

Underwater Cultural Heritage Management on In-Situ Preservation and Training Courses for Diving Community in Taiwan

Pin-Wen Chenn (Taiwan University)
Tzu-Chia Huang (Tamkang University)
Chen-Fen Huang (Taiwan University)
Jin-Yuan Liu (Tamkang University)

ABSTRACT

The awareness of protecting the Underwater Cultural Heritage (UCH) has grown over the past decades around the world as well as in Taiwan. In-Situ preservation is the international principle of management and protecting the site. Following the UNESCO 2001 UCH Convention, Taiwan passed the Underwater Cultural Heritage Preservation Act in 2015. Since then, there have been 6 listed shipwrecks and over 90 potential targets were found by the underwater archaeology team of Academia Sinica. Different approaches in each sites' management depend on the environment and material such as wood, metal or even bones, and as the result, a practice of setting up an environmental database, implementation of a regime of regular underwater observation by divers or unmanned underwater vehicles, and oceanic dynamic monitoring should be adopted. In 2020, despite many difficulties, a research project focused on these related issues for scuba diving instructors took place in Taiwan. This included a 4-day workshop, during which time the instructors had access to Professor David Gregory via webinar. This article aims to present the result of the research and the result of the training workshop.

Key words: Underwater Cultural Heritage Management, In-situ Preservation, Protection and Monitoring, Training Courses

INTRODUCTION

UNDERWATER CULTURAL HERITAGE MANAGEMENT IN TAIWAN

The Bureau of Cultural Heritage (BOCH) has entrusted the *Academia Sinica* to build an underwater archaeological team since 2006. In 2015, the *Legislative Yuan* finally enacted the *Underwater Cultural Heritage Preservation Act (UCHP Act)* to preserve and protect the underwater cultural heritage around the territorial sea around Taiwan. Over decades, there are six listed shipwrecks (Table 1), 20 identified remains (including metal or wooden shipwrecks, even animal fossils from the late Pleistocene period), over 90 potential targets to be recognized, and more sites to be found in the future. Thus, the corresponding author and also the principal investigator, Profs. Jin-Yuan Liu, and Chen-Fen Huang conducted a research project using the sites of ‘*General Number One*’ and ‘*Warship Guang Bing*’ as examples to demonstrate the UCH management procedure in Taiwan (Liu et al., 2018).

Six Listed Shipwreck in Taiwan				
No.	Sites	Depth	Location	Dating
1.	<i>Warship Guang Bing</i> (廣丙號防護巡洋艦): Qing Protected Cruiser	15-30 meters	Southeastern Jiang-Juen Yu (將軍嶼), Penghu Islands	1895
2.	<i>General Number One</i> (將軍一號): Merchant vessel	21 meters	General Yu (將軍嶼), Penghu Islands	Mid Qing dynasty.
3.	<i>S.S. Sobraon</i> * (蘇布倫號): Steam sailing ship.	14-18 meters	Chicken Rock (雞礁), Dongying Township	1901
4.	<i>Green Island One</i> (綠島一號): Merchant Vessel	27-40 meters	Near Nan-Liao Bay, Green Island	Mid 19 th century
5.	<i>Ymanafuji Maru</i> (やまふじ丸、山藤丸號): Japan Transport Ship	9-52 meters	Southeastern Lung-Men Port (龍門港), Penghu Islands	1942
6.	<i>S.S. Bokhara</i> (博卡喇汽輪): British Steam Ship	5-14 meters	Ku-po Yu (姑婆嶼), Penghu Islands	1892

Table 1: Listed Shipwrecks in Taiwan.

Based on the previous research, the project assigned by the BOCH aims to summarize the related researches, discuss the training courses with Dr David Gregory and held a 4-day workshop. Both theoretical and practical training courses will help to cultivate the potential talents from the diving community and to raise awareness of the In-Situ preservation of UCH.

IN-SITU PRESERVATION RESEARCH

IN-SITU PRESERVATION

In-Situ Preservation refers to preserving an underwater cultural heritage in its original location on the seafloor, and it is one of the four main principles of the *2001 Convention*. In Taiwan, chapter 4 of the *UCHP Act* mentions “*The preservation in situ of underwater cultural heritage shall be the first option before allowing or engaging in any activities directed at this heritage.*” The Manual for activities directed at UCH further explained the four reasons for In-Situ Preservation should be the first option: The site of a historic event is authentic, the context defines significance, heritage is finite, and many sites cannot be preserved in situ (Maarleveld et al., 2013).

The Training Manual for the UNESCO Foundation Course on the Protection and Management of Underwater Cultural Heritage in Asia and the Pacific (Asia-Pacific UNESCO Training Manual) considers sustainably that ‘our maritime past has to be preserved for future enjoyment and research’, and the author Manders points out that three threats to the underwater archaeological sites. First, physical-mechanical by water and human activity. Then, the biological threat is related to oxygen and biological deterioration such as marine borers, fungi and bacteria. Last, the chemical threat is usually in an oxygen-rich environment. But even under anaerobic conditions, the organic material or iron can also corrosion such as Iron sulfide.

RELATED EU-PROJECTS

Based on the EU-MoSS project in 2004, Manders summarises the pros and cons of the different techniques for in-Situ preservation: sandbags, sand deposition, road barriers, artificial seagrass, and geotextiles in *the Asia-Pacific UNESCO Training Manual* (Manders, 2012). For the actual processes that threaten and the techniques for In-Situ preservation, some of the previous EU-founded projects such as *MACHU* in 2000, *MoSS* in 2004, *Wreck Protect* in 2011 and the *SASMAP* in 2015 could provide direction. The information and objectives of each project could be found in Table 2. The guidelines of *SASMAP* were translated into Chinese in 2017.

Project	Objectives and achievements
MoSS: Monitoring, Safeguarding and Visualizing North-European Shipwreck Sites. (2001-2004)	To increase the awareness, protection and management of the UCH by developing the practices in safeguarding, monitoring and visualizing the sites.
MACHU: Managing Cultural Heritage Underwater. (2006-2009)	Constructing a GIS-based Decision Support System, a database with archaeological and historical data from the sites and environment, to provide the information about UCH for academic purposes, policymakers and the public.
Wreck Protect (2009-2011)	Predicting the threat of the spread of <i>Teredo navalis</i> both today and in the future. Protecting wooden shipwrecks and other submerged archaeological heritage In-Situ.
SASMAP: Development of Tools and Techniques to Survey, Assess, Stabilise, Monitor and Preserve Underwater Archaeological Sites. (2012-2015)	Developing new technological tools and practices to survey, assess, stabilise, monitoring and preserve underwater archaeological sites. Understanding the presence and extent of potential threats to an archaeologist from the large-scale regional level to the local site level, and find a cost-effective method for the stability of the site.

Table 2: Project Objectives.

CONSERVATION AND MONITORING RESEARCH IN TAIWAN

During 2016 – 2017, related research was accomplished by National Sun Yat-sen University based on the following three references: *SASMAP Guideline*, *the Asia-Pacific UNESCO Training Manual*, and *the NAS Guide to Principles and Practice*. They used two sites ‘General Number One’ and ‘Warship Guang Bing’ as examples (see Table 3). The practices include desk-based assessment, using ROV (Remotely Operated Vehicle) for photogrammetry of the sites, using side-scan sonar and sub-bottom profiler for collecting acoustic information, taking sediment samples to analyze the marine geology and setting the baseline database for future research (Tian et al., 2017).

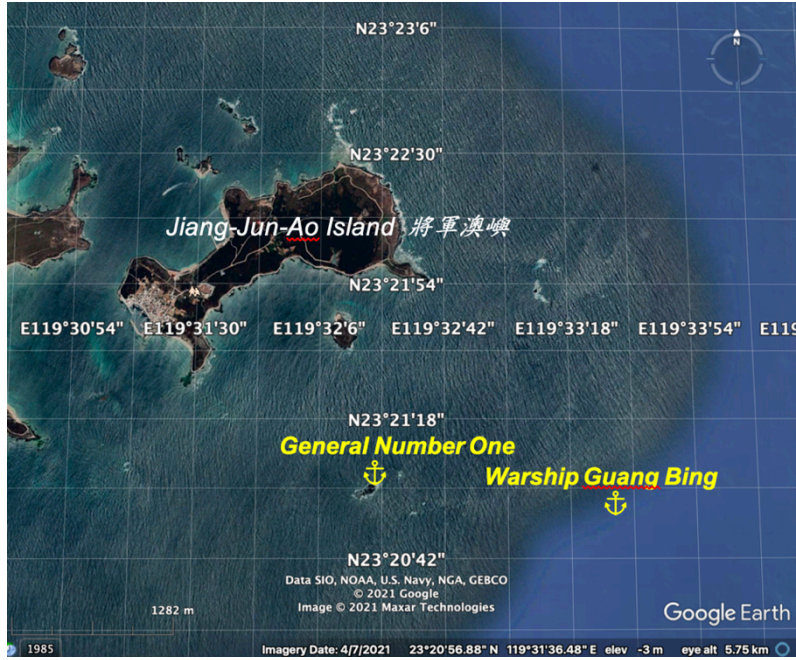
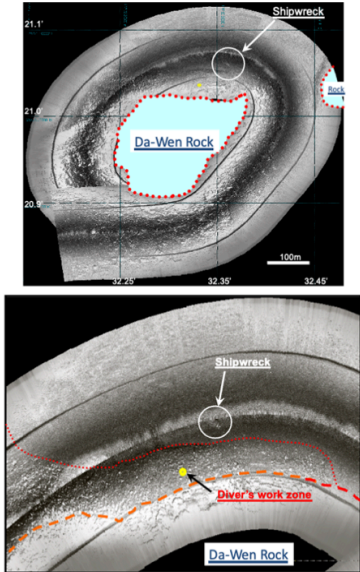
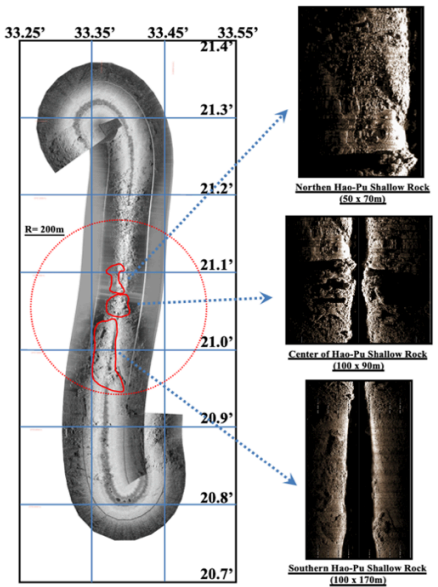
Site	General Number One	Warship Guang Bing
Location		
Length*Width*Depth	25*9*21	200m radius from site centre
Historical background	Merchant vessel of Chinese Fir from Fuzhou, sunken around mid-Qing Dynasty.	iron-hulled protected cruiser launched in 1891, it was aground in 1895.
Displacement	350 tonnages	1,030 tonnages
Cargo and the remains	Mainly bricks, tiles, ceramics with lustrous brown glaze (醬釉).	Remains were scattered around, covered by coral. (Lee, 2015)
Side-scan Sonar Image	 Side-scan sonar image of General Number One shipwreck and the seabed around. (Tian et al., 2017)	 Side-scan Sonar image of Warship Guang Bing shipwreck Site. Center Location : 23° 21.056' N / 119° 33.388' E.

Table 3: Example Entry.

Threats from the economic exploitation in aquatic development work is increasing during these years, especially the ongoing offshore wind power field in western Taiwan sea. According to *Regulations Relating to Underwater Cultural Heritage Surveying and Processing Prior to Water Area Exploitation and Utilization* announced in 2020, with the purpose of preventive archaeology, each work affecting the seabed should be evaluated the potentiality of UCH. As a result, there will be a predictable gap and necessary demand for future labour requirements. The research conclusion suggests that BOCH needs to prepare for both training courses, set both short- and long-term goals, and continue the works in preservation and monitoring of the sites each year. It would be better to choose a site and adapt methodologies of conservation to its condition. Furthermore, BOCH will develop an effective standard operating procedure for UCH management in the not far future. This procedure would be an important and necessary stepping stone for the sustainable management of UCH in our country (Liu et al., 2018).

2020 PRACTICAL TRAINING WORKSHOP IN TAIWAN

If the coronavirus epidemic didn't happen last year, we would be able to invite experienced experts from aboard and plan a training workshop near the *General Number One* site. Instead, via webinar with Dr. David Gregory. We exchanged the practical training experience of in-situ preservation and the latest methodologies in august. Then, a 4-day practical training workshop was held and recruited 25 diving instructors from different backgrounds in October. The workshop promoted UCH by both theoretical and underwater field training. From the reflections of the participants, the workshop did achieve its educational purpose.

WEBINAR WITH DR. DAVID GREGORY

In the first part of the webinar, we discuss the alternative plan for the training workshop. After that, in the second hour of the webinar, we invite Dr. Gregory to discuss practical training courses and the investigation experience. He highlighted that the in-situ preservation relies on the stability of the environment around the site. During the SASMAP project, there was a rapid increase while using the artificial seagrass in the Baltic Sea. But in different projects, sometimes mussels grow fast on the artificial seagrass, and the artificial seagrass didn't catch enough sediment. He summarized five fundamental steps for responsible management and in situ preservation from the previous researches that the extent of the site; the physical, chemical or biological threats to the site; The condition of materials on-site of preservation; strategies to mitigate deterioration and stabilization of the site from natural impacts; following monitoring of the site and the subsequent. For the field training, he suggested the team be better under six members: two laying and two stabilize the geotextile, the rest of the people taking sandbags and put them on the covered site.

Consider the following field training for the diving community is not vocational training but more an educational workshop. He suggests that the ideal working zone could be within 5 meters, and members with Open Water Diver certification, could also participate. This also considers diving security. As for the future research suggestions, he mentioned that before they used a pine ball, half under sediment and half in the water, to understand the environmental erosion; they used zinc (anodizing) or other sacrificial methods to protect the metal shipwreck. In his latest project

(Gregory, 2020), he took some sediment core samples from the site and measured the dissolved oxygen and hydrogen sulfide in them. The main reason for the deterioration of organic materials (such as wood) in marine sediments is related to the percentage of oxygen, indicating either an *oxic* or *anoxic* environment. This could give more understanding of the post-depositional formation processes on the sites.

4-DAY TRAINING WORKSHOP: BOTH THEORETICAL AND PRACTICAL COURSES

Initially, the project was designed to continue study at *General Number One*, but considering the listed site is under the protection of the *UCHP Act*. Another backup location in Badouzi Chaojing Park, northern Taiwan, was not ideal for diving due to the upcoming monsoon season in late September. Finally, the workshop took place from 13 to 16 October in Hengchun, which means “always spring” in Chinese, located in the south of Taiwan. There were 25 participants who own at least the diving certification as instructors, and they came from educational institutions recommended by different diver certification organizations and cultural heritage researchers. After participating in all the courses in the workshop, they will receive a certification of learning hour by BOCH.

The total theoretical teaching hours are 13 hours constituting 12 different lectures during four days which included the introduction to UCH, understanding of in-situ conservation, *UNESCO 2001 Convention* and *UCHP Act* in Taiwan, code of ethics for the diving community, local maritime history and shipwreck stories, management of UCH, utilization of ROV in UCH research, recreational diving and the underwater archaeological museum, development of UCH protection in Taiwan etc. Collecting and deducing from the workshop feedback, up to 48% of people chose ‘Extremely Satisfied’, and 52% chose ‘Very satisfied’ about the course design. The workshop created the conservation awareness of UCH. Many of them didn’t know about the UCH or the difference between excavation and salvage. But now they wish the BOCH could have further advanced courses in the future (Liu et al., 2021).

PRACTICAL TRAINING

The main purpose of the practical training was to experience how the underwater archaeologists do the conventional survey, measure and record the site, lay the geotextile, put the sandbags to stabilize it and lift the items via Lifting Bag. Among many covered materials, we chose the geotextile for the practice. Because the artificial seaweed cannot be purchased and needs handmade, the plastic material might cause pollution. We had also considered other local materials such as scouring pads, but it is way too expensive than geotextile. For the preparation, the geotextile was soaked in water for 8 hours to reduce positive buoyancy. First, the on-land training courses were taught by Mr Huang Han-Zhang, the field leader of the underwater archaeology team of Academia Sinica. He shared his field experience that *Green Island One* is covered by propylene mesh and lay sandbags above for in-situ preservation. They totalled four dives during two days, at a depth of around 10 – 14 meters with the visibility up to 10 meters. All 25 divers were divided into four groups, and each dive for each group had different goals, and they took turns on the next dive. At the end of each day, the divers need to write in their diver’s log and hand it over to the organizer.

From the feedback about the practical training, some people think the field training could be more of a challenge; some people suggested that there could have a target like an artificial reef or simply a fake ceramic to draw and measure; some people noticed that related training could combine with their existed diving courses and therefore this UCH knowledge could be shared to more people in the diving community. From the feedback, 48% of participants consider the workshop is ‘Extremely helpful’, and 43% of people think it is ‘Very helpful’ that the workshop did help with their professional career development (Liu et al., 2021). From learning how archaeologists work during excavation to protect the site after survey, this time, the educational workshop for the diving community is productive.

CONCLUSION AND FUTURE WORK

The outcome of this project built up a research team and grouped talents from cross-disciplinary backgrounds. Each year, there are different educational projects to promote UCH knowledge. Considering many divers are interested in related issues, it would be a win-win situation for protecting UCH to cooperate with the diving community. As the time capsule of UCH, in-situ preservation is the principle. Based on previous research and experiences abroad, a training workshop was designed to focus on In-situ preservation practice. The main purpose of the workshop is for educational promotion rather than professional career training.

Around Taiwan, there are six listed shipwrecks, 20 identified targets and over 90 potential sites found by the underwater archaeology team of Academia Sinica. Each year, there are even more UCH found. Those existing underwater archaeological sites need to be monitored and preserved in a sustainable way. Then, based on different materials of the sites, such as wooden hulls or metal shipwreck, it would be better to have mid- and long-term researches to understand these site conditions. Different management approaches in each site depend on the site condition and material such as wood, metal, or even bones. As a result, setting the environmental database, regular underwater observation by divers or unmanned underwater vehicles, and ocean monitoring should be adopted in the future.

Acknowledgements

The Bureau of Cultural Heritage sponsored the project. The authors are indebted to Dr. David Gregory, Dr. Chris Underwood, Prof. Dr. Akifumi Iwabuchi, Section Chief of BOCH Hon-Long Lin 林宏隆, Dr. Ying-ying Tun 董盈穎, Dr. Zhuo-mou Wen 溫卓謀, Dr. Chi-lin Lee 李其霖, the Underwater Archaeology Team of Academia Sinica, Mr. Han-Zhang Huang 黃漢章, Captain Bo-Qi Cao 曹伯琪, Mr. Bo-Wei Chen 陳伯瑋, M. Zhi-Qin Xu 許至欽, Mr. Xi-Yao Gao 高璽堯, Kenting National Park 墾丁國家公園管理處, CJ Blue Bay Diving Center 旗艦藍海灣潛水度假村, and people who assisted last year. The project would not have been possible without their help and support.

Bibliography

- Bowen, A. (Ed.), 2009. *Underwater Archaeology: The NAS Guide to Principles and Practice*, 2nd Edn. Wiley-Blackwell, Oxford.
- Gregory, D., 2020. Characterizing the Preservation Potential of Buried Marine Archaeological Sites. *Heritage*, Vol. 3(3): 838-857.
- Gregory, D. and Manders, R. M. (Eds.), 2015. *Best Practices for Locating, Surveying, Assessing, Monitoring and Preserving Underwater Archaeological Sites, SASMAP Guideline Manual 1-2*. SASMAP Project, Amersfoort.
- Lee, C., 2015. Warship and Shipwreck: The Odyssey of Warship Guan Bin. *Sinological Research of East Asia*, Vol. 5: 246-262.
- Liu, J., Huang, C., Wen, C., and Lee, C., 2021. *Underwater Cultural Heritage Educational Promotion in 2020: Final Report (109年水下文化資產教育推廣活動:成果報告書)*. Bureau of Cultural Heritage, Ministry of Culture, Taichung.
- Liu, J., Tian, W., Shyue, S., and Chiu, J., 2018. The Study of Protection and Monitoring of Underwater Cultural Heritage: Using “General Number One” and “Warship Guang Bing” as Example (水下文化資產保護與監測之研究:以「將軍一號」與「廣丙艦」為例). *Journal of Ocean and Underwater Technology*, Vol. 28(2): 87-104.
- Maarleveld, T. J., Guérin, U., and Egger, B. (Eds.), 2013. *Manual for Activities Directed at Underwater Cultural Heritage: Guidelines to the Annex of the UNESCO 2001 Convention*. UNESCO, Paris.
- Manders, R. M., 2012. Unit 9: In-Situ Preservation. In UNESCO (Ed.), *Training Manual for the UNESCO Foundation Course on the Protection and Management of Underwater Cultural Heritage in Asia and the Pacific*, UNESCO Bangkok, Bangkok: 208-242.
- Manders, R. M., 2009. *Managing Cultural Heritage Underwater (MACHU): Final Report*. The National Cultural Heritage Agency, Amersfoort.
- Liu, J., Tian, W., Shyue, S., and Chiu, J., 2017. *Monitoring and Management of the Underwater Cultural Heritage: Final Report (水下文化資產監測與管理研究案成果報告)*. Bureau of Cultural Heritage, Ministry of Culture, Taichung.
- Tsang, C., and Liu, J., 2018. *The Project for the General Survey of the Underwater Cultural Heritage in the Seas of Taiwan: Stage 2*. Bureau of Cultural Heritage, Ministry of Culture, Taichung.

Biography



Pin-wen Chen is now a research assistant at the Department of Anthropology at Taiwan University. She used to work at the Centre for Ocean and Underwater Technology Research at Tamkang University and assisted two underwater cultural heritage educational programs (2020). She completed her Master of Maritime and Coastal Archaeology at Aix-Marseille University, France (2020) and her M.Phil in Public History and Cultural Heritage at Trinity College Dublin, Ireland (2018). She has dual degrees in Journalism and History at National Chengchi University, Taiwan (2015). She participates in two underwater excavation projects in Fos-sur-Mer (France, 2019), Aegina Island (Greece 2019) and a land excavation in Chongde village (Taiwan, 2021). Her research interests lie in the area of modern maritime history, underwater archaeology and underwater cultural heritage management.



Tzu-Chia Huang is a Project Manager at the Center for Ocean and Underwater Technology Research (COUTR) and a master student in History at Tamkang University. Her research interests lie in underwater cultural heritage management, underwater survey and maritime history. She has many years of experience in planning, organizing and ensuring different projects on time, and budget including several international conferences, educational workshops and research projects since 2017.



Chen-Fen Huang received the Ph.D. in oceanography specializing in geoacoustic inversion from the Scripps Institution of Oceanography, University of California San Diego, La Jolla, CA, USA, in 2005. From 2005 to 2007, she was a Postdoctoral Researcher at the Scripps Institution of Oceanography. From 2007 to 2008, she was a faculty member of the Department of Marine Environmental Informatics, National Taiwan Ocean University. Since 2008, she has been a faculty member of the Institute of Oceanography, National Taiwan University. Her research interests include current mapping using ocean acoustic tomography, underwater geoacoustic exploration, underwater signal processing, and acoustic wave scattering from rough surfaces. Dr. Huang is a Fellow of the Acoustical Society of America.



Jin-Yuan Liu received a B.S. in oceanography from National Taiwan Ocean Univ. at Keelung, Taiwan in 1978, and an Sc.D. in ocean engineering from MIT in 1993. Between 1985 and 1988, he was a Visiting Assistant Professor in the Dept. of Mathematics at the Univ. of Wyoming, and between 1992 and 1993 a Research Assistant Professor in the Dept. of Electrical Engineering at Duke Univ. Between 1993 and 2011, he was a faculty member in the National Sun Yat-sen Univ. in Kaohsiung, Taiwan. Between 2012 and 2016 he served as the President of National Taitung Univ. in Taitung, and between 2015 and 2017 as the Chairman of the Ship and Ocean Industries R&D Center administrated by the Ministry of Economic Affairs of Taiwan government. Currently he is a professor in the Dept. of Electrical and Computer Engineering, and the Director of the Center for Ocean and Underwater Technology Research at Tamkang Univ. in New Taipei City. His research interests include acoustic wave propagation and scattering in an ocean waveguide, underwater survey and identification analysis, sonar engineering, and underwater cultural heritage.