of their areal extension and visibility, which rarely reaches 2 m even in optimal conditions, the surveys proceeded in small portions which were subsequently oriented and joined by a series of topographically surveyed points. The work made it possible to obtain complex photogrammetric models, thanks to which an overall and detailed view of the sites was achieved, with obvious advantages for the study and protection activities.

Finally, at sea, off the coast of Venice, the so-called "Wreck of the Bricks" was investigated, located 20 meters deep, a large amount of bricks from a cargo probably dated to the late Medieval period, and three shipwrecks dated to the nineteenth century, two off the coast of Eraclea and one near the shore of S. Nicoletto, on the Lido of Venice.

Some of the underwater sites investigated during the project (Bricks shipwreck and Grado 2) have been processed into precise and attractive 3D models that form the basis for Virtual Reality environments (Real Time Render technology). This technology enables also very young or old people and people with disabil-

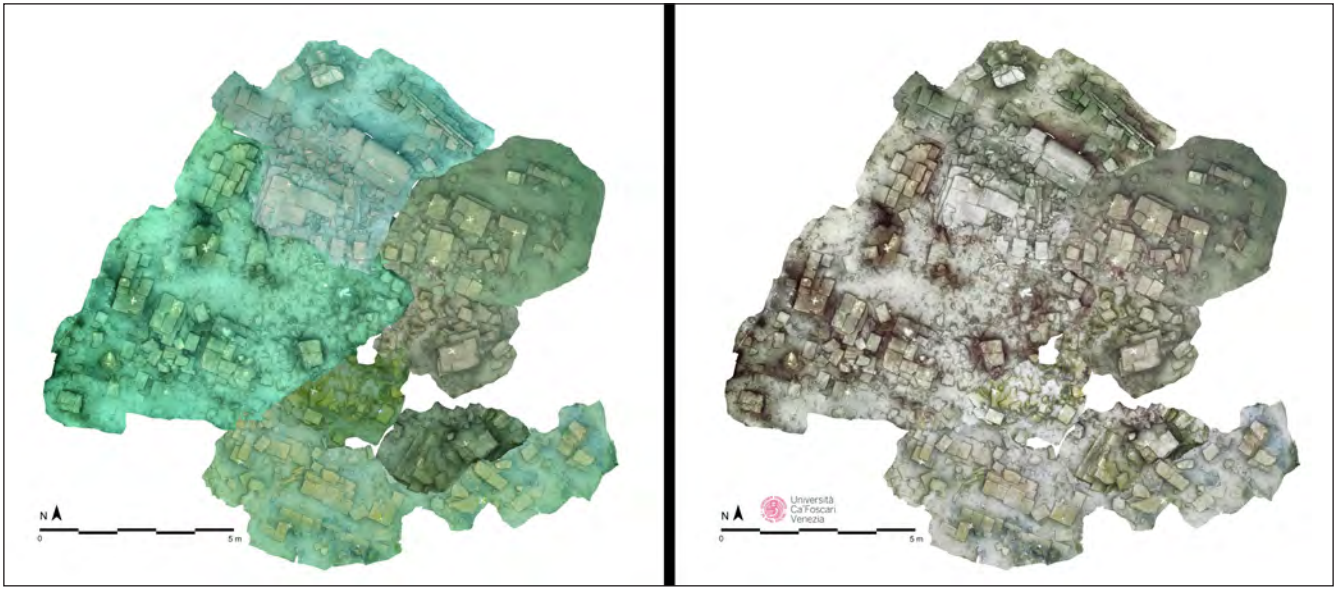
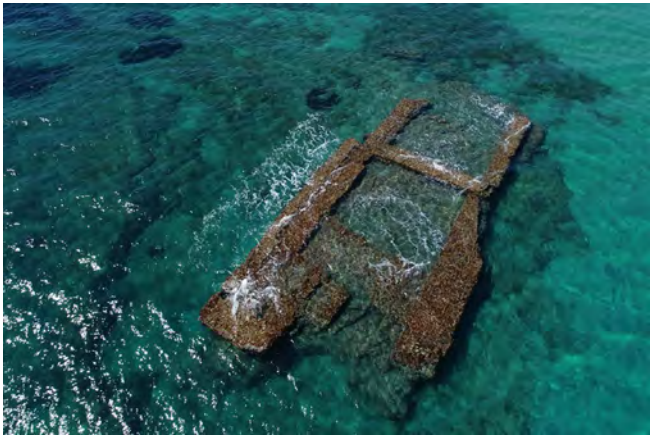


*Fig.34a-b: Wreck of the Bricks. 3D model and VR environment in Caorle Museum (development Ca' Foscari University of Venice – E. Costa)*

ity to access the sites (figs. 34a-b). By sharing information between participating museums (Caorle Museum, Grado Museum, Castromediano Museum in Lecce, Ribezzo Museum in Brindisi, Carovigno Castle Museum, etc.) virtual tours of each other's site will be accessible, virtually travelling also to the most distant underwater sites.

### 4.5. Surveys in Puglia

Surveys have been carried out in several coastal sites of Puglia in 2020–2021 within the UnderwaterMuse project. The activities conducted at the "Le Cesine" Natural Reserve, on the Adriatic Sea, led to the identification of a large port complex probably from the Augustan or Early-Imperial period, composed by a big pier (figs. 35a-b), whose foundation is preserved for a lenght of 90 m, a similar stone parallelepiped blocks structure in line with it, 40 m further offshore, apparently detached because of a large amount of sand accumulated in recent years, and another structure, maybe identifiable with a lighthouse. Some walls and a probable salt-



*Figs.35a-b: Le Cesine, Vernole (Le). Submerged foundation of the Roman port complex at (ph. University of Salento – R. Perrone)*

pan are along the coast, while an ancient road with stone foundation leads from Lecce directly to the pier area; it is visible in some sections and in an aerial photo.

On the Ionian Sea, furthermore, in Porto Cesareo Marine Protected Area, new evidence has been added to the numerous ones already known, including spectacular formations composed of cemented sherds of Tripolitanian amphorae (2nd cent. AD; fig. 36) and submerged portions of a settlement and necropolis area of the Roman Imperial Period (fig. 37), whose emerged part on the small neighbouring peninsula had already been investigated. Already known in the area were the remains of a partially submerged Bronze Age settlement in the locality of Scalo di Furno, as well as the load of marble columns of a navis lapidaria that sunk in the locality of Torre Chianca, and two Medieval beached wrecks. These findings are also significant indicators of sea-level changes and the evolution of the seascapes.

*Fig.36: Porto Cesareo MPA (Le). Wreck of Tripolitanian amphorae. Conglomerate of sherds (ph. University of Salento – M. Buccolieri)*

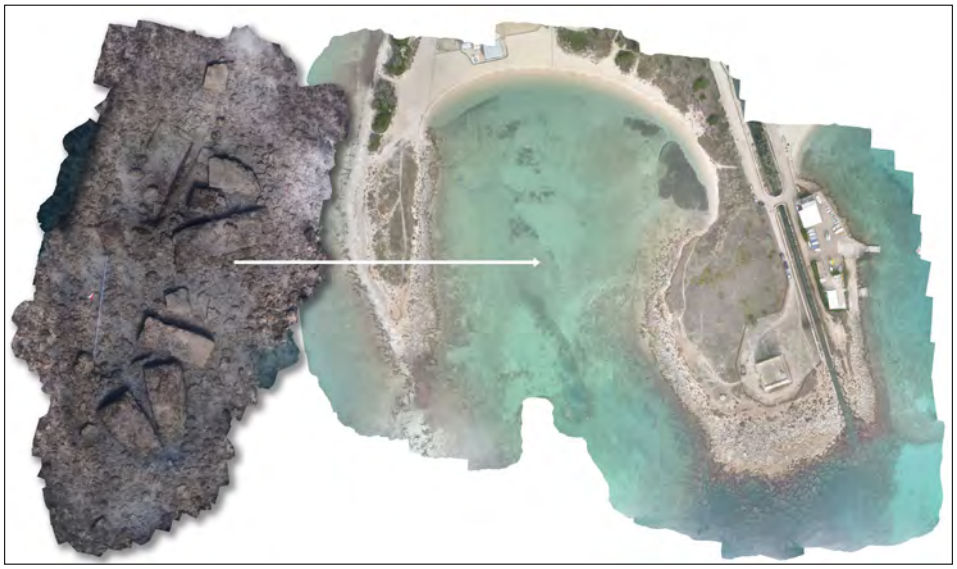
*Fig.37: Porto Cesareo MPA (Le). Steles from the submerged part of the Roman necropolis (ph. University of Salento – M. Buccolieri)*

*Fig. 38: Porto Cesareo MPA (Le). Drone photogrammetry of the submerged part of the Roman necropolis (ph. University of Salento – E. Peluso; development L. Coluccia)*

The photogrammetric survey, both aerial (by drone) and underwater, carried out on all the submerged and coastal structures (fig 38), experimented with some innovative practices such as the use of underwater sensors for GPS positioning, which are being developed. In addition, the resulting 3D models give rise to digital storytelling that could evolve further.

In both cases, Cesine and Porto Cesareo, in terms of UnderwaterMuse research and acquisitions, included in the UnderwaterMuseMap portal and in CartApulia, are covered by the same protocol applied to the pilot project sites: their development into Underwater Archaeological Park (Porto Cesareo) and into Blue Trails (Cesine), through targeted solutions.

It is important to point out that the Municipality of Porto Cesareo, based on previous research and on the latest results of UnderwaterMuse, passed a resolution to start the project for the realization of the Porto Cesareo Coastal and Underwater Park.



### 4.6. Cataloguing and Portal: UnderwaterMuseMap

The **UnderwaterMuse web portal**, implemented by the Ca' Foscari University of Venice, public and geo-referenced for the virtual exploration of submerged archaeological sites through voice, text, images and animations, also responds to the need to tell this "invisible" heritage to an ever-increasing number of people.

The WebGIS (i.e. a system that manages, stores, analyzes, maps and visualize the data of cultural heritage on the web) represents the digital catalogue of all underwater archaeological sites of the involved regions (Friuli Venezia Giulia, Veneto, Puglia and Split Dalmatia County) already or potentially accessible, designed for the experts, the divers, but also for ordinary tourists and general public. The *UnderwaterMuseMap* hosts info sheets with attractive images, videos and some 3D models realized on the underwater sites. The interactive application is hosted in the Museums of involved regions, starting from the Caorle National Museum of Maritime Archaeology (fig. 39), dedicated to the underwater heritage.


*Fig.39: Caorle, National Museum of Maritime Archaeology. The digital workstation of Underwatermuse project (ph. Ca' Foscari University of Venice)*

Through a simple navigation on the digital map (fig. 40), it will finally be possible to access a historical heritage that has hitherto been beyond the reach of potential audiences.

The map can also be visited at the web site (fig. 41): http://mizar.unive.it/underwatermusemap/.

*Fig.40: Caorle, National Museum of Maritime Archaeology. Navigation of the UnderwaterMuseMap (ph. Ca' Foscari University of Venice)*

*Fig.41: The UnderwaterMuseMap from the website (development Ca' Foscari University of Venice - P. Perozzo)*

## 5. INCREASING AWARENESS THROUGH PARTICIPATORY PROCESSES

### 5.1 Heritage community & target groups' involvement

One of the project objectives is the fundamental multivocality of the target groups, like general public (local communities, children, visitors, particularly "green and experience-based" tourists, divers, boaters, kayakers, sport fishermen, tourist guides and activity guides as targets of knowledge impact); local, regional and national public authorities (especially their tourism and natural/cultural heritage, development or planning departments as targets of knowledge and political impact); public service providers of natural/heritage services of public interest; cultural and natural heritage management bodies; regional and local development agencies, enterprises (in particular SMEs within the cultural and creative industry as well as the environmental and tourism sector); associations/regional innovation agencies; NGO's (tourist&cultural associations, organisations in the field of tourism and culture, research centres; NGO's promoting tourism development); education and training organisations, universities, research institutes.

Several actions to fully involve stakeholders and meetings regarding the role of new social policies and innovative business models in sustainable tourism (Regional Stakeholder Groups) were implemented during pilot interventions.

In **Resnik**, in parallel to excavations, attempts to include as many stakeholders as possible have been made since the end of 2019, at the project's presentation in the Vitturi Castle. Local diving clubs participated (in total, 18 divers from diving clubs Giričić, Rostrum and Spinut) through an underwater archaeology course. Apart from amateur divers, archaeology students who had already actively participated in underwater excavations organized by Zadar University and Museum of the Town of Kaštela also participated in the investigations. Divers' education was conducted *in situ*, with an introductory lecture on the site and the excavations conducted up to that point both on land and in the sea, classes on underwater excavations techniques and methodology and drills with archaeological finds to better understand how to recognize them during the excavation. Most of the participants had previous experience in archaeological excavations, successfully acquiring new skills, while those who had no previous experience worked under the supervision of expert archaeologists.

At **Torre Santa Sabina**, local governments and local community supported the Project with concrete and spontaneous actions: the Hoteliers Association of Carovigno provided room and board to all staff for the entire duration of the excavation campaigns; the Municipality made available spaces for equipment storage and materials laboratory.

The local community followed the work with great participation, visiting the laboratories and asking for information on the Project progress. The research team welcomed visitors to the site on a daily basis, describing in detail the activities underway and the objectives of the project.

*Fig.42: Carovigno, Dentice di Frasso Castle. Final dissemination event of the pilot action in Torre S. Sabina - 21.10.2021 (ph. ph. University of Salento – M. Buccolieri)*

The final dissemination events, organized by the project staff at the end of the campaigns (30.09.2020; 21.10.2021) and filmed in live streaming via Facebook (https://www.facebook.com/ArcheoSubUniSalento/), were very successful and saw the presence of the representatives of Puglia Region, involved regional Universities, Carovigno Municipality and large turnout of the public (fig. 42).

Particularly engaging events were organized: the *open day* of the excavation, which saw the participation of 60 people (including many children and adolescents) and a waiting list of over 100 people (fig. 43a-b); the *Roads of Sand Festival*, with various musical and theatrical events dedicated to the sea staged in Carovigno and Porto Cesareo, which was a great success with the public despite the difficult situation due to the pandemic (Fig. 44).

*Figs.43a-b: Torre S. Sabina, Carovigno (Br): open day on the site - 25.09.2021 (ph. University of Salento – E. Peluso)*

In **Grado**, the diving sport clubs, particularly sensitive to archaeological issues, visited the site and enthusiastically supported the project, also providing a small technical support (fig. 45). The municipality of Grado, for its part, supported the project by providing logistical support on land and organizing a promotional event (29 August 2021) to communicate to the

*Fig.44: Carovigno, Dentice di Frasso Castle. The Roads of Sand Festival (ph. University of Salento)*

citizens what type of operations were taking place in their sea and and what the developments might have been.

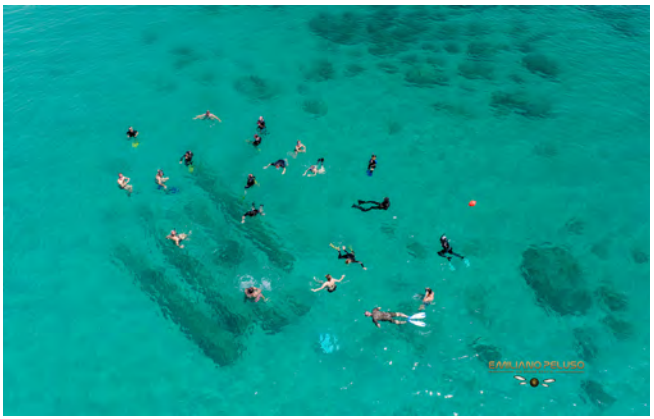
Finally, within the **Final Event** (Lecce-Porto Cesareo, 3–5 June 2022) an **International Conference** was held (fig. 46), entitled *General States of the bottom-up management of un-*

*Fig.46: Lecce, Castromediano Museum. The International Conference "General States of the bottom-up management of underwater heritage" (ph. Puglia Region – E. Peluso)*

*Fig.45: Grado. The working team and diving club members on the boat (photo: ERPAC- FVG).*

*derwater heritage* (3 sessions, 24 lectures, 38 authors, live streamed via Facebook: https://www.facebook.com/ESACpuglia/ and https://www.facebook.com/ArcheoSubUniSalento/), aimed at a constructive comparison of virtuous examples, which respond to the principles of the Faro Convention: heritage as a common good, fundamental for the cultural, social and economic development of individuals and communities.

The same Final Event provided a **snorkeling and walking tour** for the participatory experimentation of underwater trails in Porto Cesareo MPA (figs. 47a-b), including 85 participants: the wreck of the Columns, the wreck of Tripolitani-




*Figs. 47a-b: Porto Cesareo MPA (Le). Snorkeling tour of underwater trails (ph. Puglia Region - E. Peluso)*

*Fig. 48: Porto Cesareo MPA (Le), Torre Chianca. Visit of the Tower and the archaeological exhibition (ph. University of Salento - M. Rugge)*


*Fig.49: Porto Cesareo MPA (Le), Torre Chianca. Immersive use of 3D app with Oculus Quest (ph. University of Salento - A. Antonazzo)*

an amphoras, the submerged necropolis (3 groups, in turn). In parallel, visit of the Tower and the archaeological exhibition (fig. 48); use with Oculus Quest of the app *The wreck of the Columns: the unfinished journey* (3 groups, in turn; fig. 49). This successful experience represented the very first step for the birth and development of the Underwater Archaeological Park coinciding with Porto Cesareo MPA.

### 5.2. Community involvement & cultural tourism offer: the exhibition

On April 27, 2022, an exhibition dedicated to the results of UnderwaterMuse project was opened in the Museum of the Town of Kaštela, in Vitturi Castle, within the Permanent museum exhibition (figs. 50a-b).

The exhibition, titled "***Submerged Siculi***", shows the results of underwater archaeological excavation at the multilayered site Resnik/Siculi conducted as part of the project. Along with the new results, the materials found in previous underwater excavations were presented, as well as the materials collected by local divers.

The three main cultural periods found in Resnik – the remains of a Neolithic settlement, a settlement with a port from 2nd–1st century BC and the Roman port are displayed each with subthemes. During the project, a virtual reconstruction of these three phases has been made. It has been presented on this exhibition and can be seen through VR glasses Oculus 2.

A small dissemination booklet was printed, containing texts in Croatian, Italian and English.

*Figs. 50a-b: Kaštel Lukšić. The exhibition "Submerged Siculi" in the Museum of the Town of Kaštela (ph. A. Jureškin)*

### 5.3. Community active involvement: online photographic contest

The online photographic contest on the topic "*Underwater man-made landscapes in the area of the Adriatic Sea*" – which started in July 2021 and ended in February 2022 – aimed at raising awareness about the project among youngsters and their peers (school friends, families), as well as professional underwater photographers, and thus contribute to an overall increase in potential visitors of the Project's underwater pilot locations.

The contest was announced and promoted through the social media (Facebook), Project and Project Partners web pages. Project partners made additional effort and contacted local photography and diving groups, photographic and archaeological associations in order to participate and promote the online contest.

The contest was divided into two categories:

- Photo enthusiastic amateurs and professionals over 35 years of age

*Fig.51: Božidar Vukićević photocontest winner photo*

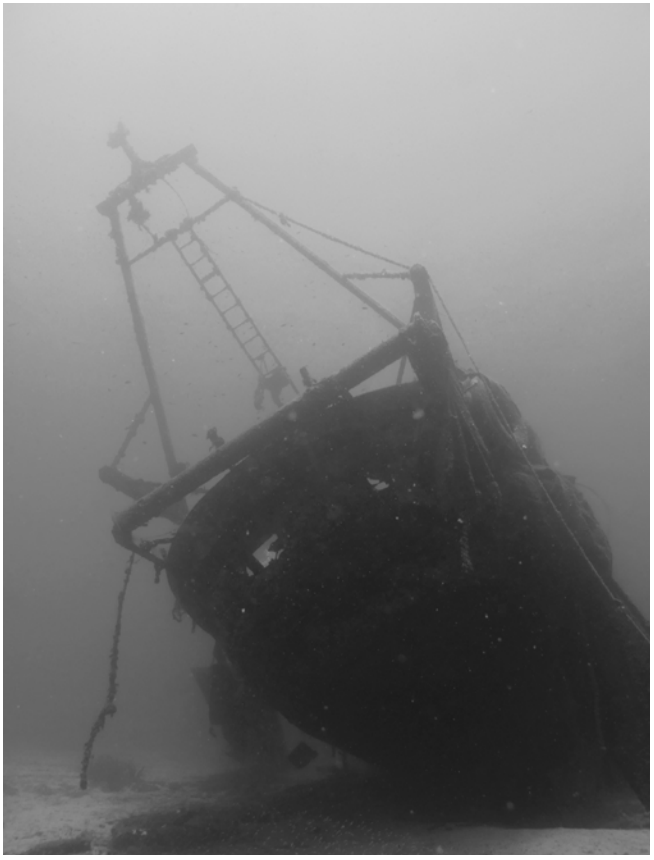


*Fig.52: Loriana Marović photocontest winner photo*

- Photo enthusiastic amateurs and professionals up to 35 years of age

During the voting period, March 1–10 the contest reached around 550,000 people via Facebook posts while around 2.000 people reacted with comments, shares or likes on the posts. Finally, the winners of the photo contest were announced on March 16, 2022, respectively:

Božidar Vukičević (category over 35 years) – the picture portrays divers (without bottles) around an 8-meter statue of Jesus Christ whose pedestal is located at a depth of 10 meters. The statue is a part of the underwater museum Via Crucis in the bay Jelinak near Trogir, where at a depth of 4–5 meters is currently the world's only Way of the Cross under the sea with a total of 52 statues (fig. 51).

Loriana Marović (category under 35 years) – the winning photo shows the gloomy atmosphere of the stranded ship. The scenario is a "seascape" of great impact (fig. 52).

The photo exhibition "*Underwater man-made landscapes*" was firstly presented during the Kaštela museum exhibition (figs. 53), *"Submerged Siculi"* March 27, 2022., in Vitturi Castle/ Kaštel Lukšić, and then in the framework of the *UnderwaterMuse* final event in Lecce, Castromediano Museum, June 3, 2022, with the participation of the winners of the contest (fig. 54).

*Fig.53: Kaštel Lukšić. The photocontest exhibition "Underwater man-made landscapes" (ph. Ante Jureškin)*

*Fig.54: Lecce, Castromediano Museum. Photocontest exhibition and the winner Božidar Vukićević*

## 5.4. Heritage community & stakeholders' specific training

### *5.4.1. Diving clubs & centers' training in FVG*

After the conclusion of the operations on the Grado 2 wreck and the Thematic meeting which was held in Grado and Aquileia on November 24–25, 2021, and given the enthusiastic response from the diving clubs, the activity of information, awareness raising and involvement of our main interlocutors went on to hopefully achieve that model of participatory management in line with the objectives and the shared intentions of the project.

The first step for the involvement of local diving centers, whether they are sport clubs or tourist diving centers, is their education. Based on this assumption and following the Grade 2 pilot project, which involved the participation of diving club members during field activities, a "heritage education" project was carried out, aimed at making diving club members and other possible stakeholders participate.

A "heritage education" project was carried out, aimed at familiarizing members of diving clubs and other possible stakeholders with both the Grado 2 site and other submerged sites in the region and formulating a possible offer of use of these sites through the clubs themselves. The beneficiaries of this training project were about 25 divers belonging to the region's sports clubs (Circolo Sommozzatori Trieste, Gradese sub, Centro Pordenonese subacqueo, CSU-Centro subacqueo Udine, etc.), diving centers and the Miramare Marine Protected Area; the participants were accompanied by two underwater archaeologists. Accompanying divers with an

*Fig.55: Grado (Go). Diving training. Theoretical workshop (ph. ERPAC - FVG – C. Pizzinato)*

*Fig. 56: Muggia, P. Sottile (Ts). Diving training. Guided visit on archaeological sites for regional diving clubs and (ph. ERPAC – FVG – D. Gaddi)*

interest in archaeology or underwater tourists with an interest in culture allows them to learn about underwater sites and how to approach them properly.

Furthermore, in the perspective pursued by UnderwaterMuse of a participatory management through specific agreements, the diving clubs and diving centers will also be involved in the maintenance of the sites, an activity that requires targeted training.

The training included a series of modules:

- a first theoretical workshop, carried out by University professors and professional underwater archaeologists (fig. 55);
- two days of diving on the Grado 2 wreck;
- another three days intended to expand the regional offer, with visits to submerged sites especially near the coast, to be reached both diving and snorkeling, such as the small piers of Muggia and other sites in Grado and Marano lagoons (fig. 56).

### *5.4.2. Training for diving guides and tourist guides in Salento, Puglia*

A total of 100 hours training course has been carried out in Porto Cesareo MPA (Lecce), aimed at 20 young people, mostly women, under 35, to make them archaeological-naturalistic diving and local tourist guides, including also the achievement of diving license.

The course was divided in the following modules:

1. The invisible heritage. The coastal and submerged heritage of the Puglia Region: the state of the art and information systems.

2. The invisible heritage. The coastal and submerged heritage and the prospects for enhancement. The UnderwaterMuse projects, Puglia Seascapes, FISH & C.h.i.p.s., the ESAC Center. The invisible heritage chain and the actors.
3. The coastal and submerged heritage in the Museums of Puglia – guided tours of the Ribezzo Museum of Brindisi, the Castromediano Museum of Lecce, the Ancient Sea Museum of Nardò, permanent exhibition of Torre Chianca.
4. Making the invisible visible: photogrammetry and 3D modeling techniques.
5. Making the invisible visible: underwater photographic and video shooting techniques. The use of the drone and external shots.
6. Telling the invisible heritage: communication and storytelling.
7. Everyone's heritage: the legislation on underwater heritage, the 2001 UNESCO convention, the 2005 Faro Convention, the National Superintendency for Underwater Heritage.

Furthermore, field – underwater activities have been carried out (fig. 57): diving prospecting and video-photographic documentation of the submerged sites of the AMP of Porto Cesareo, of the Natural Reserve of the State Le Cesine (Vernole, Lecce) and of the Emperor Hadrian pier in S. Cataldo (Lecce).

*Fig. 57: Roca, Melendugno (Le). UnderwaterMuse Training for diving guides and tourist guides in (ph. University of Salento)*

## 6. REGIONAL ACTION PLANS. OPERATIONAL & MANAGEMENT FRAMEWORK: 3 CASE STUDIES, 3 PROJECTS: TORRE S. SABINA, GRADO 2, RESNIK

### 6.1. Torre S. Sabina site operational & management framework

#### *6.1.1. Premise. Puglia Region Action Plans*

It should first be pointed out that the cultural heritage of the Puglia seas is under the supervision and jurisdiction of the 3 territorial Superintendencies of Archaeology, Fine Arts and Landscape of the provinces of Brindisi and Lecce, Barletta-Andria-Trani and Foggia, and Bari Metropolitan City. In addition, the most relevant interlocutor in Italy for UCH policies and strategies is the **National Superintendency for Underwater Cultural Heritage**, established in 2019. It is based in Taranto and has operational headquarters in Naples and Venice. It is responsible for carrying out the activities of protection, management and enhancement of the underwater cultural heritage referred to in Article 94 of the Cultural Heritage and Landscape Code and Law No. 157/2009, ratifying and implementing the UNESCO Convention.

More than half a century of uninterrupted underwater research is the **record** which Puglia can boast of over other regions. Thanks to continuous and passionate efforts, culminating in **national and international projects** conducted by the universities of the Region, vast stretches of coastline and seabed have been systematically investigated. The methodology adopted is the holistic, contextual, diachronic, multi and trans-disciplinary approach to the global archaeology of coastal and underwater landscapes or, more precisely, **seascapes**.

Puglia was one of the first regions to develop a regional cultural heritage information system (SIRPaC, now known as **CartApulia)**, an indispensable tool for the protection, planning and development of the region's cultural heritage, and it has catalogued thousands of sites of cultural interest, including **coastal and underwater sites.**

The Puglia Region – Department of Tourism, Economy of Culture and **Community Enhancement** – has collected this precious legacy and in recent years has organised and promoted actions aimed at the knowledge, enhancement and accessibility of the underwater heritage, through the creation of the **Euro-Mediterranean Seascapes Archaeology Center** – **ESAC**, linked to Libraries and Museums Hubs of Apulia Region. Its areas of interest are research and cataloguing, conservation and restoration, training, dissemination and communication, international planning, promotion and use and, in general, the use of incentives in order to promote cultural policies for the underwater heritage and the blue economy. The Center's governance process is the result of an agreement between the Regional Department, the Universities of Bari, Foggia, Salento and the National Superintendency for Underwater Cultural Heritage on a participatory process aimed at heritage knowledge and enhancement through specific projects and tangible measures.

### *6.1.2. Operational & Management Framework proposal*

For the implementation of the site's **operational and management framework,** the parties involved must put in place a **participatory process** through a series of Thematic Tables and Services Conferences; during the process, they define the various roles and duties and share a roadmap according to the following steps.

*1. Signing of a Programmatic Agreement*

The institutions involved should sign a **Programmatic Agreement** aiming at:

- developing a relationship of broad collaboration on issues of mutual interest in the field of research and enhancement of cultural heritage in compliance with the specific skills;

- promoting and encouraging research, enhancement and integrated management of local cultural heritage and in particular of the Dentice di Frasso Castle Museum and the archaeological evidence present in Torre Santa Sabina both on land and under water;

- establishing the Torre S. Sabina Management Authority and its duties, the entity that seems to best respond to this role is ESAC, due to its own institutional mission statement. The Euro-Mediterranean Center has, among its purposes: "*the creation and setting up of parks and/or ecomuseums underwater aimed at the "Blue growth", even with remote use through direct shooting systems, to respond to the challenges that the places of culture have to face to become alive and inclusive places, of learning, mediation, welcoming, in the name of heritage as a common good*".

- establishing the management framework guidelines.

Each part appoints its internal representative for the **Management Committee**, supporting the Managing Authority and approving the Site Regulations and future Management Plan.

***a. Roles and responsibilities of all parties involved***

- **Superintendency ABAP Brindisi Lecce** and **National Superintendency for the UCH**, both on behalf of Ministry of Culture, are responsible for the protection of UCH, the permission for the set-up of "blue archaeological trails", the permission of guided diving and snorkeling tours.
- **The Municipality** of Carovigno undertakes to cooperate with other stakeholders for the upgrading of the Dentice di Frasso Castle Museum and archaeological sites in the area to uniform levels of quality for the enhancement of museums and places of culture as public good, adopted by Ministerial Decree of February 21, 2018, for the recognition/accreditation in the National Museum System of museums of regional importance. It also agrees to provide a lightweight and removable structure as a logistical base on the beach for tourists, for briefing and de-briefing and for diving equipment, as well as reserved parking spaces for visitors' cars.

- **Libraries&Museums Hubs – The Puglia Region** is the body responsible for the establishment and development of the Regional Museum System and Places of Culture as well as for the relevant integrated enhancement regional policies. It is committed to providing tangible measures and human and financial resources, according to the regional operational plan.
- **University of Salento – Department of Cultural Heritage** undertakes to make its scientific consulting for
  - the scientific plan of site enhancement;
  - the scientific direction of the Museum;
  - the scientific direction of communication and editorial projects on the site (catalogs, guides, brochures, etc.), as well as of scientific works;
  - the archaeological scientific supervision of the project to enhance the waterfront of Torre S. Sabina, as regards sustainability and compatibility with the archaeological evidence on land, submerged and semi-submerged ones.
  - scientific research activities in the municipal area of Carovigno, to continue the already started path of systematic knowledge and enhancement of the heritage historical-archaeological of the territory itself.
- **Coast Guard/Brindisi Harbour Master's Office** undertakes to guarantee the granting of general provisions for navigation in the Bay and the subsequent surveillance activities; it must also authorize the presence of a light and removable structure on the beach as a logistics base for the tours. The nautical activities must be limited, except those necessary for scientific research and underwater visits, expressly authorized by the Superintendency, and reported in the regulations (see below).
- **Pugliapromozione**, non-economic public body which works to implement Puglia Region policies on tourism promotion, could provide advice to the Managing Authority on the design of the Marketing Plan and the dissemination of the UCH through the info-points that coordinates.
- Relevant **stakeholders** – cultural/environmental heritage associations, diving clubs, territorial bodies such as Torre Guaceto MPA, – can be involved in the Management Plan.

***b. Management Framework guidelines***

In line with the principles of the UNESCO's Convention on the Protection of the Underwater Cultural Heritage (Paris 2001), and the Framework Convention on the Value of Cultural Heritage for Society (Faro 2005), as well as the European Union guidelines promoting Blue Growth, the management framework of Torre S. Sabina UCH must be aimed at ensuring the development of the site in according to the following guidelines:

- re-appropriation of a common good, capable to raise the quality of the life of the local community (cultural, social and economic);
- raising awareness;
- dissemination of knowledge through both concrete measures and measures to raise visitors' awareness of the specific and unique characteristics of the area;
- responsible and sustainable tourism and experiential tourism capable of satisfying a wide range of personal needs, from pleasure to the search for meaning, and of strengthening the network of community resources, enhancing existing assets and creating new opportunities in the Torre S. Sabina target area (Brindisi, Carovigno, T. Guaceto Regional Reserve and MPA, San Vito dei Normanni) for the local economy;
- proactive and inclusive protection for the UCH, acted by all the chain of actors involved in management of the site and assured by shared regulations, to counter also unsustainable and high-impact tourism;
- monitoring of tourist flows, directing them towards a reduction in negative impacts.

***c. Staff duties of the site's Managing Authority***

**The managing Authority** assures the development of the site in compliance with the Management framework Guidelines and deals with the "heritage chain", from preservation to enhancement, communication and tourist enjoyment.

Notably, its staff must contribute to the scientific plan of the site enhancement (2nd step), to the participatory design of blue trails (3rd step) and to the participatory writing of the site regulations (4th step); furthermore, it is in charge of the implementation of the blue trails with diversified solutions, including traditional and innovative tools for experiencing the underwater and coastal trails (signage, archaeological materials replicas, booklets, underwater devices/tablets, monitoring buoys equipped with sensors, etc.; see below).

The staff must provide the maintenance of the trails equipment, the archaeological testimonies' surveillance and monitoring, through the archaeological guides, and constant interaction over time with the actors involved.

It must implement an integrated communication plan, including visual identity, website, social networks (Facebook and Instagram), reservation portal for booking guided visits (see below) and special tours/events.

Furthermore, it should hopefully also deal with the permanent exhibition at the Carovigno Castle Museum, enriching it and providing it with contents, laboratories and services aimed at emphasizing the strict connection with the Blue Trails experience.

Finally, it can train and certify underwater archaeologists and biologists as diving guides for the site, who will be able to support diving clubs and centers regarding the naturalistic-archaeological aspects, including the respect of the rules in diving.

*2. Implementation of the scientific plan of the site enhancement*

The scientific plan should be curated by University of Salento, due to its multi-year under water and on land research activities in the territory and to the numerous regional, national and international projects carried out on Torre S. Sabina and Torre Guaceto sites (included the Museum project and the feasibility study on the new waterfront), with the consulting of ESAC, and approved by the Superintendencies.

The scientific plan should provide:

- selection of the points of interest/archaeological-naturalistic spots;
- evaluation of the archaeological risk;
- evaluation of the different degradation processes and the environmental conditions: geomorphologic changes (shoreline erosion, regression, advancement, etc.), physical phenomena (currents, waves, etc.), chemical conditions (in water and sediment) and biological factors;
- trails planning: study of the underwater itineraries and their equipment;
- study and development of digital storytelling with the communicative and narrative use of VR/AR and other digital means. The basic output should be the DEM/3D map of the whole Torre S. Sabina sea-bottom and intertidal stretch, and part of coastal stretch, with all the archaeological assets, likewise represented by 3D models.

*3. Participatory design of blue trails*

It is fundamental that the underwater itineraries with floral and faunal, geomorphological, geoarchaeological (the paleoshore) and archaeological points of interest could be conceived with the contribution of all possible involved local actors in a participatory process. The design of the Blue Trails should be conducted by the stakeholders and the local community with the presence of a facilitating and expert agents such as ESAC and the Managing Committe, as happens, for example, in the participatory process of the **community maps** created in the framework of **ecomuseums** or for the purposes of regional landscape plans.

*4. Participatory writing of the site regulations*

The writing of Site Regulations should be acted also in a participatory way, through Working Tables, under the guidance of ESAC and then submitted to the Managing Committee for the approval.

The **regulations** should foresee the type of authorization, granted by the Superintendency, the subjects recipients of the diving authorization, the opening period, opening hour, number of visitors, free and/or guided visits, access modalities, guided tours for people with disabilities; snorkeling and diving can be equally practicable; in the first case, a self-declaration of good health - which exempts the organization from responsibility – is sufficient, in the second case it is also necessary the diving license.

Regulations also report the general provisions for navigation in the Bay as defined by the **Coast**

**Guard/Brindisi Harbour Master's Office**, in charge of surveillance activities managing; the nautical activities must be limited, except those necessary for scientific research and underwater visits, expressly authorized by the Superintendency. The boats for diving guides must be equipped with passenger traffic license for guided tours, rental or enabled for navigation for private use or in own account.

However, the underwater guided tours are supposed to start mostly from the beach, where is available a logistic base for visitors meeting, briefing and de-briefing and diving equipment, or for glass-bottomed/transparent canoes/kayaks/sups (stand-up paddles). Actually, local diving infrastructure is also crucial factor to consider when establishing a diver trail and there isn't either in Carovigno and in Torre S. Sabina. So, it's important to guarantee to the nearby Tourist and Diving Centers a facility on the site.

The regulation must individuate the recipients of diving authorization, among which:

a) no profit diving clubs and associations, whose purposes provide for teaching activity according to national structures standards;

b) diving and commercial enterprises, whose company object includes entrepreneurial activity of underwater tourism.

The autonomous visitors with diver license, not related to diving or clubs don't need any permission.

The diving or tourist centers which intend to carry out guided tours will have submit instance to the Superintendency, specifying the type of visit (scuba diving or snorkeling or kayaking, for example); the instance must be accompanied by certificate of the Chamber of Commerce requested by current legislation, documents of the physical subjects, statute and constitutive act for legal entities, documents relating to the used boats and the engaged crew, name and Dive master license of diving guides, all information about personnel involved in visits, on the used materials and facilities.

The subjects authorized to carry out visits should pay an annual fee to Managing Authority by the regional authorized diving centers as contribution to the expenses of management and maintenance. The regulations will establish the maximum prices for services and the corresponding fee to the Managing Authority (for example, scuba diving visits € 40, fee € 5); the costs and the fees may be reduced by 50% for particular categories: people with disabilities, students, minors under the age of 18, teachers or operators in the cultural field.

The Tourist, Clubs and Diving Centers must book the dive on the specific reservation platform on the website of Managing Authority (see above), and report, for each dive or guided tour: the date, the place of the dive, the details of the participants and of the related licenses, the names of diving supervisors.

Besides the underwater tours, the diving clubs and centers can organize also diving training courses and special visits: night underwater tours, sea-watching snorkeling for kids, guided visits for people with disabilities, headed by dive masters with specific license, etc.

The diving clubs and centers will be flanked and supported in diving by underwater archaeologists or biologists, accredited and trained

by ESAC, as naturalistic-archaeological guides. They won't be responsible for immersion safety, but respond to violations concerning the rules, issued by the Superintendency, on the protection of the archaeological assets; the guides will however have to provide all the information available regarding aspects biological-naturalistic, landscape and archaeological of the seabed, and prepare a pre-immersion briefing indicating the biological, geomorphological and archaeological peculiarities of the itinerary as well as the behavioral rules to follow in immersion.

The visits can be carried out by respecting a guide-sub ratio, to be defined also in the regulations (not more than 1:8).

The regulations should also include the enjoyment of the Carovigno Castle Museum: only one ticket including underwater tours and Museum guided visits; the Museum must offer specific enjoyment experiences linked to underwater environment: immersive/VR/AR application usable with Oculus devices or dedicated screens, specific laboratories and activities particularly dedicated to the kids, etc.

*5. Implementation of the blue trails*

The Managing Authority, once designed the Blue Trails participatory project, provides its setting-up. The implementation of Blue Trails in Torre S. Sabina is a **real challenge**, more than other underwater sites, because it's a pluristratified site, with very different evidence, some of them really fragile and vulnerable and hardly readable; in primis, some **wooden remains** of various shipwrecks, first of all the TSS 1 beached wreck; these wooden remains obviously can't be left without protection, exposed to the environmental elements. Secondarily, the dense **stratigraphical sequence**, constituted by the overlapping of various cargos of the ships crushed against the reef and sunken, alternating with natural sediments and materials dumped as part of normal everyday activity of the landing place. Therefore, since basic options of *in situ* preservation (metallic cages or simple exposition) cannot be exploited, different solutions must be put in place and applied in a complementary way.

***a. Trails equipment***

The trails start from a 'point zero' and link Point of Interest represented by replicas of scattered cargos' materials (amphorae, pottery, etc.) and decontextualized finds, quarries' blocks, Bronze Age settlement' postholes or other traces. Given the necessity to communicate the pluri-stratified character of the site, the permanent exhibition at the Carovigno Castle Museum shows a replica of the stratigraphical section of the Torre S. Sabina sea-bottom with all the distinguished layers and the included archaeological original materials representing the sunken and overlapped cargos. The same **diorama** can be placed, of course in non-invasive way, also under water, on the sea-bottom at the foot of the reef, with specific materials.

Nevertheless, trails can include also *in situ* stratigraphic deposits' materials to be exposed during the visits under particular conditions of surveillance, today allowed by technological innovations, such as, for example, the NOUS Undersea Vision Surveillance System (successfully implemented in the Greek Underwater Museum of Peristera shipwreck): submarine units fully equipped with cameras and windshield

wipers fitted to the camera lenses. The underwater operation is controlled by multitasking computing units. The network of underwater cameras is powered by a cable reaching to the nearby shore, connected to a purpose-built solar power station.

For the well-preserved Torre S. Sabina 1 wreck and the other wooden remains in the bay the best solution could be 3D models to enjoy with underwater tablets in situ and visors/Oculus in the land Museum. In parallel, the recovery and the restoration of the ship could be studied and planned, as well as the ship's physical replica construction (see feasibility study).

Trails may or may not be materialized/marked out with guide cables or 'Ariadne's threads' of fluorescent color. The PoI can be signaled on the sea-bottom by labels or tag. The use of environmentally friendly material for the underwater signage is required.

The trails can be enjoyed with both simple/plain but efficient means and technologically advanced tools, depending on the budget.

Option A: an underwater information booklet and some "diver stations/Point of Interest" established along the trail to aid diver navigation. The diver stations can be numbered with a small ball float. As visitors reach each diver station, they are encouraged to read the text on the appropriate page of the underwater booklet.

Option B: underwater visualization in augmented reality (like in the Archaeological Submerged Park of Baia or in the Underwater cultural trails of the Sea Superintendence of Sicily – UCH Fruition Interactive System UG3K): an innovative underwater localization system which allows divers to view their position on the map of the archaeological site via an underwater tablet, to receive contextualized information with respect to their position and to enjoy the 3D reconstruction that shows the visitor what the archaeological remains looked like in their heyday.

The tablets could be provided free of charge by Managing Authority to diving clubs and centers that will request them, by specific agreements.

***b. Operating period***

The land Museum can be opened all year long; the blue trails can be exploited seasonally, from late spring to autumn.

***c. Services offered***

Guided underwater tours, guided snorkeling tours, guided kayaking/SUP tours, specific tours for kids, night underwater and coastal tours, virtual/dry dives with Oculus on the various archaeological testimonies, land Museum permanent exhibition, land Museum temporary exhibitions, educational workshops for school, families, etc., reenacting activities, etc.

*7. Economic plan*

The initial pricing policy should take into consideration an annual fee as contribution for the setting up and maintenance of the site, fee per each diver in percentage on the whole amount of the visit, and revenues from laboratories and events in Carovigno Castle Museum and on the coast. Meanwhile, the annual budget needed for the operation of the site should include staff, equipment, maintenance and operational costs, as well as a budget for marketing/promotion activities.

## 6.2. Grado 2 site operational & management framework

### *6.2.1. Premise. Friuli Venezia Giulia Region action plans*

After the intense season of excavations and studies on the Grado 1 wreck (1987–1999), ended with the whole recovery of the load and hull, the underwater archaeological research in Friuli Venezia Giulia Region stopped. During this institution's stalemate, the University of Trieste promoted a lot of scientific projects targeted at the knowledge and valorization of the underwater cultural heritage: the project Interreg Italia – Slovenia IIIA ***AltoAdriatico***. *The coastal sites of the upper Adriatic: topographic surveys on land and at sea* (2004–2007), during which pre-Roman and Roman structures, partially or totally submerged between the mouths of Timavo and Pirano, were studied, in order to redesign the coastal layout and landscape profile in ancient times. The following similar Project ***Stories from the Sea*** concerned the Marano Lagoon (Ud), in Italy, and the wide inlet of the port of Salvore/Savudrija (Umago/Umag), along the Istrian coast, but some surveys have included also the inland waters, especially the **river harbour of Aquileia** and the **Stella River,** with the Project ***Anaxum***. *Archaeology and History Project of a river landscape, carried out by University of Udine.*

The Regional Information System of the Cultural Heritage – SIRPaC FVG (www.ipac.regione.fvg.it; Catalogo dei Beni Culturali; Carta dei Beni Culturali), managed by ERPAC and connected to the general **WebGIS** of the Region FVG, EAGLE FVG (sistemiwebgis.regione.fvg.it/eagle/), is an open-access webGIS which includes the submerged and semi-submerged archaeological assets of Friuli Venezia Giulia, which are constantly updated. The database is available to the citizens and stakeholders operating in the territory, a useful archive for knowledge, socio-cultural-economic development, spatial planning and preservation.

The submerged archaeological heritage is only minimally recorded in the **Raptor portal** as well, an instrument of the Superintendency Archaeology, Fine Arts and Landscape of Friuli Venezia Giulia aimed essentially at protection, not open access (http://www.sabap.fvg.beniculturali.it/attivita-2/tutela/software-raptor-ricerca-archivi-e-pratiche-per-la-tutela-operativa-regionale).

There are no known tourist or cultural websites or social networks dedicated to underwater cultural heritage.

**ERPAC FVG**, in accordance with Regional Law 2/2016, is in charge of promoting the development of projects of relevant regional interest for the enhancement of cultural heritage and to participate in initiatives carried out in collaboration with sector bodies and organizations operating at European and international level, also for the purpose of accessing EU funding in this area.

On 2021, precisely in the framework of UnderwaterMuse Project ERPAC signed a **Programmatic Agreement** with Regional Secretariat and Superintency Archaeology, Fine Arts and Landscape of Ministry of Culture, aiming at establishing a collaboration for the *in situ* and remote exploitation of the Grado 2 Roman shipwreck as well as at the enhancement and dissemination of the regional underwater heritage.

In particular, pursuant to the art. 6 – *Enhancement of the underwater cultural heritage: stakeholder involvement activities*, the parties collaborate in identifying good practices and designing protocols or guidelines aimed at the protection, but also at the management of the submerged site, also through the involvement of the community and local actors (in particular diving centers, diving and cultural associations, etc.) who can organize guided tours and carry out site monitoring and maintenance activities.

Based on this Agreement, the aforementioned "heritage education"/dive training project (p. 5.4.1) was implemented, aimed at acquainting diving members and other possible stakeholders with both the Grade 2 site and other underwater sites in the Region and formulating a possible use of them through the clubs themselves.

### *6.2.2. Operational & Management Framework proposal*

The parties involved must put in place a **participatory process** through a series of Thematic Tables and Service Conferences; during the process, they define the various roles and duties and share a roadmap according to the following steps.

*1. Signing of a Programmatic Agreement*

For the implementation of the **Site Operational Framework**, a second **Programmatic Agreement** should be signed between the actors involved:

- **ERPAC**, which takes on the role of Managing Authority, by reason of its institutional mandate and the enhancement activity carried out on the site;
- **Superintendency ABAP FVG** and **National Superintendency for the Underwater Cultural Heritage**, both on behalf of Ministry of Culture, in charge of the protection of UCH;
- **PromoTurismoFVG**, which is the regional body dealing with the strategy, operational management and promotion of tourism in Friuli-Venezia Giulia, planning and organizing the offer through specific tourism products and welcoming guests as "temporary citizens". It could implement tourist offers with the involvement of diving centers, including the Grado 2 and other regional submerged sites.
- **Coast Guard/Grado Harbour Master's Office**, responsible for general provisions for navigation in the area and the subsequent surveillance activities.
- **Regional Museums Direction**, in charge of the management of National Museum of Underwater Archaeology of Grado, where a computer station for "virtual" diving on the wreck will be available.
- Relevant **stakeholders** – local heritage/environmental associations, diving clubs, etc. – can be involved in the Management Plan.

Each party appoints its own internal representative for the Management Committee, which supports the Managing Authority and approves the Site Regulations and future Management Plan.

The Programmatic Agreement will be aimed at the following:

– developing a broad collaboration on issues of mutual interest in the field of

research and enhancement of UCH in compliance with the specific skills;

- promoting and encouraging enhancement and integrated management of regional underwater heritage;
- defining roles and duties of the parties;
- establishing modalities of involvement of the local community through participatory processes.

***a. Duties of the site's Managing Authority***

**The Managing Authority** assures the development of the site in accordance with the Management framework Guidelines and deals with the "heritage chain", from preservation to enhancement, communication and tourist enjoyment.

Notably, it takes care of the following:

- site maintenance: monitoring and cleaning of the metallic grids and the signage;
- site protection: setting up a surveillance system through technological innovative tools, such as, for example, the NOUS Undersea Vision Surveillance System (see above);
- site dissemination: implementing an integrated communication plan, including visual identity, website, social networks (Facebook and Instagram), booking portal for guided tours (see above) and special tours/events.

Furthermore, it should hopefully also collaborate with the National Museum of Underwater Archaeology of Grado, curating the digital devices and the scientific contents dedicated to letting all visitors and non-divers experience virtual diving on the wreck.

Finally, it will be able to train and certify (award qualifications) to underwater archaeologists as underwater guides of the site, who will be able to support diving clubs and dive centers with regard to naturalistic-archaeological aspects, including compliance with diving rules.

*2. Participatory writing of the site regulations*

The writing of Site Regulations should be preformed also in a participatory way, through Working Tables, under the guidance of ERPAC and then submitted to the Managing Committee for the approval.

The **regulations** must foresee the type of authorization, granted by the Superintendency, the recipients of the diving authorization, the opening period, opening hours, number of visitors, free and/or guided visits, access modalities, guided tours for people with disabilities.

Regulations also report the general provisions for navigation in the area as defined by the **Coast Guard/Grado Harbour Master's Office**, in charge of surveillance activities managing; the nautical activities must be limited, except those due to scientific research and underwater visits. The boats for diving guides must be equipped with passenger traffic license for guided tours, rental or enabled for navigation for private use or in own account.

The regulation must individuate the recipients of diving authorization:

a) nonprofit diving clubs and associations, whose corporate purpose includes educational activity that meets the standards of national facilities;

b) diving and business enterprises, whose corporate purpose includes the business activity of underwater tourism;

c) autonomous visitors with diver license.

Diving centers wishing to do guided tours shall submit an application or simply report dives.

Those authorized to make visits will have to pay an annual fee to the Managing Authority as a contribution to operation and maintenance expenses from authorized regional diving centers. Regulations will establish maximum prices for services and the corresponding fee to the Managing Authority; costs and fees may be reduced by 50 percent for particular categories: people with disabilities, students, children under 18, teachers or cultural workers.

The Clubs and Diving Centers must book the dive on the specific reservation platform on the website of Managing Authority (see above), and report, for each dive: the date, the place of the dive, the details of the participants and of the related licenses, the names of diving supervisors.

The diving clubs and centers will be assisted and supported in diving activities by underwater archaeologists or biologists, accredited by ERPAC, as naturalistic-archaeological guides. These latter shall not be responsible in terms of safety, but respond to violations concerning the rules, issued by the Superintendency, on the protection of the archaeological assets; the guides shall however provide all available information related to the biological-naturalistic, landscape, and archaeological aspects of the seabed, and prepare a pre-dive briefing indicating the biological, geomorphological, and archaeological peculiarities of the itinerary and the behavioral regulations to be followed while diving.

The visits should have comply with a guide-sub ratio, to be defined also in the regulations (not more than one to eight.

The regulation could also include the visit to the Museum of Grado: a single ticket including underwater visit and guided tour of the Museum and guided tour of the Museum; the Museum could offer specific enjoyment experiences linked to underwater environment: immersive/VR/AR application usable with Oculus devices or dedicated screens, specific laboratories and activities particularly dedicated to the kids, etc.

## 6.3. Resnik site operational & management framework

### *6.3.1. Premise. Split Dalmatia County and Resnik action plans*

The research on the underwater archaeological sites in the area of Split-Dalmatia County (SDC) dates back to the second half of the 18th century when the first findings were mentioned in Sućuraj on the island of Hvar. From then until after second World War, the archaeologists and museums had little interest in underwater sites, resulting in the loss of topographic data of certain archaeological sites which had since been completely plundered. Moreover, there was no law on the protection of cultural goods. However, after WWII and with the development of more advanced scuba diving equipment, the interest in underwater archaeological sites arose. Consequently, the Act on the Protection and Preservation of Cultural Heritage was passed and since the 1960s continuous research has been performed throughout the entire SDC's territorial sea area. To this day, there are over

200 underwater sites found in the area of SDC, whereas only 48 are protected by the Act on protection and preservation of cultural heritage (NN 69/99, 151/03, 157/03, 100/04, 87/09, 88/10, 61/11, 25/12, 136/12, 157/13, 152/14, 98/15, 44/17, 90/18, 32/20, 62/20, 117/21). Regarding Kaštela Bay, the exploration of the Resnik area began in 1988, when the remains of Hellenistic and Roman ports were found and further research pointed out that there are numerous underwater sites. In addition, not all of them are under protection or are properly managed and preserved. This is the issue on both local and regional level. Moreover, there are not enough financial or technical resources to ensure the necessary, quality and appropriate exploration or preservation of the sites. In light of the aforementioned, the Action plan (AP) cannot be limited to the project area alone, but the objectives and measures are relevant to the area of SDC. The same form the basis for future projects and actions in the area of exploration, conservation, and finally tourist enhancement of underwater heritage. Fundamental to the achievement of the goals set in the AP are the funding opportunities of the new 2021-2027 programming period and the participatory approach of all stakeholders, starting with the Ministry of Culture and Media, the SDC, the municipalities involved, scientific institutions, diving clubs, and other stakeholders.

In addition, the AP is the basis for the following operational and management proposal that concerns the underwater sites in the area of Kaštela Bay.

### *6.3.2. Operational & Management Framework proposal*

As in this case for Italy, in Croatia all activities regarding the research, preservation and enhancement of the cultural heritage must also be submitted and approved by the Ministry of Culture and Media. The Croatian Conservation Institute with its branch offices and licenced private companies is in charge for performing the conservation and restoration activities. At the regional and local level, competent administrative departments of regional and local public authorities, together with the aforementioned national bodies jointly perform underwater investigations, surveillance and determination of the condition of underwater archeological sites as well as reconnaissance of new areas with the aim of finding new and preserving the existing underwater archaeological heritage. For this purpose, it is also relevant to mention the International Center for Underwater Archeology in Zadar that represent UNESCO's 2nd category centre focused on the protection, study and preservation of underwater cultural heritage in Croatia, the development of international scientific cooperation and education in the field of underwater archaeology, presentation and promotion of underwater heritage to the general public and dissemination of UNESCO Convention on Underwater Cultural Heritage.

In the Kaštela Bay area, as mentioned before, there are numerous sites with different protection statuses. Some are protected, some are only protected on a precautionary basis, and some are only registered. In addition, there is the issue of ownership, as under Croatian law cultural property can be privately owned. For

example, the Resnik project area, which covers both continental and maritime territory, is partially privately owned. Therefore, it is difficult to perform any kind of activities if the owner refuses to be involved. Moreover, diving on certain sites is not regulated at all. Thus, the relevant regional and local stakeholders, SDC and municipality of the Bay area (City of Split, City of Trogir, City of Solin and City of Kaštela) should advocate with the Ministry to buy out all privately owned goods and to legally protect all sites in order to assure prompt and appropriate management, preservation and valorisation of the same.

For the Kaštela Bay area, the Managing Authority should be established. The Body should be a form of an advisory body consisting of one representative of each relevant stakeholder listed below.

- Ministry of Culture and Media as the main responsible public authority for the issue of preservation and protection of cultural heritage in Croatia;
- Croatian Conservation Institute – Split Department for Conservation (branch department) conducts protection and supervision of underwater heritage;
- SDC – Administrative Department for Education, Culture, Technical Culture and Sports that performs administrative and professional tasks in the field of education, culture, technical culture and sports and prepares reports, proposals and draft documents within the scope of the administrative body in order to develop these activities in the SDC;
- Local municipalities – City of Split, City of Trogir, City of Solin and City of Kaštela which perform activities of local importance including culture;
- Scientific and research institutions – Center for Underwater Archeology and the University of Split that prepare research plans, site enhancement plans, conduct scientific research and perform scientific activities;
- Museums and other institutions – Museum of the City of Kaštela, Archaeological museum in Split, Museum of Croatian archaeological monuments, Croatian Maritime Museum in Split, Trogir City Museum, Public institution in culture *Zvonimir* Solin;
- Coast Guard/SDC Harbour Master's Office – responsible for general provisions for navigation in the area and the subsequent surveillance activities/responsible for the construction, maintenance, management, protection and improvement of maritime assets that represent the port area, etc.;
- Other relevant stakeholders – local heritage associations, local tourist communities and diving clubs.

The role of the Managing Authority must be versatile. It should be a central body for the preparation and implementation of future projects for the further protection and valorisation of the underwater cultural heritage. Also, it should represent a key body for communication between regional and local stakeholders and the Ministry. This will ensure easier man-

agement of underwater cultural heritage and a more streamlined way of conducting all research and protection activities. Together with the stakeholders, the body should identify the best ways for the enhancement and tourism development of the sites. In addition, for any kind of future activities on maritime assets that include cultural heritage, this advisory body should be informed if the activities can or cannot be carried out and/or what protection efforts should be carried out. In addition, public authorities should be also consulted with the body with regard to new spatial development plans and strategies.

Besides the Managing Authority, the vision is to establish the Museum of the City of Kaštela as the regional Centre for underwater cultural heritage. In this regard the Museum can organize and perform diving training and education courses, and certify future divers in collaboration with diving clubs. Moreover, as a Center, it will be responsible for arranging blue trails in diving sites and it could perform tourist diving tours to those sites during the tourist season. To this end, the Museum would purchase a boat to transport tourists and necessary diving equipment and/or glass-bottom boats for monitoring the seabed from above. The sites where diving is not allowed will be represented in the Museum using AR/VR technologies (virtual dives, on-land exhibitions). The activities will be versatile (daytime diving tours, snorkeling for children, night diving experience, etc.) and adapted to a wide range of visitors (students, children, people with disabilities, etc.) with adjustable prices/fees. To perform aforementioned activities, new employees should be employed, i.e., diving instructors, skippers (or another person who steers the boat), and diving tour guides. Accordingly, the staff will be responsible for the following:

- organizing education and performing diving training courses;
- issuing diving certificates;
- diving with the tourists *in situ* as a guide through the site, i.e. navigating the tourist through the blue trails set up;
- maintenance of the diving equipment and the blue trails;
- guiding tourists through their VR/AR experience.

Thus, the Museum becomes a leading institution in the implementation of projects on the topic of underwater cultural heritage of Kaštela Bay and the SDC region prepared and promoted by the Managing Authority.

Underwater centers/clubs also play an important role, as they are often the first to discover new sites and report them to the competent institutions. Currently, clubs must have the cultural property concession for marketing purposes or a license to dive such sites for their own purposes. Once the museum is established as a regional center, diving clubs will have to sign diving agreement contracts with an annual fee that will enable them to obtain permission to dive the sites. In addition, all diving activities will have to be reported to the Museum so that the number of dives, attendance at diving activities, and the number of participants in diving activities can be recorded. number of dives, site attendance, diving programs, and similar activ-

ities can be monitored in real time and maintenance activities planned accordingly.

In addition, it would be mandatory to take the Museum's dive guide. In this way, better control and management of underwater cultural sites can be established, which will improve their preservation and enable the development of their full tourism potential.

Consequently, to increase the visibility and promotion of the underwater heritage of Kaštela Bay and the Museum as an established regional center, it is important to develop a marketing plan. Such a plan should include market analysis, target groups, development of marketing goals, and promotion through various media channels, especially social networks. In addition, a public campaign should be launched in cooperation with local and regional tourism organizations, tourism agencies, sailing charterers, and other possible stakeholders.

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