5.2.4 TRANSNATIONAL TOOLKIT

The "invisible" heritage to the challenge of the valorization: the UnderwaterMuse Project Transnational Toolkit: Handbook of good 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. The premises and the 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), comprises 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 visible the invisible: port areas today below sea level, shipwrecks, underwater stratifications produced by the continuous frequentation of landings.

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 line 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.

In both ways, we can generate two outcomes: the safeguarding of the heritage itself, guaranteed by the citizens who learn to know it and recognize 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)

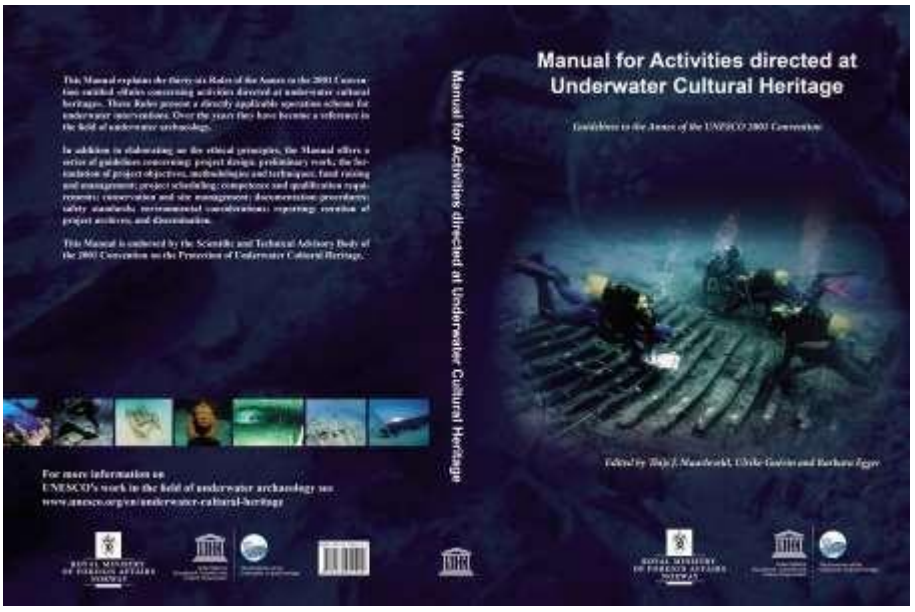


Fig.1: Manual for activities directed at underwater cultural heritage: guidelines to the Annex of the UNESCO 2001 Convention (https://unesdoc.unesco.org/ark:/48223/pf0000220708)

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

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 coherent 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).

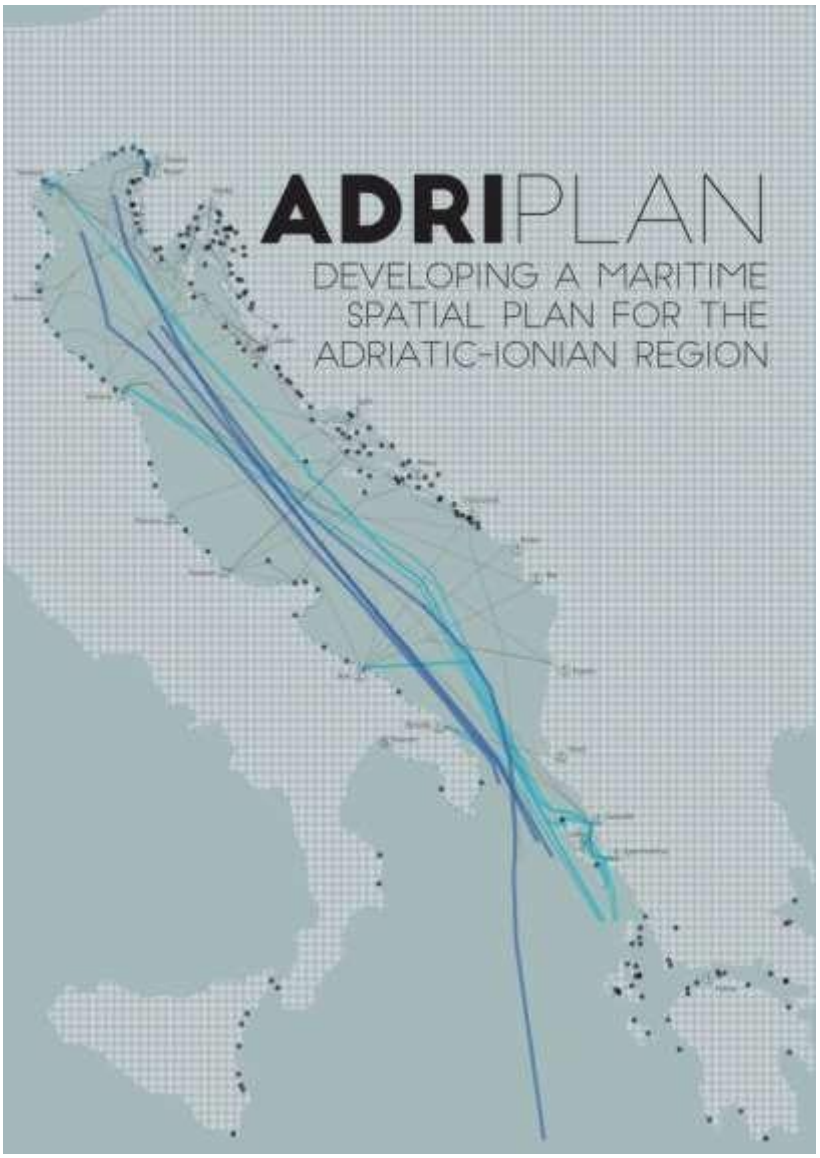


Fig.3: Maritime Spatial Plan for the Adriatic-Ionian Region (https://maritime-spatial-planning.ec.europa.eu/projects/adriatic-ionian-maritime-spatial-planning)

Furthermore, it is in perfect compliance with the **Maritime Spatial Planning** (**MSP**) process (fig. 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)).
There is a lot of potential for multi-use "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 in MSP?

- Ensure integration and cohesion of UCH planning with the plan of the wider marine area.
- Catalogue, designate and evaluate UCH sites. Determine level of protection (no go, highly protected, under research, open for recreational/educational purposes ...), utilisation character (for science, tourism, education, other) and Status of incorporation (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 which 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 of the *UnderwaterMuseMap portal* (http://mizar.unive.it/underwatermusemap/) and 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*".

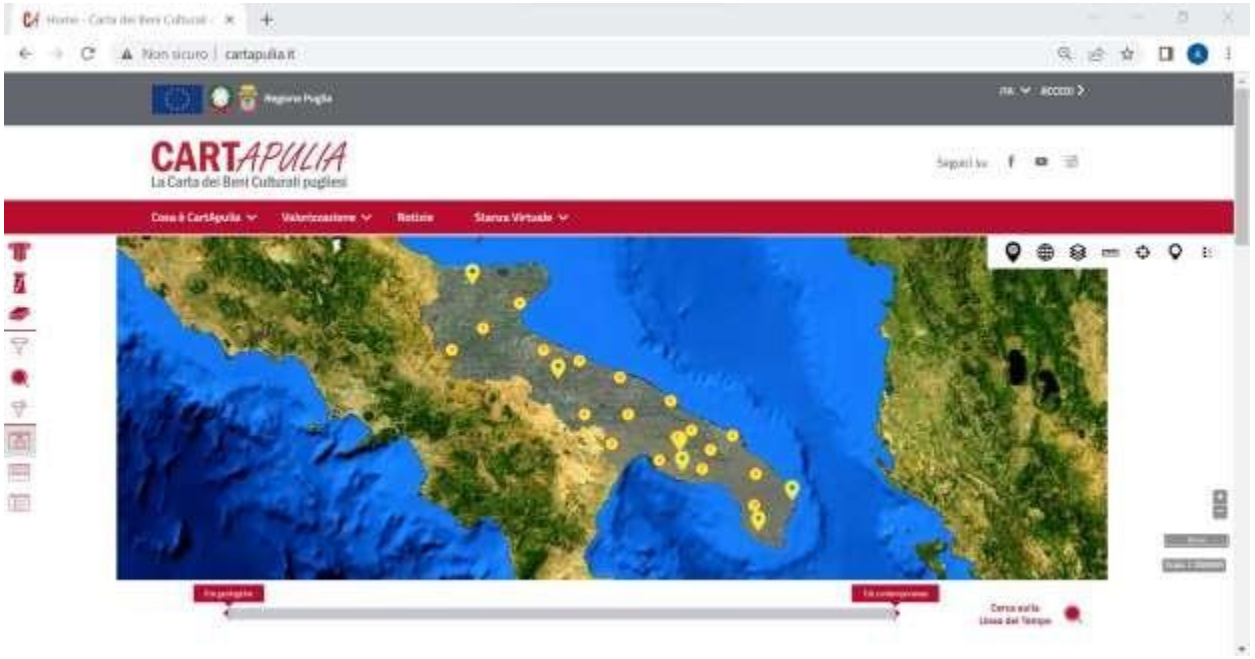


Fig.4: CartApulia home page (www.cartapulia.it)

2.2 UnderwaterMuse specific challenge

From the historical-archaeological point of view, the Adriatic Sea has been an unique basin, for millennia the priority transport link for people living on the seashore. Their transit left numerous traces in the seabed of the areas concerned by these ancient commercial routes, and ruins of landing places, harbors or inhabited villages by the sea remain.

Archaeological sites are an important tourist, economical and historical resource, yet a remarkable gap in the protection of underwater archaeological sites still exists.

Numerous sites along the Adriatic coasts are currently neglected and subject to constant destructions, illegal depredation, natural or anthropic destructive actions (trawling, modern harbour facilities, etc.).
The challenge of UnderwaterMuse — 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 and knowledge, totally according to the principles of the 2001 UNESCO Convention on the Underwater Cultural Heritage *in situ* conservation (Maarleveld et al. 2013). It occurs going beyond the natural and cultural heritage protection: heritage must be conceaved as productive economic activity with new solutions for long-term economic and social prosperity, developing new tourist attractions, diversifying activities in the protected areas, offering to local communities employment opportunities integrated into the local economy, introducing new management models through substantial participation of stakeholders.
The practices are very different between the two countries, despite they had often work together on the field.

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

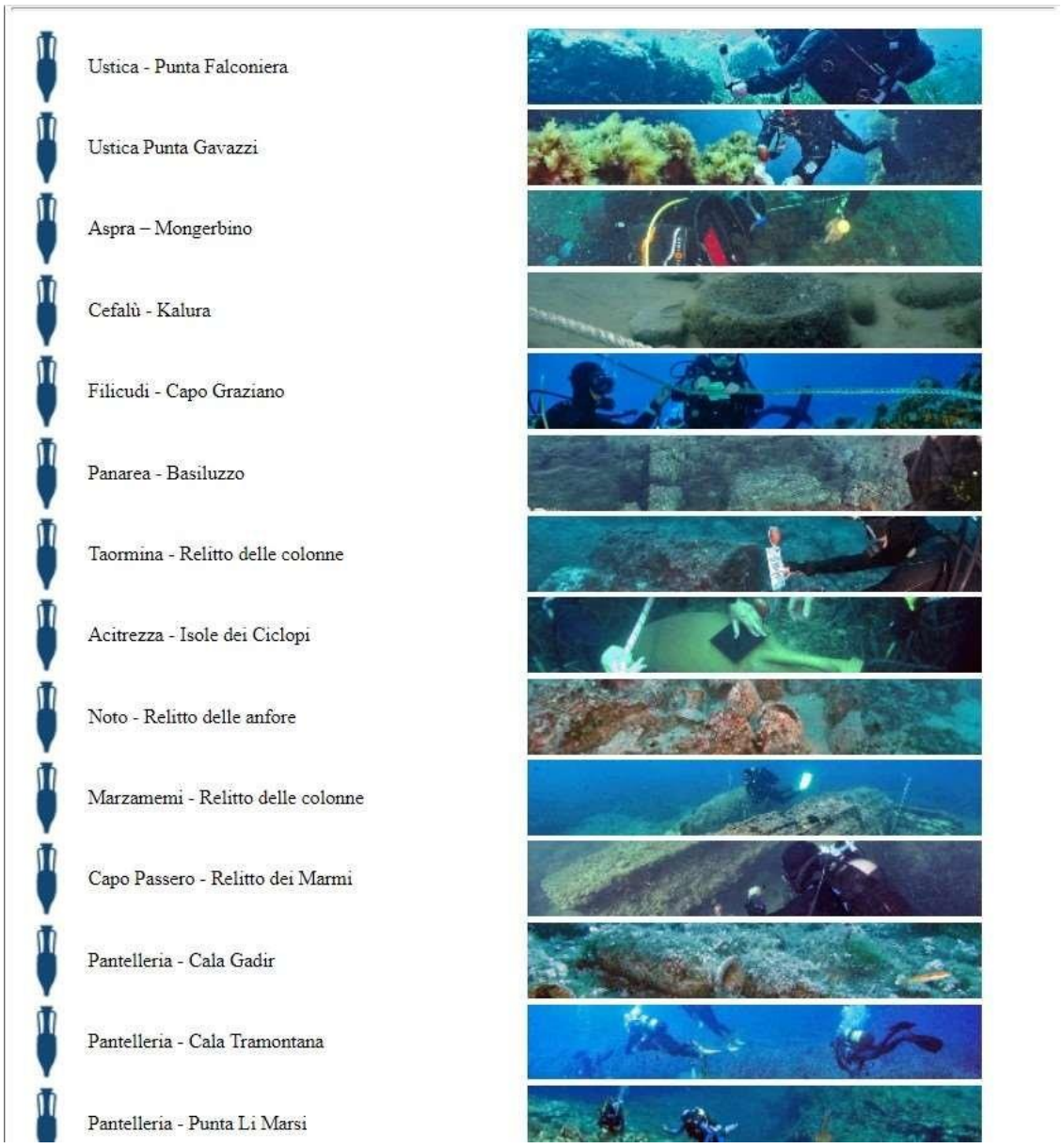
Fig.5b: Submerged Park of Baia (https://www.parcosommersobaia.beniculturali.it/mappa-di-baia-sommersa)

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

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 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 the Region of Sicily, which has a Superintendence of the Sea, has fostered the creation of numerous archaeological trails (figs. 7a-b) and the publication of scientific and informative material, related to the underwater tourism (Melotti 2007; www.regione.sicilia.it/beniculturali/archeologiasottomarina/itinerari).

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



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

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 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).

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)

However, acting only at the national/regional level is negative as it leads to a variety of regulatory and programmatic efforts towards what is actually a single common and shared resource, the Adriatic Sea. UnderwaterMuse has tried to overcome this fragmentation in cultural heritage policy with cooperation, pooling together resources, exchanging knowledge, sharing practices and working to guarantee

accessibility towards natural-cultural sites offering replicable solutions, engaging skilled professionals towards transmitting cultural heritage values, motivating people to acquire the knowledge to transform the silent past of a society in a captivating story.

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 '*UnderwaterMuseMap*', within which 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.

Repeatability in different areas is assured by the different typology of underwater sites chosen and the particular context of reference. The exploitation of the sites to their full-scale protection, reintegrating them into the local economy as a living and viable economic tourist activity. At the same time, new demand of cultural heritage usage is arising by young generations born in the information and globalization age.

The necessity of VR is also embracing the needs of a wider inclusion of diverse groups of people integrating creative thinking and innovative ideas in exploiting traditional cultural contents. An immersive VR approach renders underwater sites accessible to a wider public, including people with different kinds 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 heritages, guaranteeing an economic spin-off with their tourist-cultural promotion, 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 selected underwater archeological sites for pilot actions —Torre Santa Sabina, Grado, Resnik/Siculi – and other interventions (Venice lagoon, Porto Cesareo, Cesine, etc.) — are characterized by strong diversity: we faced both single contexts (the amphoras' cargo of Grado 2 shipwreck, for exemple) and pluristratified and complex sites/seascapes, with numerous and heterogeneous 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, “water scapes”.
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 dictated by **Seascapes archeology**, the contribution of different techniques and innovative technologies was crucial; **methodologies 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).
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 both different acquisition schemes (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 any operation 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 realized: nadiral images orthogonal to the site, in the same way 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 related to the camera calibration and the topographic survey (fig.10).

Fig.10: Porto Cesareo, Torre Chianca, wreck of the Columns. Underwater photogrammetric survey on (ph. UniVenezia -E. Costa)

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 topographic network, following the DSM (Direct Survey Method) technique (Rule 1989) or, thanks to the low depth and the nearness to the coast, with a total station or DGPS to achieve further control and accuracy (Beltrame, Costa 2017, Balletti et al. 2015, Costa 2022).

In 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 via total station side shot acquisitions from the shore. One scuba diver handled the prism to make it vertical before the total station measurements, with the help of an adjustable structure created *ad hoc* (fig. 11).

Fig.11: Torre S. Sabina, Carovigno (Br). Multi-image photogrammetry and topographic survey (ph. UniSalento)

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 was 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).
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 Ionian coasts of Salento, 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 in S. Giovanni locality - Le Cesine Nature Reserve, the Roman Imperial necropolis in Torre Chianca in MPA Porto Cesareo).

Fig.12: Torre S. Sabina, Carovigno (Br). Photogrammetric survey performed using UAS at Torre Santa Sabina (ph. UniSalento-F. Zongolo)

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 gained experience shows 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).

To recreate the virtual reality of the archaeological sites, Unreal 4 Engine software has been used, a cross-platform developed by Epic Games. The first step of the process concern uploading the 3D elaboration of the archaeological site and of the bottom created on the bathimetry 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 texturized through 3D CAD software, uploaded in UE4 and scattered with the Foliage technique.

During the final step, 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 following the real condition of the diving to maintain the nearness to the reality (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).

Fig.13: Grado 2 shipwreck virtual reality (E. Costa)

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 designed stations in 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 it happened also in Kaštela and Castromediano Museum (fig. 15).

Fig.14: Virtual navigation on Grado 2 shipwreck (E. Costa)

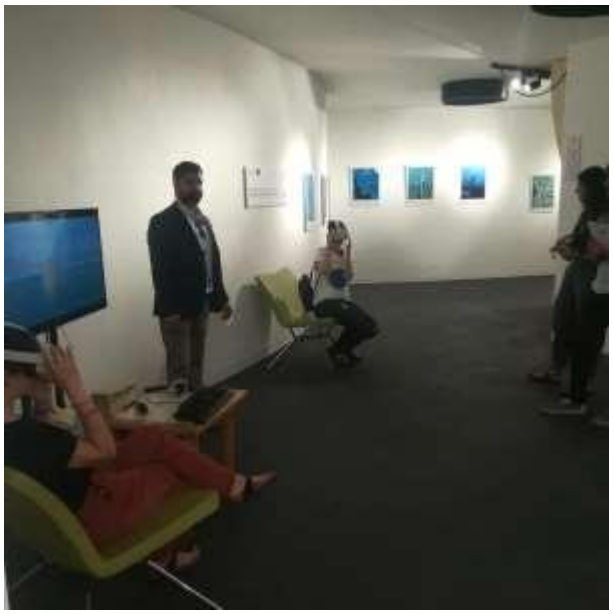


Fig.15: Immersive use of 3D app with Oculus Quest at the Castromediano Museum (ph. UniSalento

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 testing a sustainable tourist offer in areas less interested by major tourist flows.

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

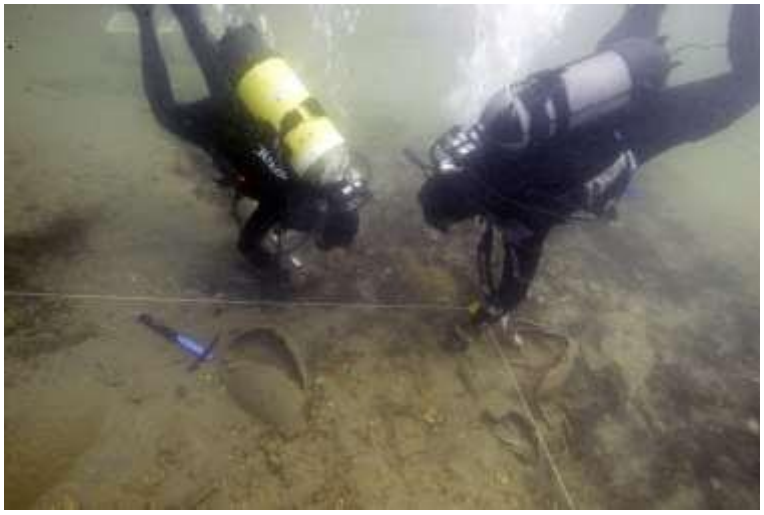
The activities in **Friuli Venezia Giulia** focused on the wreck of a Roman merchantship known as **Grado 2** (3rd century BC), which lies 7 miles off the coast of Grado and 19 m deep.

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).

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

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, prior to the foundation 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.



Figs.17-18: Grado 2 wreck. Phases of the underwater investigations

Fig.19: Grado 2 wreck. The underwater grids for covering, protecting and ensuring accessibility to the site

The pilot action made it possible to highlight the entire load, document it accurately (figs. 17-18), reposition the existing grids and add others (fig. 19), identical and to completely cover it, thus ensuring the protection and accessibility for underwater tourists. Excavation trenches were realized, verifying the deposit consistency and the lack of the hull's wooden remains.
The realization of the 3D model through the photogrammetric survey also allows for those who cannot or do not want to dive themselves 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 assist the protection bodies, as already happens in neighboring Croatia, in the enhancement of the site, through underwater guided tours, with modalities and protocols always developed within the framework of *UnderwaterMuse*.

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 millenary landing place is an ideal scenario 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 are also significant indicators of the coastal landscape evolution: cargos and hulls, but also remains of quarries and settlements (fig. 20).

Fig.20. Torre S. Sabina, Carovigno (Br) : aerial view of Camerini Bay (ph. UniSalento-E. Peluso).

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 valorisation 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 level, 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 vegetable materials, is exceptionally well-preserved: it has yielded a few stanchions, deck beams, as well as presumed remains of the hatch, elements only rarely preserved in wrecks (fig. 23).

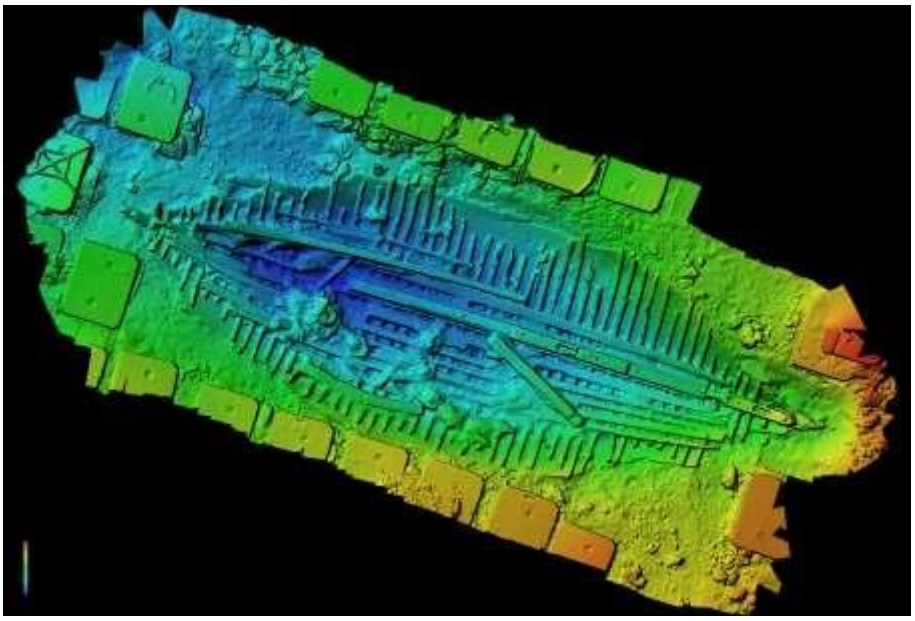


Fig.21: Torre Santa Sabina 1 wreck. DEM (UniSalento, Politecnico of Turin)

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

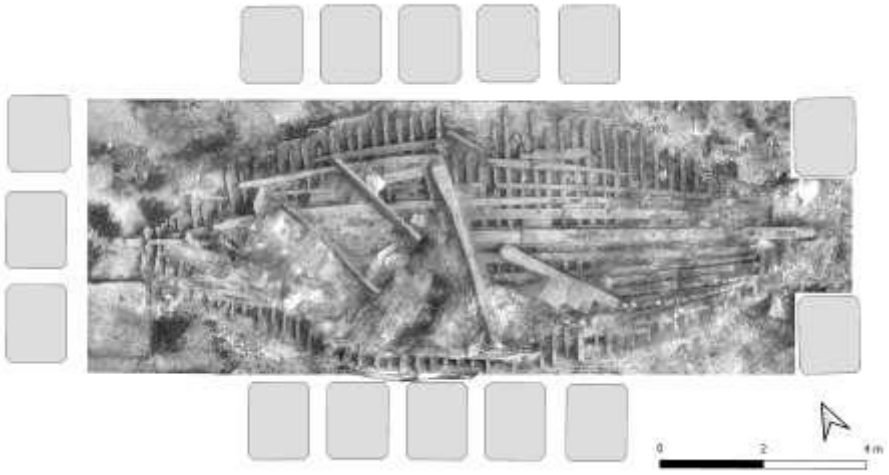


Fig.23a: Torre Santa Sabina 1 wreck. Orthophoto and details of the deck remains (ph. UniSalento – S. Notarangelo)

Fig.23b: Torre Santa Sabina 1 wreck. Orthophoto and details of the deck remains (ph. UniSalento – S. Notarangelo)

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 fragmentary, and various items in organic materials – hawsers, ropes, baskets, leather objects – belonging to living on board and equipment, as well as food remains, both faunal and botanical, found in the pump 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.

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

Other 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, result of repeated sinking epysodes over the centuries and the subsequent ovelapping of the scattered cargos in this "trap bay" (fig. 26).

The seabed of Torre S. Sabina will be transformed 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 for the exhaustive 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. UniSalento – M. Buccolieri)

4.3. Pilot Project in Resnik, Kaštela, Split County

Excavation and training activities of the pilot project were carried out in the locality of **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 stones and other materials, were recovered; above all, ceramic fragments from the ancient Neolithic, lithic artefacts and animal bones were found. Research confirms the presence of a Neolithic settlement in this area, which has been indicted by previous findings.

Fig.27: Resnik/Siculi. Aerial view of the site

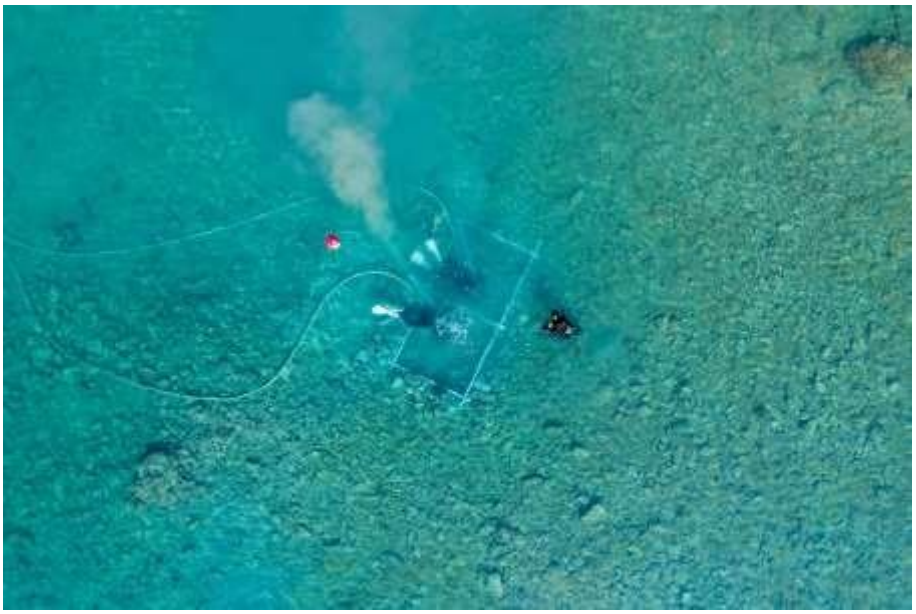


Fig.28a: Resnik/Siculi. Underwater excavation of the Neolithic settlement

Fig.28b: Resnik/Siculi. Underwater excavation of the Neolithic settlement

The other area subject to research is that of the late Hellenistic settlement (fig. 29), which shows a presence from the second to the first 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 extension 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.

Fig.29: Resnik/Siculi. Aerial view of the Hellenistic settlement

The third area coincides with the Roman port. Although the structures are clearly legible in aerial photos, it has never been investigated. This sector has returned most of the materials, datable between the 2nd and 5th centuries A.D. (fig. 30°-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: Resnik/Siculi. Excavation of the Roman harbour

Fig.30b: Resnik/Siculi. Excavation of the Roman harbour

4.4. Surveys in Veneto

The Department of Humanities 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.

Fig.31: Venice lagoon. Investigations of the archaeological sites (ph. UniVenezia)

Fig.32: Venice lagoon. Investigations of the archaeological sites (ph. UniVenezia)

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).

Fig.33: Venice lagoon. The poor visibility

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.
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 disability 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.

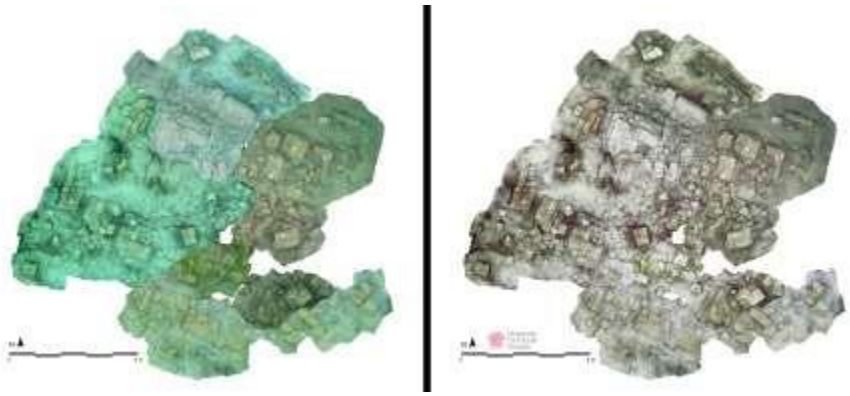


Fig.34a: Wreck of the Bricks. 3D model and VR environment in Caorle Museum

Fig.34b: Wreck of the Bricks. 3D model and VR environment in Caorle Museum

4.5. Surveys in Puglia

Surveys have been carried out in **several** coastal sites of Puglia in 2020–2021 within the UnderwaterMuse project. The activity conducted in 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 parallepiped 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 saltpan are along the coast, while an ancient road with stone foundation leeds from Lecce directly to the pier area; it is visible in some sections and in an aerial photo.

Fig.35a: Le Cesine, Vernole (Le). Submerged foundation of the Roman port complex at (ph. Uni Salento – R. Perrone)

Fig.35b: Le Cesine, Vernole (Le). Submerged foundation of the Roman port complex at (ph. Uni Salento – R. Perrone)

On the Ionian Sea, furthermore, in Porto Cesareo Marine Protected Area, new evidence has been added to the numerous ones already known, such as 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 Belvedere peninsula was already 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 markers of sea-level changes and the evolution of the seascapes.

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

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

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. Furthermore, the 3D models obtained in this way give life to digital storytelling, that could evolve further.

In both cases, Cesine and Porto Cesareo, the UnderwaterMuse researches and acquirements, inserted in the *UnderwaterMuseMap* portal and *CartApulia*, are object of the same protocol applied on the pilot project sites: the evolution in Underwater Archaeological Park (Porto Cesareo) and Blue Trails (Cesine), through targeted solutions.

It's important to point out that Porto Cesareo Municipality, on the basis of the previous researches and last UnderwaterMuse results, deliberated to start the project of realization of the coastal and underwater Park of Porto Cesareo.

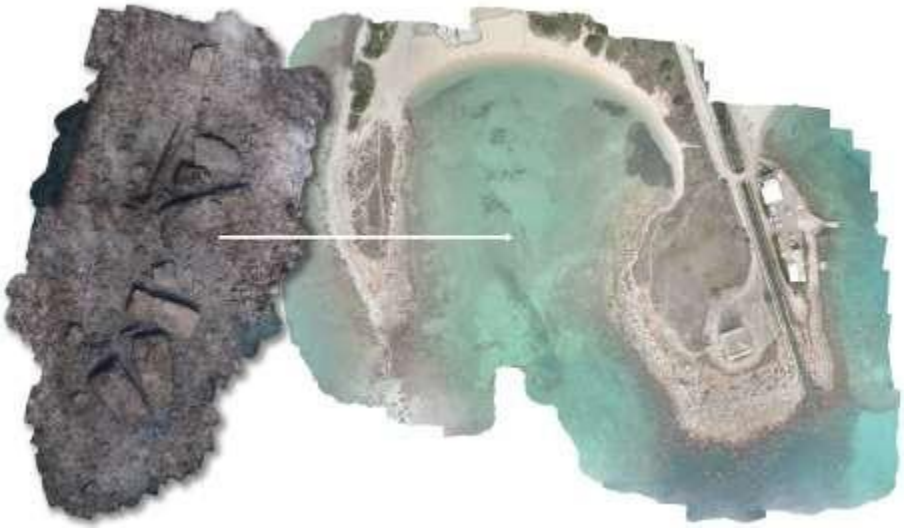


Fig. 38: Porto Cesareo MPA (Le). Drone photogrammetry of the submerged part of the Roman necropolis (ph. UniSalento – E. Peluso; el. L. Coluccia)

4.6. Cataloguing and Portal: UnderwaterMuseMap

The **UnderwaterMuse web portal**, implemented by the University Ca' Foscari 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 Spalato county) already or potentially accessible, conceived for the experts, the divers, but also for simple 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.

Thanks to a simple navigation on the digital map (fig. 40), it will finally be possible to access a historical heritage that has so far 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.39: Caorle, National Museum of Maritime Archaeology. The digital workstation of Underwatermuse project

Fig.40: Caorle, National Museum of Maritime Archaeology. Navigation of the UnderwaterMuseMap

Fig.41: The UnderwaterMuseMap from the website

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**, 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 introductory lecture on the site and the excavations conducted up to that point both on land and in the sea, lessons 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 didn't have previous experience were assigned to work with expert archaeologists.

At **Torre Santa Sabina**, administrations and local community supported the Project with concrete and spontaneous actions: the Carovigno Hoteliers' Association offered 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.

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 presence of the representatives of Puglia Region, involved regional Universities, Carovigno Municipality and large turnout of the public (fig. 42).

Fig.42: Carovigno, Dentice di Frasso Castle. Final dissemination event of the pilot action in Torre S. Sabina - 21.10.2021 (ph. UniSalento - xxx)

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 between Carovigno and Porto Cesareo, which met with great success with the public despite the difficult situation dictated by the pandemic (fig. 44).

Fig.43a: Torre S. Sabina, Carovigno (Br): open day on the site - 25.09.2021 (ph. UniSalento – E. Peluso)

Fig.43b: Torre S. Sabina, Carovigno (Br): open day on the site - 25.09.2021 (ph. UniSalento – E. Peluso)

Fig.44: Carovigno, Dentice di Frasso Castle. The Roads of Sand Festival (ph. UniSalento - xxx)

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

Fig.45: Grado. The working team and diving club members on the boat

Lastly, in 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 underwater heritage* (3 sessions, 24 lectures, 38 authors, filmed in live streaming 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 Tripolitanian 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). The successful experience represented the real first step for the birth and development of the Underwater Archaeological Park coinciding with Porto Cesareo MPA.

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

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

Fig. 47b: 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. UniSalento - M. Rugge)

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

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, among the Permanent museum exhibition (figs. 50a-b).

Fig. 50a: Kaštel Lukšić. The exhibition "Submerged Siculi" in the Museum of the Town of Kaštela

Fig. 50b: Kaštel Lukšić. The exhibition "Submerged Siculi" in the Museum of the Town of Kaštela

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 material found in previous underwater excavations were presented, as well as the material 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 smaller, popular booklet was printed, containing texts in Croatian, Italian and English.

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
- 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 announcement 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. Its final port became a man- made museum in nature (fig. 52).
The photo exhibition "*Underwater man-made landscapes*" was firstly presented during the Kaštela museum exhibition (fig. 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 participation of the winners of the contest (fig. 54).

Fig.51: Božidar Vukićević photocontest winner photo Fig.52: Loriana Marović photocontest winner photo

Fig.53: Kaštel Lukšić. The photocontest exhibition "Underwater man-made landscapes"

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 has been continued, to hopefully arrive at that model of participatory management in line with the objectives of the project and the shared intentions.

The first step for the involvement of local diving centers, whether they are sport clubs or tourist diving centers, is their training. With this assumption and following the pilot project of Grado 2, which saw the participation of diving clubs' members during the field activities, a "heritage education" project has been carried out, aimed at making diving members and other possible stakeholders to know both the Grado 2 site and other submerged sites in the Region and to formulate a possible offer to use them through the same clubs. The recipients of this training project were about 25 divers belonging to the sports clubs of the region (Circolo Sommozzatori Trieste, Gradese sub, Centro Pordenonese diver, CSU-Centro diver Udine, etc.), diving centers and Marine Protected Area of Miramare; participants were accompanied by two underwater archaeologists. Accompanying divers who are passionate about archeology or underwater tourists interested in culture provides for the knowledge of the submerged sites and modalities of approaching them correctly. 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).

Fig.55: Grado (Go). Diving training. Theoretical workshop (ph. Informest – C. Pizzinato)

Fig. 56: Muggia, P. Sottile (Ts). Diving training. Guided visit on archaeological sites for regional diving clubs and centers

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 articulated in the subsequent modules:

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

We must premise that the cultural heritage of the seas of Puglia is under the supervision and jurisdiction of the 3 territorial Superintencies Archaeology, Fine Arts and Landscape of the provinces of Brindisi and Lecce, Barletta-Andria-Trani and Foggia, Metropolitan City of Bari. Furthermore, the most relevant interlocutor in Italy for policies and strategies regarding UCH is the **National Superintendency for Underwater Cultural Heritage**, established in 2019. It has its headquarters right in Taranto and operational centers 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 Code of Cultural Heritage and Landscape, as well as the Law no. 157/2009, concerning the ratification and implementation of the UNESCO Convention.

Over half a century of uninterrupted underwater research is the **record** which Puglia can boast of over other regions. Thanks to its continuous and passionate commitment which has culminated in **national and international projects** conducted by the Region's universities, vast stretches of coastline and the 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 governance of the Centre is the fruit of an **agreement** between the Regional Department, the three Universities and the National Superintendency for the Underwater Cultural Heritage on a participatory process of knowledge and heritage enhancement through specific projects and concrete measures.

6.1.2. Operational & Management Framework proposal

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

1. Signing of a Programmatic Agreement

The involved Institutions 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 Torre S. Sabina Managing Autorithy and its duties, the entity which seems to better respond to this role is the ESAC, for its own institutional mandate. The Euro-Mediterranean Center has, between its own finalities, "*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 involved parties

- **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.
- **Carovigno Municipality** undertakes to collaborate with the other parties for the upgrade of Dentice di Frasso Castle Museum and archaeological sites of the territory at uniform levels of quality for the enhancement of museums and places of culture of public belonging, adopted with D.M. of 21 February 2018, for the recognition/accreditation in the National Museum System of museums of regional relevance. Furthermore, it undertakes to make available a light and removable structure as logistic base on the beach for the tourists, briefing and de-briefing and diving equipment, as well as reserved parkings for the visitors' cars.
- **Libraries&Museums Hubs – Apulia Region** is the entity in charge for the establishment and development of Regional Museum and Place of Culture System and for the regional policies of integrated valorization. It undertakes to put concrete measures and human and financial

resources, according to the Regional Planning, at disposal for the Operational and Managing Framework.

- **University of Salento – Department of Cultural Heritage** undertakes to give 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 for the implementation of the policies of the Puglia Region in the field of tourism promotion, could give its consulting to the Managing Authority for 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, etc.

b. Management Framework guidelines

Following 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 with 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 the knowledge through concrete measures and communication to visitors the specific and unique characteristics of the area;
- responsible and sustainable tourism as well as experience tourism, capable to satisfy a wide range of personal needs, from pleasure to a search for meaning, and to boost the network of the community resources, exploiting the existing assets and creating new opportunities in the reference area of Torre S. Sabina (Brindisi, Carovigno, Regional Reserve and MPA T. Guaceto, 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 counteract also reckless 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

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, 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 provided of sensors, etc.; see below).

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

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 in 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 accredit 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 responsibles.
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 breafing 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 (amphoras, 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, in the Carovigno Castle Museum the permanent exhibition 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 place, 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 how the archaeological remains have looked 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. Offered services

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 (but we are still waiting for the musealization of the wreck himself), 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: topographical surveys on land and at sea* (2004–2007), during which Preroman and Roman structures, partially or totally submerged between the mouths of Timavo and Pirano, were studied, to re-draw the coastal settlement and the 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*.

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 for citizens and stakeholders operating in the territory, an archive good for knowledge, social-cultural-economic development, territorial planning and safeguard.

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).

Touristic or cultural websites or social networks, dedicated to the underwater cultural heritage, are unknown.

ERPAC FVG, according to the Regional Law 2/2016, is appointed to promote the development of projects of significant regional interest for the enhancement of cultural heritage and to participate in initiatives carried out in collaboration with bodies and sector organizations operating at European and international level, also for the purposes of accessing Community funding on the subject.

On 2021, 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 Roman Grado 2 shipwreck as well as at the enhancement and dissemination of the regional underwater heritage.
In particular, pursuant 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 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 conduct guided tours and carry out site monitoring and maintenance activities.
The aforementioned "heritage education"/diving training project (p. 5.4.1) has been carried out on the basis of this Agreement, aimed at making diving members and other possible stakeholders to know both the Grado 2 site and other submerged sites in the Region and to formulate a possible enjoyment of them through the same clubs.

6.2.2. Operational & Management Framework proposal

The involved parties must put in place a **participatory process** through a series of Thematic Tables and Services Conferences; during the process, they share the various roles and duties and establish 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 involved actors:

- **ERPAC**, which assumes 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, responsible for 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 will undertake to 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.

Each part appoints its internal representative for the **Management Committee**, supporting the Managing Authority and approving 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

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: set-up of surveillance system through technological innovative tools, such as, for example, the NOUS Undersea Vision Surveillance System (see above);
- site dissemination: it must implement an integrated communication plan, including visual identity, website, social networks (Facebook and Instagram), reservation portal for booking guided visits (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 experiencing the virtual diving on the wreck by all visitors and non-divers.
Finally, it can train and accredit underwater archaeologists 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. Participatory writing of the site regulations

The writing of Site Regulations should be acted also in a participatory way, inside 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) no profit diving clubs and associations, whose social object provides for teaching activity according to national structures standards;
b) diving and commercial enterprises, whose social object includes entrepreneurial activity of underwater tourism;
c) autonomous visitors with diver license.
The diving centers which intend to carry out guided tours will have to submit instance or simply communicate the diving.
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; 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 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 responsibles.
The diving clubs and centers will be flanked and supported in diving by underwater archaeologists or biologists, accredited by ERPAC, 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 breafing indicating the biological, geomorphological and archaeological peculiarities of the itinerary as well as the behavioral rules to follow in immersion.
The visits should have to respect a guide-sub ratio, to be defined also in the regulations (not more than 1:8).
The regulations could include also the enjoyment of the land Grado Museum: only one ticket including underwater tour and Museum guided visit; 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 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 Property was enacted 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 property (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. Nevertheless, 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 assure the necessary, quality and proper exploration or preservation of the sites. In light of the aforementioned, the Action plan (AP) is not limited to the project area alone, but the objectives and measures are relevant to the area of SDC. The same are the basis for future projects and actions in the area of underwater heritage exploration, preservation and lastly tourist valorisation. Key to achieving the set goals in the AP are the funding opportunities from the new programming period 2021–2027 and the participatory approach of all relevant stakeholders, beginning with the responsible Ministry of Culture and Media, SDC, involved municipalities, scientific institutions, diving clubs and other relevant stakeholders.

Additionally, 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 Italy, in Croatia all activities regarding the research, preservation and valorisation of the cultural property 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, relevant 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 preventatively protected and some are only recorded. Also, there is the question of ownership, where according to the Croatian law the cultural goods can be private property. For example, the project area Resnik, 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 should 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. Thus, ensuring easier management of the underwater cultural heritage and easier performance of all research and protection activities. Together with the relevant stakeholders, the Body should devise the best ways for the tourist valorisation and development of the sites. Moreover, for any kind of future activities on maritime assets which include cultural heritage, the advisory Body should be inquired whether the activities can or can not be performed and/or what protective activities must be performed. Also, the public authorities should be consulted with the Body regarding new spatial and 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. As such 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. For that purpose, the Museum would acquire a boat for tourist transportation 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 (day 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. Correspondingly, 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 set blue trails;

- maintenance of the diving equipment and the blue trails;
- guiding tourists through the VR/AR experience.

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

Diving centres/clubs also play an important role, given that they are often the first to discover new sites and report to the higher institutions. Currently, the clubs must have concession over cultural goods for commercialization purposes or license for diving in such sites for their own purposes. Once the Museum is established as the regional centre, the diving clubs would have to sign diving agreement contracts with an annual fee that will enable them the diving permit for the sites. Additionally, all diving activities would have to be reported to the Museum so that the number of dives, attendance at the site, diving schedules and likewise activities can be monitored in real-time and consequently maintenance activities planned. Also, it would be mandatory to take Museum's diving tour guide. This way, better control and management will be established upon underwater cultural sites that will enhance their preservation and enable the development of their full tourist potential.

Correspondingly, for increased visibility and promotion of the Kaštela Bay underwater heritage and Museum as an established regional centre, it is important to develop a marketing plan. Such a plan should include market analysis, target groups, development of marketing goals, and promotion through different media channels, especially social networks. Also, a public campaign should be launched in cooperation with local and regional tourist communities, tourist agencies, sailing charters and other possible actors.

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Captions:

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)
Fig.3: Maritime Spatial Plan for the Adriatic-Ionian Region (https://maritime-spatial-planning.ec.europa.eu/projects/adriatic-ionian-maritime-spatial-planning)
Fig.4: CartApulia home page (www.cartapulia.it)
Fig.5a-b: Submerged Park of Baia (https://www.parcosommersobaia.beniculturali.it/mappa-di-baia-sommersa)
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)
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)
Fig.10: Porto Cesareo, Torre Chianca, wreck of the Columns. Underwater photogrammetric survey on (ph. UniVenezia -E. Costa)
Fig.11: Torre S. Sabina, Carovigno (Br). Multi-image photogrammetry and topographic survey (ph. UniSalento)