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Conservation, and Presentation of Underwater Cultural Heritage to the Public

Case study: The current projects in Belgium

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Underwater Cultural Heritage

1- Introduction

1-1- Underwater Cultural Heritage

"Diving into the past, the underwater cultural heritage is a significant component of human history."[1] Besides, searching for the lost land of Atlantis was always a dream for adventurers. The hopes, history, true stories and legends about treasures lying under the water of oceans, seas and lakes have nowadays lent the branch of underwater archaeology greater credibility. Underwater archaeology- or 'underwater cultural heritage' as it is called by the world heritage organizations- is a relatively new area of Heritage, and is going to be more and more crucial and remarkable as a part of the human heritage. This project attempts to introduce the Underwater Cultural Heritage from the points of view of world heritage organizations (such as UNESCO and ICOMOS), to give a brief history of development of Underwater Cultural Heritage conventions, to present a general overview of the archaeological experiences in the world, and specifically Belgium to deal with the problems of criteria and applying the conventions, and finally, to depict a future perspective of Underwater Cultural Heritage in Belgium and introducing some cases.

According to the UNESCO charter[2] the definition of underwater heritage and its divisions are as follows:

'*Underwater cultural heritage' refers to all traces of human existence having a* cultural, historical or archaeological character which have been partially or totally under water, periodically or continuously, for at least 100 years, such as:
(i) sites, structures, buildings, artifacts and human remains, together with their archaeological and natural context;
(ii) vessels, aircraft, other vehicles or any part thereof, their cargo or other contents, together with their archaeological and natural context; and
(iii) objects of prehistoric character."[3]
For the ICOMOS charter Underwater Cultural Heritage is understood to be archaeological heritage which is in, or has been removed from, an underwater environment. It includes submerged sites and structures, wreck-sites and wreckage and their archaeological and natural context.

1-2- The importance of Underwater Cultural Heritage

The importance of underwater cultural heritage has been perfectly described at the beginning of the convention of UNESCO:
"…as an integral part of the cultural heritage of humanity and a particularly important element in the history of peoples, nations, and their relations with each other concern their common heritage."

[1] http://www.underwaterarcaeology.com
[2] UNESCO Convention 2001
[3] Pipelines and cables placed on the seabed shall not be considered as underwater cultural heritage. Installations other than pipelines and cables, placed on the seabed and still in use, shall not be considered as underwater cultural heritage.

Examples include: Alexandria in Egypt; the ancient city of Kish, the wall of the ancient city of Gorgan, Takht-e Suleiman and part of the Portuguese Castle, submerged in Iran's coastal water; a huge archaeological site deep in Fuxian Lake in Southwest China's Yunnan Province, in Qian Dao Hu, (One-thousand Islands Lake) at Hangzhou, Zhejiang Province, -China- two ancient cities underwater built in 1500; "Lac de Sanguinet" in France, which reveals shaping life in this area from the Bronze Age until now; the underwater excavation in Bodrum, Turkey, which led to the tripling of the area's population and it becoming one of the most visited places in Turkey; the Vasa wreck, the most popular tourist site in Stockholm; the numerous shipwrecks at the Belgian coast, especially close to Ostend; the medieval fishing settlement of Walraversijd- Belgium, which is partially submerged in the sea. These illustrate the importance, variety and existence of underwater relics, which led us to other aspects of hidden parts of human civilization and history needing to be revealed. There are many other examples[4], and also a large variety of activities that have been initiated for conserving, studying, introducing and saving underwater cultural heritage.

Apart from being an important element in the history of people, the increasing attention towards underwater relics make them more vulnerable: free divers, tourists and adventurers, treasure hunters, some with the intention of helping and studying without sufficient knowledge - with their different interests and with no perception of the damage that they cause- has forced global heritage professionals to put more effort into studying different aspects of underwater and maritime archaeology. On the other hand the legal aspect of ownership of the wrecks is an issue which needs more considerations and study; the ownership of the original ship, the trade goods inside it, its location in free waters or another country's water are problematical issues making legalization of underwater cultural heritage important.

1-3- Archaeological study on UCH

1-3-1- Overview of UCH world experiences

The majority of underwater archaeologists specialize in the study of nautical archaeology: the study of ships, shipping, and the construction and operation of all types of prehistoric and historic watercraft. For these specialists, shipwrecks are the focus of research, many of which (but by no means all) may be found underwater.[5]

[4] - Over three million undiscovered shipwrecks are estimated to be spread across ocean floors. For example the Dictionary of Disasters at Sea1 lists 12,542 sailing and war vessels lost at sea between 1824 and 1962.
Remnants of ancient civilizations currently under water include, among others, the Alexandria lighthouse in Egypt, which was known as the seventh Wonder of the World, and the ruins of numerous Neolithic villages still to be found in the Black Sea;
Whole cities have disappeared under the waves, such as Jamaica's Port Royal, the victim of a 1692 earthquake – its archaeological excavation has afforded scientists unprecedented opportunities to study 17th century life."

[5] As stated earlier, other types of sites in the underwater archaeologists' domain include: ancient land sites inundated after the last ice age; sinkholes or bogs where people placed offerings or buried their dead; cities and harbors now submerged from sea level change or earthquake; and dwelling, agricultural, and industrial sites along rivers, bays, and lakes. Underwater archaeologists make extensive use of historical records such as ship's plans, logs, and manifests; explorer's accounts; old maps; and legal, business, and tax records. They also study long-term geologic changes to locate submerged early man sites

The practice of underwater archaeology is truly interdisciplinary, combining the methods of various allied fields of study including anthropology, chemistry, ethnography, geology, history, naval architecture, oceanography, and paleography -- to name only a few. Some of the major archaeological experiences in the world are in Denmark, Holland, France, Egypt, Australia and Turkey. These experiences are almost similar in the methods of survey and study, but differ in the ways of presentation and concepts of museology.
The classical way of study is excavation, conservation of findings, and presenting them in a museum for the public. Nowadays, with pressure from the world heritage organization, these destructive excavations have been limited, and non-physical excavation methods recommended. Since study and preservation of all relics has been recommended, and presentation of the heritage to the public is one of the main objectives of the all conventions, different countries are developing different methods of presentation. For instance in Denmark, a system of mobile data presentation has been developed for visitors to go to the sea on boat to see each of the wreck-sites and will receive on sight information and complimentary photos of the site.

The part of the North sea under Belgium supervision and the rivers conceal not only large number of shipwrecks but also a vide variety of other maritime archaeological heritage such as shiploads lost or left behind, drowned settlements and skeleton remains of extinct animal species.

Maritime archaeology activities started from 2005 under the supervision of the Flemish Heritage Institute (VIOE). The main activities done during this time were documentation, providing a data base and updating it according to new collected data, study on and conservation of archaeological findings, and organizing exhibitions and maritime museums. New and adapted legislation that regulates the issues of ownership of wrecks and provides the legal basis for the protection of historically or archaeologically valuable wrecks have in the meantime been approved.[6]

The variety of underwater archaeological finding in Belgian waters and costal areas reveal a large part of the history and development of life in that part of the world. The importance of the impact of Viking movement in Scandinavian countries, the materials they used, the techniques of building ships and so on can be traced by finding links among all the archaeological studies on land and in sea. Later on the medieval relics depict the development of ship-building techniques. The coordination of these findings will likely suggest Belgium as a central developer of European ship building. Later-date findings in some drowned cities such as Walraversijde (Fisherman city), close to Ostend, shows the way of life and banish the idea and image of a poor fishing village off from this settlement.

Large numbers of wrecks are steel ships lost in the first half of 20th century. Some of them show the development of the techniques of ship-construction and some are of importance as war-memorials
Together, these examples highlight the significance of underwater archaeology as a part of heritage of each region, which helps to provide historical definition and identity to the regions' occupants.

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[6] Drowned Past, Newsletter, Vanblaere S., Kerckaert P., 29.01.2007

1-3-2-Categorizing UCH and Maritime Archaeology in Belgium

Using the studies available on the topic of underwater and maritime archaeology in Belgium on different sites, combined with the UNESCO definitions of underwater cultural heritage, the underwater historic sites and relics can be divided into four main categories:
1- Underwater buildings, cities and sites. (Such as Walraversijde)
2- Shipwrecks of historic and prehistoric.
3- Shipwrecks of World War I and later.
4- Maritime remains under the layers of soil in-land. (Despite the fact that they are located in-land, they are considered as maritime archaeology and in anaerobic condition.)
In each case, different kinds of value can be noticed. In some groups more tangible aspects of heritage can be highlighted, such as construction techniques, history of navigation, utensils of life and so on, and in some cases more intangible aspects have the value of heritage. In the case of Battleships wrecks of the World Wars, the memory of the victims and soldiers are important to save and to link with the on-land War Heritages.

The issues which are common in all cases are the used conservation and study methods, as well as the public presentation of these heritages. At the same time the criteria in which a relic can be considered as a heritage, and the amount of effort which should spent to study each one, comes to the light.

As stated earlier, according to the UNESCO convention of 2001, any **traces of human existence** which are **of cultural value** and have been **underwater for more that 100 years** are considered as Underwater Cultural Heritage. This definition shows the first qualities that a site or relic should posses to be called underwater cultural heritage.

However through development of the underwater cultural heritage study and more activities on underwater archaeology during recent years, these criteria seem to have been changed in practice. For instance, the memorial aspect of battleship wrecks and linking these relics with the inland War-Sites is a topic which is being developed.

1-4- Problems of the criteria:

As it is said above in the criteria of UNESCO, some aspects and values of underwater relics have largely been ignored. The age criteria-100 years old- in some cases brings difficulty to determine the most valuable underwater relics. For instance a wreck from 150 years ago with no technical and aesthetical value could be respected as a heritage, but the Titanic with all its stories would not be, although Titanic is a part of underwater cultural heritage. This highlights the discrepancy between the current frameworks in place for on-land heritages which are less robust, or even absent, for Underwater Cultural Heritage.

Hence, developing a framework for Underwater Heritage, to define its limits and boundaries according to its level of value, and the way, the quantity and the quality of its interaction are the issues that need more focus.

Future perspective:

Answering to the question below could be a general perspective of future studies on the topic of underwater cultural heritage:

1- According to the World Heritage Policies: “World Heritage is man’s interactions with his environment.” Putting stress on the point that man-made items of Underwater Heritage were not planned to be "underwater" and the importance of this heritage is because of its extraordinary location. Therefore, some questions still remain unresolved: should the manmade elements be preserved at the expense of the encroaching natural or environmental elements? Here, the quality of “being underwater” is of value; should this quality remain tangible or is there the possibility to conserve this value in other ways? How and to what extent, would stopping the decay not damage the identity of the underwater heritage? Considering that ‘Identity’ includes tangible and intangible aspects of a heritage, a large part of identity is dealing with the memorial facts of the heritage. Hence, the memory of the affect of natural damage, in addition to the man-work values such as artistic and technical aspects, defines the identity of an underwater heritage. Accordingly, not all underwater remains are of value of heritage. As a result, what could be the best criteria in order to judge an underwater manmade object as an underwater heritage?

2- Over the last 30 years there have been debates about the fragility of the Heritages. Accordingly, how to define the solution to save the Underwater Heritage? When, where and to what extent should we intervene? What are the convenient tools to document and present this part of heritage? Still, different schools of thought, or “ideologies”, concerning the definition and conservation of underwater heritage need to be more linked to the practical experiences around the world.

3- According to the conventions, growing public interest to the Underwater Heritage is one of the aims of the whole activities and these sites should be a part of man’s life. How and what are the possibilities and implications of this aim on the topic of the heritages under shallow water and the ones in deep water, for those which might be visible, or can be visited, and those which might not? Considering the different kinds of interested visitors, what could be the best and the most convenient way(s) to provide accessibility (actual or virtual) to this kind of heritage?

As it mentioned, in some cases, there are some theoretical guidelines to treat underwater cultural heritage as an interdisciplinary project, but in some other cases this objective does not come true. From the points of view of a conservator/architect, still, there are some aspects that need more study and consideration to give a better out come to satisfy the majority of stakeholders involved in such projects. I believe through answering the questions above, there could be more coherence between the theoretical ideologies, and practical methodologies.

Following research will provide a general understanding of what is going on in the world; a catalogue will show different approaches in conservation and presentation of UWCH to the public. According to the pre-approaches which come out of a comparison among different experiences, world conventions and guidelines, a series of evaluation table and methods will be presented in order to evaluate UWCH in Belgium according to its own climatic, cultural, historical and so forth conditions.

Three main cases have been studied, evaluated and presented in order to examine the application of the tools and knowledge which have been gained through the present research.

2- Chapter I

Museology
Catalogue
Damage assessment and Conservation
Environmental Conditions

2- Chapter I:

2-1- Museology Philosophy:

As a term, whenever the word Museum come to the mind, brings an image of some galleries, with some glass cases and show boxes in which the objects are displayed. Using proper light for different objects as well as considering the damage which light could cause on some specific objects, and controlled environmental conditions such as relative humidity, temperature and so on are different aspect of a museum. At the same time, there are some theoretical aspects and some philosophical concepts behind all these constructional and technical issues.

What is a museum? It is a question that will help to find different ways of displaying cultural heritage to the public. As we could find in different texts and literatures "Museum are no longer built in the image of that nationalistic temple of culture... Today, almost any thing may turn out to be a museum, and museums can be found in farms, boats, coal mines, warehouses, prisons, castles, or cottages. The experience of going to a museum is often closer to that of going to a theme park or a funfair than that which used to be offered by the austere, glass-case museum."[7]

But here we face with the question that what is the purpose of the museum or in general what is the purpose of displaying cultural heritage to the public? And what do we want to present? Apart from these entire questions, one of the main objective of any displaying of cultural heritage is contribution to enhance the public' and visitors' knowledge. Considering all the facts above, "if the museums are places in which we may come to know things, and where our perceptions may radically change, what is the nature of this knowledge, and how are these changes brought about?"[8]

As a result to all the discussion above, in brief, to provide a suitable and proper way of displaying of cultural heritage or any other kind of objects of importance, we need to answer to the questions below:

1- What is going to be presented?
2- Why is it going to be presented?
3- Who are the visitors?
4- What are their expectations of visit?
5- What kind of knowledge is going to be provided?
6- What does the museum want to put in display?
7- On what different kinds of visitors (stakeholders in general) the displaying will have effect?

"The museum" is analysis of various elements that together make up the "reality". [9] This very general explanation of the museum is not limited in any time or place. Considering the development of technology, growing different interests, social and economic issues, and so on, give a variety of realities, which could be shown into the museums. In fact, museums or any displaying ground should provide a general concept

[7] Hooper-Greenhill E., Museums and the Shaping of Knowledge, Routledge, 1992
[8] Hooper-Greenhill E., Museums and the Shaping of Knowledge, Routledge, 1992
[9] Hooper-Greenhill E., Museums and the Shaping of Knowledge, Routledge, 1992

of a real thing; this thing can be history, art and so forth. However, it is impossible to keep a museum far from just an exhibition, if we do not consider the fact that people change and they like changes. As a result, the context of a museum might be permanent, but there people need to experiment a range of verity. This verity is not only over the space, but also over the time. The aim of enhancing visitors' knowledge will not come true, if we believe that people needs enjoyment at the same time that they are visiting something. Otherwise, they could stay at home watching movie or reading scientific book to develop their knowledge. To give this simultaneous opportunity to the visitors, we need attractive stories, through which they could get some knowledge.

As a result, a museum or a display ground is a place which permanently has the context of the history, but temporarily present different kinds of stories related to the history. In this way we will have live museums, in which people not only visit once for the history, but they come back for more stories.

The general plan of the history is all periods of a life of a relic, an object or monument. Therefore, the general context of any displaying ground should show all these periods, which means should be a narrative history.

As for the underwater cultural heritage, the periods of life should include not only the time in which it was used as a vessel or as a house or village, but also the accident and the wreckage of the vessel, or submerging the site due to the flood, and also its recovery after long time in our present time should be come into account to shape the historical context of the shipwreck or any other underwater sites.

The aim of all above discussion is to give this idea that people are not coming to an underwater museum just to see the history of development of a ship or technical aspects of shipbuilding during the ancient time till now, they come also to see the unknown stories about people who lived and traveled on those ships, the way that the ship was passing, the cargo which was being carried and also all intangible and memorial aspects about the fear of wrecking, the events on board and so on.
One other aspect of museology is that taxonomy or the science of classification; it is not only inside the museum, but also before displaying inside the museum we need to have the classification. What is object? What is monument? What is site? About underwater relics, shipwrecks and sites, it is important to distinguish all these issues. When can we put a shipwreck as a solid object inside a box in a museum?

Following, I would like to present some museums and exhibitions on the topic of underwater cultural heritage and also maritime archaeology. Different aspects will be discussed; the traditional way of displaying, the new technology adopted for some of them, the aim of each display, the extent of their success in displaying, the kind of knowledge which they provide to the visitors and so on. According to all these aspects, on one hand, I come up with a scheme in which the museum could justify its existence or not, and on the other hand, if the way of displaying is coming along with the objects and the context or not.

This part of study covers a different range of museums and ways of displaying, according to the relics, the environmental condition and nature, the finance issues, the different concepts of planers and so on. For some of the main examples the procedures of conservation and restoration are important from the point of view of having a

sustainable site or relics as well as public participation during these procedures. Where it felt that it is necessary to explain, this procedure has been explained.

2-2- Catalogue- Practices in the world:

2-2-1-Excavation, conservation and displaying challenges-Museum of Bodrum:

One of the first experiences on the topic of underwater archaeology has been done in Bodrum, Turkey, under supervision of Prof. Bass. This has been a large scale research and excavation project, including the museum and presentation to the public. In this museum which has been managed inside an ancient castle, some galleries have been dedicated to underwater archaeology. [Fig. I-01] Apart from the museum, the castle itself prepared a kind of public space, where people can gather, sit and enjoy the environment. In general this project is a successful project to attract people from all over the world to visit the city as well as some ancient monuments and the museum. But concerning the underwater museum, the effort is not showing the scale of the project. Here, in a classic way of presentation, we could see galleries in which the objects have been displayed. And also a very important gallery a shipwreck has been put in display. [Fig. I- 02, 03]

The effects used in different galleries are of importance value to show some parts of the history of the wrecks which are being shown inside the museum. The material used in reconstruction of one of the wrecks in the glass-gallery is showing the layer of history of the wreck as well as its original form as a ship.

Although, this museum could be considered as a classical way of presentation, the website of the museum provide a virtual tour inside the museum with applying 360-degree photography. This system of virtual presentation is easy and not expensive. This museum shows a lifetime of a part of history, in which the sailing and the trade by sea was important for the area. The way of displaying objects, in some galleries, as if they are merchandises to be sold in a local market shows a story from the history of the town and the involvement of the ships, while they were not wrecked yet, in this type of life. [Fig. I- 04, 05, 06]

There are two rare examples of underwater shipwrecks experience existing in the world; one is the warship of Vasa in Stockholm and the other is the warship-wreck of Mary Rose in England. Both are considered as the largest examples of their types in the world. They show a vast technical progress in the history of warship building. Their ways of displaying- as been shown from bottom to the top in different level- reveal the expansiveness and importance of these two vessels. What is needed to be questioned here again, is that are they considered as historic objects or as small historical site with their own history, social life and so on inside.

The difference between these two vessels is that Vasa never was able to have a trip on the sea; in a few hours after having departed from the port, due to its construction problem, got sunk. Here we face two main stories. One is about the construction methods which are supposed to be shown in the museum, the other is the story of its

life. As for the Mary Rose, the case is different; this vessel had its long history and at the same its stories.[10]

2-2-2- Excavation, conservation and displaying challenges-Mary Rose:

The Mary Rose Museum is a green wooden building, where had been a 19th century boat house. The gallery in which Mary Rose shipwreck is being displayed is one of the galleries of the museum of Mary Rose. The way of displaying shows the condition in which it has been excavated. [Fig. I-07]

The process of detaching the hull from the silt was a complicated process, and then a giant floating crane carefully transferred it underwater into a purpose-built cradle positioned on the sea-bed nearby. [Fig. I-08] Once secured to the cradle the whole package, weighing 580 tons, was raised and towed ashore. As soon as it broke the surface, the water inside the hull was pumped out to reduce the load on the structure. For 12 years after her dramatic exit, during the time the hull was turned upright and the deck structures replaced, the Mary Rose was conserved by constant spraying with chilled freshwater. [Fig. I-09] In 1994, active conservation was begun using the water-soluble wax polyethylene glycol which, over 10 years, would eventually replace the water in the ship's timbers and coat the hull. [Fig. I-10] The wreck would then be slowly air-dried to remove any remaining moisture. Strict hygiene is necessary to prevent wood decay or microbiological contamination. The building in which the Mary Rose is housed includes air-conditioned viewing galleries to screen visitors from the conservation chemicals.[11]This preservation technique is the same as that begun in 1961 for the Vasa, a Swedish ship of the line which capsized in 1628 and is now on display in Stockholm. The Vasa is virtually intact while the Mary Rose is an almost perfect longitudinal vertical cross-section, due to marine worms such as the shipworm Teredo navalis destroying the port side above the seabed.[12] [Fig. I-11]

2-2-3- Excavation, conservation and displaying challenges -Vasa:

Vasa was one of the most intact shipwrecks in the world whose wreckage was due to technical problems of its construction. This vessel never completes a trip, and sunk just a few hours after its fist lunching. The process of its moving out of the water was a huge effort [Fig. I-12], and its conservation process was an innovation in the field of conservation of underwater wooden relics; Setting the vessel under the constant jets of a sprinkler system, experts invented and then applied the *"glycol-method",* impregnating the black oak with polyethylene glycol for 17 years to prevent it from shrinking and cracking as it dried. Some 580 tons of water evaporated[13], during the process. Up until 1990, the Vasa Museum was housed in a basic aluminum building which slowly rusted with the 98% humidity need for the ship's restoration. But in 1990, a new museum awaited: a modern building crowned by three masts, complete with cinemas, computer rooms replicated captain's quarters, sailors' cabins and a cannon deck.[14] [Fig. I- 13]

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[10] After a long and successful career, she sank accidentally during an engagement with the French fleet in 1545.

[11] 2- THE RAISING OF THE MARY ROSE, UNESCO SOURCE/No. 87/Feb. 1997

[12] http://en.wikipedia.org/wiki/Mary_Rose#Modern_work_on_the_wreck/ (16 July 2007)

[13] When the ship reached the surface every kilo of wood contained 1.5kilo of water.

[14] 3- WASA GOES DOWN, CAN COME UP!, UNESCO SOURCE/No. 87/Feb. 1997

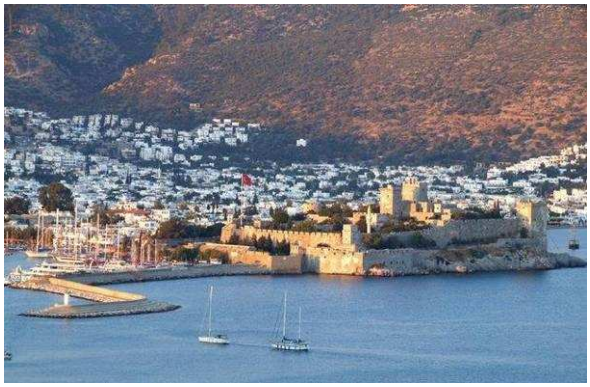

Fig. I-01

Fig. I-02

Fig. I-03

Fig. I-05

Fig. I-04

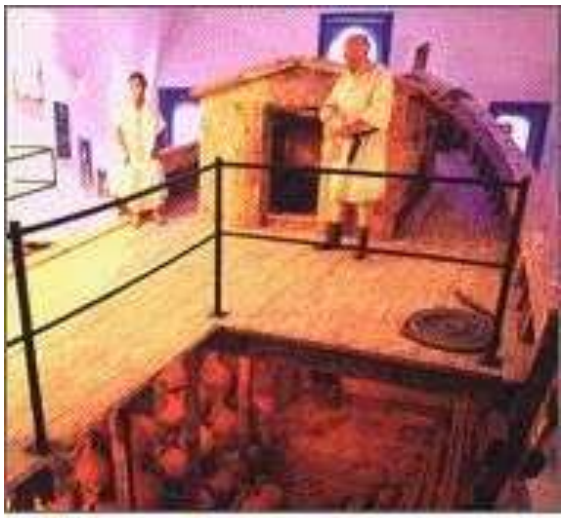

Fig. I-06

Fig. I-01: Overall view from museum of Bodrum
Fig. I-02, 03: The shipwreck put into a gallery to be displayed, with some restoration in glass.
Fig. I-04, 05: Objects found in the site of the shipwreck in Bodrum.
Fig. I-06: Reconstruction model of the life on the ship.

Fig. I-07

Fig. I-08

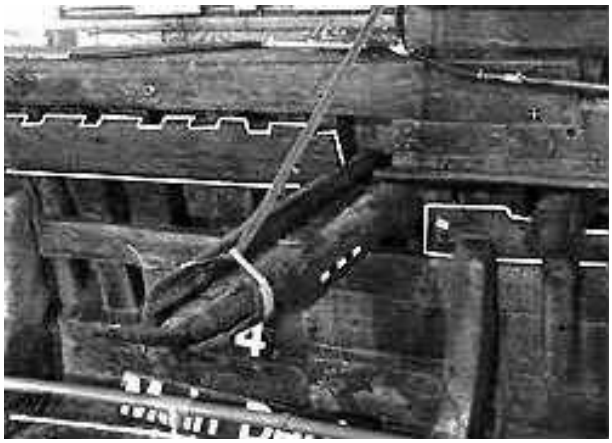

Fig. I-09

Fig. I-10

Fig. I-11

Fig. I-12

Fig. I-13

Fig. I-07: Process of excavation and conservation of Mary Rose.
Fig. I-08: Bringing Mary Rose out of water.
Fig. I-09: Upper deck clamp (outlined in white) – showing the discontinuity between the forward and aft sections.
Fig. I-10: Mary Rose on display
Fig. I-11: Assembling and restoration process of Mary Rose.
Fig. I-12: Carrying Vasa on land
Fig. I-13: Present Vasa museum

Therefore, in the Vasa museum, we could see the Vasa, without any historical lie; it had been sunk almost intact, and the process of its restoration did not need that much intervention. [Fig. I-14, 15] Thus what has been into display in the museum is the same as the condition of its sinking. Visitors have the opportunity to see the ship as well as the possibility to examine what was the problem of its sinking.

In compare with these two museums in which two of the most important shipwrecks are being shown, and in fact we could consider these museum as a kind of international attractions, there are some more national and regional museums could be found around the world, in which has been tried to show the underwater archaeological activities as well as maritime findings.

One of the pioneer countries in underwater archaeology activities is Denmark, with a large numbers of shipwrecks from Viking period when the Scandinavian countries were still joined.

2-2-4-Excavation, conservation and displaying challenges-Roskilde, Skuldeve Shipwrecks:

One of the most important museums of underwater archaeology is Museum of Roskilde where shipwrecks found in Denmark are in display.

When the wrecks were fully uncovered they were mapped, using photogrammetry, just as all wrecks were thoroughly photographed to record constructional details. During the excavation the timbers were kept wet at all times by means of garden sprinklers. To involve the public in this fascinating process one of the sides of the pentagonal cofferdam had been provided with a platform, from where the work on the wrecks could be seen.[15] This platform continued in a jetty from where regular ferry traffic took place. [Fig. I-16, 17] The Viking Ship Museum which exhibits the Skuldeve Ships from the Roskilde Fjord has now been extended with the Museum Island. Here the Museum Shipyard, the Artefact Registry and a number of museum workshops are placed. The island was shaped by digging a U-shaped canal into the fjord shore, and during this undertaking the nine Roskilde ships, all built within the Nordic clinker tradition, were found. Most of the wrecks were cut by the sheet piling, and the parts that were laying in the future canal were excavated first. After the Museum Island was opened to the public, and the canal was opened to the fjord, the remaining parts of the wrecks were recovered.[16] [Fig. I-18, 19]

All the efforts of restoration, conservation and presentation have been concentrated to show the image of the original ships before having wrecked, and also through applying some techniques and new materials, the reconstructions of the wrecks show the original parts which have been found during the excavations. [Fig. I-20, 21, 22, 23, 24, 25] A large part of the museum is presenting the way of ship construction and also the settlements by the sea from the Stone Age. The shipwreck's study is being followed by the meant of providing important key to our understanding of ship-

[15] The excavation of the Skuldeve ships in 1962 generated considerable interest. About 30,000 people visited the site.
[16] http://www2.rgzm.de/navis/ships/ship092/Ship092.htm

Fig. I-14

Fig. I-15

Fig I-16

Fig. I-18

Fig. I-17

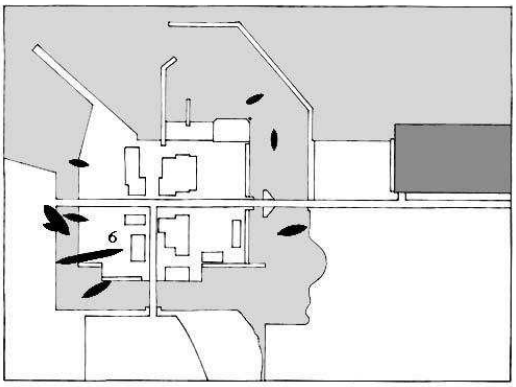

Fig. I-19

Fig. I-21

Fig. I-20

Fig. I-14, 15: Vasa on display in the museum.
Fig. I-16, 17: Roskilde site during excavation and conservation.
Fig. I-18, 19: Actual museum of Roskilde.
Fig. I-20, 21: Reconstruction of the shipwrecks of Roskilde in the museum.

building traditions and of life in the past in general.

A part of museum is a shipyard, where the restorations of shipwrecks have been implemented, as well as reconstruction of some replicas of the original ships and their restoration time to time. The idea of building replicas of the original ships was a successful project in the view points of visiting, as well as experiencing the shipbuilding technology.

2-2-5- Excavation, conservation and displaying challenges-Bremen Cog, Deutsches Schiffahrtsmuseum:

For another museum of this kind, the Maritime Museum of Bermerhaven- Deutsches Schiffahrtsmuseum- can be mentioned. [Fig. I-26] In this museum one of the most important and intact cogs is being displayed. The museum, as its director- Dr. Hoffman- says, has been built because of this cog. The cog has been found in 1962 during an expedition for a new dock in Bremen, Germany. [Fig. I-27] The excavation, conservation and restoration of this cog have been shown through some panels and posters in the museum.

Having brought the parcels of the cog out of water and sand, the main problem, again was how to conserve them properly. To having done so, conservation process consists of two treatments: first the Cog was submerged in a bath with PEG 200, and then in a bath with PEG 3000. The tank in figures: 800,000 liters capacity; 110 tones of steel, thereof 37 tones inoxidable; 11.5 cm thick glass windows to allow museums visitors to see the Cog during conservation. [Fig. I-28, 29] In the hold of the Cog, the first bath has been pumped off. Then 13 tank lorries brought each of them 20 tones of 100 °C hot molten PEG 3000 from the producer in far off Bavaria to the Deutsches Schiffahrtsmuseum on the mouth of the Weser

In the museum they added water: For the second bath the solution had to be 60 %. As it is said in this museum: “After 19 years the Cog looks like a ship in the Arctic.” [Fig. I-30]

One of the experiences which have been done for assuring the conservation and restoration project is making two model wooden boats and observing their process of shrinkage with and without considering the slow process of evaporation of water and treatments. The one which has dried without conservation changed its form in a very dramatic way, the other one- after an impregnation with polyethylene glycol- showed no deformation. [Fig. I-31]

Still the process of conservation and stabilization of this cog continues. To stabilize the cog, where it is located, some supporters are carrying a part of its load. The final purpose is to free the cog from these supports and make it stand on its own, without hanging from the roof, just using a steel frame inside the cog in order to keep the wooden planks together. [Fig. I-32]

Fig. I-23

Fig. I-24

Fig. I-25

Fig. I-26

Fig. I-27a

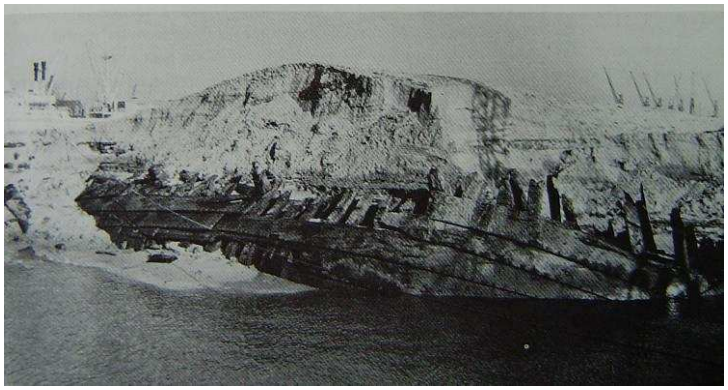

Fig. I-27b

Fig. I-23, 24, 25: Shipwrecks of Roskilde after having assembled on display in the museum of Roskilde.
Fig. I-26: Maritime Museum of Bremerhaven.
Fig. I-27a, b: Bremen Cog when found, and during excavation.

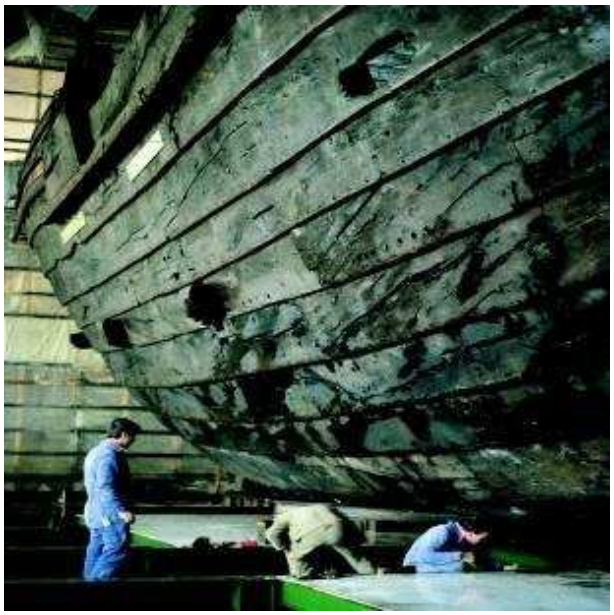

Fig. I-28

Fig. I-29

Fig. I-30

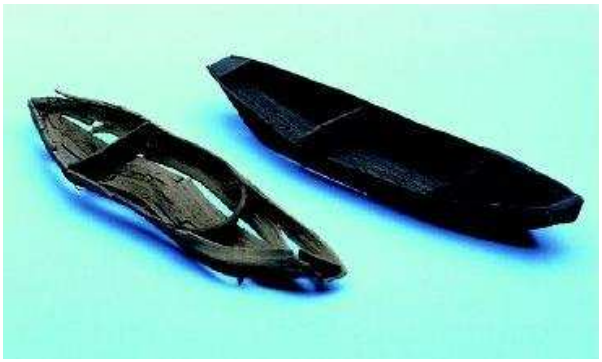

Fig. I-31

Fig. I-32

Fig. I-28, 29: Bermerhaven Cog during conservation and applying PEG.
Fig. I-30: Bermerhaven after conservation on display in the museum.
Fig. I-31: Drying test before having started the conservation of Bermerhaven Cog.
Fig. I-32: The steel frame inside the cog in order to keep the wooden planks together.

2-2-6- Excavation, conservation and displaying challenges-More practices in the world:

Applying the same system of conservation, restoration and presentation, another similar project in England could be mentioned. On the banks of River Humber (England) some remarkable remains of early Bronze Age boats were excavated. Although only a few planks were preserved to our days, it showed an advanced construction: The planks were profiled to fit better when sewn together. The boat was approximately 15.5 m length and 2.5 m broad. It was a Danish vessels- Ferribybåten (Ferriby boat) 1600 BC. [Fig. I-33]

Similar methodology could be found in Nydamskibet (Nydam Boat) 300-400 AD; this 23m length rowing boat was excavated in 1863 in the Schleswig. In the war 1864 the Germans took both Schleswig and the unique boat. The frames were fitted just as on the Hjortspring boat, but the hull was clinker built and attached with iron rivets (just like the later Viking ships). Long clinker built rowing boats with the same kind of oar locks are still built in the Swedish district Dalarna.[17] [Fig. I-34]

As for the shipwrecks, the presentation methods in the world are not just summarized as it has been mentioned above. There are other presentation and displaying ways suggested and practiced in different countries. Up to now, some examples of maritime museums in classic way have been presented. The word "classic" refers to the way of excavation, conservation and presentation. In all the cases above the site has been excavated, documented, and then the objects or the parts of relics have been moved to the other place in order to do more study and also conservation. And finally, the destination of all those objects and parts of relics and the site was in the museums.

In the following part some other kinds of presentation methods of these kinds of heritage is going to be presented and studied; methods, in which museums have been seen as a freer environment in order to display the history of the objects as well as their contributions in a vaster context. In these methods the fixed view of the identity of museums has somehow been changed. The museums are not a fragment of a city or village or a single building where visitors enter, see objects and then go out, but museums are combined with city and other daily activities. Accordingly, the importance of space, time, subject and projects show up as important aspects to organize a "museum", or better to say "the possibility to see the history".

In a new way of displaying the underwater cultural heritage, the trailing and in situ presentation could be considered as the modern methodology of providing knowledge of the history and the objects. Following the result of the paragraph above, again, here we face with the fact that even the in situ presentation is not sufficient to provide a vast and comprehensive understanding of the history. In situ presentation would provide one sub-purpose of modern philosophy of museology. In fact visiting the objects and sites in their own context or similar context would give an understanding of how they were in their original time, but still the links with other elements of that history is missing. Visiting a shipwreck in a bay under the meters of water would

[17] http://axelnelson.com/skepp/prewiking.html

illustrate the history of wreckage and the effects of the years of being underwater, but without linking this shipwreck with other elements of the life in the past could not provide a vide knowledge of the history. As it has been said before, the relationship between the original departure points, its destiny, the social life inside the ship and all tangible and intangible aspects of the ship and its story should come into account while we decide to provide knowledge through displaying a site.

Considering the in situ presentation as a proper way of displaying, one important issue is considering climatic issue and the nature of the place/geographical location in which the organizer of presentation attempted to put these relics into the public show and access. Below, some in situ presentations of underwater cultural heritage, mostly shipwrecks, are going to be presented. In these experiences the issues discussed above have been come into account to have an evaluation of these practices.

2-2-7- The Florida Maritime Heritage Trails:

When the sea level rose at the end of the last Ice Age, Florida's coastal plains became submerged continental shelves. The inland water table also rose, and prehistoric sites of human activities were slowly inundated.

As one of the successful projects, the project of Florida Coastal Management of five shipwreck sites can be mentioned. The five shipwrecks under nomination were relocated, explored, mapped, and assessed with the assistance of local volunteers. The history of each was extensively researched through national, regional, and local sources. Criteria utilized in the formation of previous preserves, and a growing public consensus, helped to select the site of Tarpon, a well-known steamer that sank with a loss of lives in 1937, eight mile off Panama City in 95 feet of water.[18] At that time, as a means of education and preservation through recreation, shipwreck parks are a relatively new idea; Local waterfront businesses organized with city, county, and state officials to enhance the wreck-site with replica cement cannons to replace those removed long ago. An official bronze plaque, embedded in a cement monument attached to a large mooring buoy, was positioned near the wreckage to mark the site and to discourage anchor damage. [Fig. I-35]

The Florida Maritime Heritage Trail is not so much a formal path, as it is a collection of interesting and fun locations that are open to the public. These trails have been situated in different parts of the city, according to the objects or places that they want to present. The objects and relics have not been displaced to be shown, the trails make people move and chose to see.

The Trail is made up of six themes, Coastal Communities, Coastal Environments, Coastal Forts, Lighthouses, Historic Ports, and Historic Shipwrecks. Each theme includes a number of places to visit or learn about, and each place features pictures, a historical narrative, a map, and information about how to visit. The themes explain how natural and cultural elements developed historically and how they fit together in a region.

[18] Development of State Underwater Archaeological Preserves Florida Coastal Management Subgrant 96-CZ-15-13-00-16-033 Final Report, prepared by Bureau of Archaeological Research

Apart from all these trails, there is a kind of underwater cultural park available for who wants to dive and visit wreck sites. [Fig. I-36, 37, 38] There are some trails underwater to guide them and provide them with sufficient information. [Fig. I-39] Having put the trails in order to provide information for visitors was one of the new experiences. The experience of in situ visiting of these relics provides wider knowledge. Apart from telling about cultures and technology of long ago, shipwrecks are important to archaeologists because they are the results of sudden cataclysmic events. Little floating worlds, in which nearly everything onboard is the same age and was in use at the same time, suddenly was deposited on the seafloor and fell into a crack in time. Unlike many land sites that were occupied and reoccupied over time, shipwrecks existed at once, isolated in time and space, providing what archaeologists call a "closed context" view of the past.[19] Hence parts of the history and stories lying inside these histories can not be revealed only by showing a rebuilt shipwreck and presenting it as an individual objects in a gallery of a maritime museum. In this respect, the issues concerning conservation in situ are of importance. In the proper chapter these issues will be discussed.

2-2-8- South Carolina's first underwater trails:

Another example of underwater trails could be found in South Carolina, in the U.S. Most of the relicts are dating back to the colonial period. There are six main trails along the river. [Fig. I-40] There are as follows: Strawberry Shipwreck, Strawberry Ferry Landing[20], Pimlico Shipwreck[21], Pimlico Barge[22], Mepkin Plantation Boat[23], Mepkin Dock[24]. [Fig. I-41, 42] For all these sites there is a very comprehensive documentation and guides for diving and visiting available. [Fig. I-43] The integration of these sites with their environment, nature and daily life of the surrounding area gives a better understanding of the flow of the life through the history. Although, there are less research and effort have been done for conservation of these sites.

As it could be seen in the photos, the water visibility of the Cooper River is not very good-almost few meters-, and the water is not clear. [Fig. I-44]

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[19] http://www.flheritage.com/archaeology/underwater/sites.cfm

[20] Strawberry Ferry was established in 1705 on the western branch of the Cooper River. It was associated with the settlement of Childsbury.

[21] The large dimensions of this vessel and the robust scantlings, such as frames and planking, suggest that it was intended for offshore operation rather than on inland waterways. There is a possibility that it was used for the lumber trade, commerce, or even warfare.

[22] The Pimlico barge lies on a marl and sandy substrate. This barge is well preserved and divers have commented that it feels like being inside a giant bathtub. It has an overall length of 39 feet and beam of 15 feet. The planked sides are 3 feet high. The presence of towing rings suggests that the barge, or a train of barges, may have been pulled behind a steamboat to carry additional cargo or supplies. A very large catfish has been observed in the space beneath the barge and the bottom.

[23] The vessel was designed to carry a heavy cargo, probably between the plantation and the harbor, and perhaps even offshore. Her last cargo appears to be cut lumber, possibly cypress shingles. The wreck lies in proximity to former Mepkin plantation owned by the illustrious Henry Laurens -- a wealthy planter, merchant, and Revolutionary War leader. The records of his estate written in 1766 reveal that he owned a schooner called the Baker valued at 2,600 pounds and crewed by four slaves. This boat plied between Mepkin plantation and his wharf in Charleston. This site is close to a monastery.

[24] A submerged rectangular wooden structure, resembling a log cabin without a roof, is currently a home to many river fish in the bend river near Mepkin Abbey. It is an example of a typical wooden dock structure historically used by early riverside residences in South Carolina.

Fig. I-33

Fig. I-34

Fig. I-35

Fig. I-36

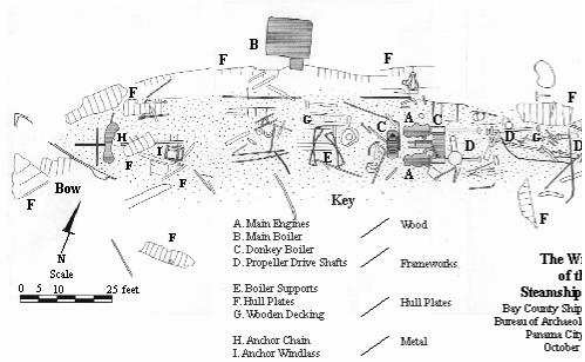

Fig. I-37

Fig. I-38

Fig. I-39

Fig. I-33: Danish vessels- Ferribybåten.
Fig. I-34: Long clinker built rowing boat, excavated in 1863 in the Schleswig.
Fig. I-35: A radar-reflecting marker buoy in Florida, positioned near the wreckage to mark the site and to discourage anchor damage.
Fig. I-37: Florida underwater cultural park, trails map.
Fig. I-36, 37, 38: Florida underwater cultural park.
Fig. I-39: Underwater trails to guide divers and provide sufficient information.

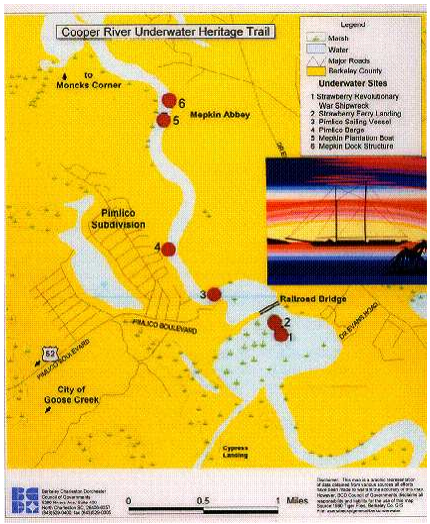

Fig. I-40


Fig. I-41

Fig. I-42


Fig. I-44

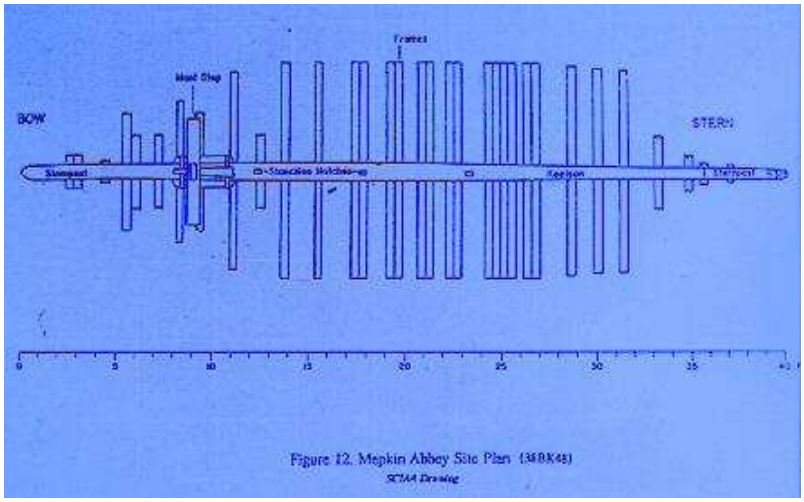

Fig. I-43

Fig. I-40: Map of the area and the trails of South Carolina
Fig. I-41: Strawberry Ferry Landing.
Fig. I-42: Plaque for Mepkin Wreck.
Fig. I-43: Site Plan of the Remaining Hull Timbers of the Wreck.
Fig. I-44: Lower end of stem post of Mepkin Wreck.

But all the efforts were focused on in situ presentation and benefiting from the advantages of the present environment. The nature around the trails, as well as villages and their daily activities all have been added to the attractions of these colonial underwater heritage. In fact these heritages could be considered as a sub-heritage of the area and with this method of presentation the integrity of the history has been saved. There is a guideline for diving and visiting the sites; the underwater maps, diving shops and guides are available to facilitate the visit.

The only question that still needs to be answered is the issue concerning sustainability and long-term conservation of these relics.

2-2-9- Victoria's Shipwreck Discovery Trails:

Another shipwreck trails is the Victoria Shipwrecks Discovery Trails in the U.S. The visibility of the water and the well-preserved state of the underwater relics are the advantages of these sites. The site has been provided by a map in which the location of all shipwrecks has been mentioned. [Fig. I-45] In addition, there is the information about each site. Some examples of these underwater relics and their state have been presented in the following images. [Fig. I-46, 47, 48, 49]

2-2-10- Israel underwater museum:

Another new approach towards in situ presentation with trailing underwater could be seen in Israel-Jules' Undersea Lodge. Jules' Undersea Lodge provides a small hotel some seven meters beneath the mangroves of the Key Largo nature reserve. Visitors must dive to the hotel's entrance, a door in the underside of the structure through which divers surface as if from a small swimming pool. The labeling of the sites is the most important feature. [Fig. I-50]

Also there are some rooms available from which, without diving, visitors can see the underwater relics and divers' activities. [Fig. I-51] Also some future projects are being discussed for this area. [Fig. I-52]

There are still more underwater parks and underwater cultural heritage trails. Almost all are using the same methodology of allocation of the underwater relics, and information technology. The main differences among all of them are the nature of the water and climatic issues.

The other recent experiment in conserving and presenting the underwater shipwrecks inside an aquarium. This experiment has been done in Sweden. The conservation process and possibilities and implication of this practice have been explained in the related chapter.

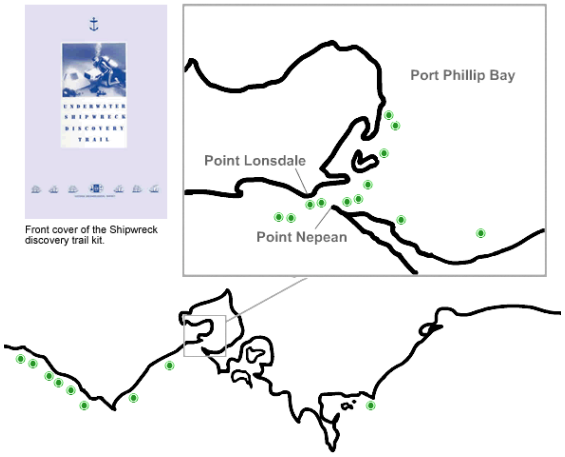

Fig. I-45

Fig. I-47

Fig. I-48

Fig. I-49

Fig. I-46

Fig. I-50

Fig. I-51

Fig. I-52

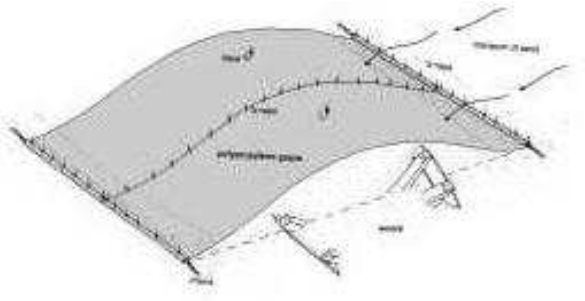

Fig. I-53

Fig. 45: The map showing the locations of historic shipwrecks in Victoria a part of the Underwater Shipwreck Discovery Trail.
Fig. I-46, 47, 48, 49: examples of these underwater relics and their state in Victoria Shipwreck Discovery Trails
Fig. I-50: Jules' Undersea Lodge; labeling the site
Fig. I-51: visitors can see the underwater relics and divers' activities.
Fig. I-52: Possible future projects.
Fig. I-53: This in situ protection, reburial, of a wreck in Wadden See.

2-2-11- Presentation methods in brief:

As it has been discussed above, there are different ways of presentation that could be summarized in the following ways:

1- The traditional way of presentation; excavation, studying and documentation, and presentation in the museum; in this method the destiny of the objects found underwater are clear and their safety and survival is for sure. However this method is very crucial, while it seems very simple. Traditional museums are places where the objects from small to large size would be displayed. Focusing on the word "object", as mostly treated with the shipwrecks as they are individual archaeological object. But here this question arise that are they just objects or since they are a sort of container of other objects, and a place to work and live for the sailors, should they be treated as a sort of monument or site? Or there could be different categories of shipwrecks; some as individual objects and some as monuments and site--especially in the cases that the importance of the underwater nature shows up as well. In this case the relics with its natural environment could be a cultural-natural heritage and not only an archaeological object.

2- Raising the importance of in situ preservation resulted in developing new ideas for underwater presentation or other possible ways of displaying these heritages and transforming the knowledge within these heritages. These ways as mentioned above, briefly, are:

- In situ preservation and reburial; in this case the possibility of presentation is minimum, but the safeguarding and preservation for future decisions stay still. In this solution which will be discussed in related chapter, consist of excavation, archaeological studying, reburial the objects and relics in their first own location or in some similar condition.

As one of the first in situ protection experiences in the world-1988-, the BZN 3 wreck, a ship of the East India Company (VOC) located in the Wadden Sea could be mentioned. This wreck was physically and legally protected. This in situ protection consisted of covering the site with 6000 sandbags and polypropylene nets. [Fig. 53] Throughout the years this method has been simplified and now only the nets are being used. [25]

The expert of this project in Netherlands has explained: "This method is cheap and easy to put in its place. It seems to work very well: over the years an artificial reef is created on the seabed that covers the wreck with sand and gauzes. The question however is, if the wreck and its artifacts are permanently being protected from the shipworm and other sea organisms." [26]

This method will be explained more in the conservation chapter.

- Another experiment is underwater cultural heritage trails; this method is applied for the sites and relics which are in clear water, under a bearable climatic condition,

[25] NAS 2006 Conference Speakers, Martijn Manders, 25 September 2007
[26] NAS 2006 Conference Speakers, Martijn Manders, 25 September 2007

suitable for diving. As for this method, still needs more development for the different condition in the world. And the issue which needs more consideration is “the process through which ancient material becomes presentable to the public.” [27]

It is necessary to repeat that "wrecks, arguably the traditional essence of maritime archaeology, also require a context for proper interpretation-a context traditionally perceived on the basis of cargo materials, and more speculatively interpreted that the context of terrestrially-based maritime sites such as ports and harbors."[28] This, again, stresses on the links among the different values which surround an underwater relic. This is the question which concerns visibility and the system which could be applied to visit an underwater site. In general the data gathered form a site can traditionally generate enough knowledge and understanding of the site and history, but still the essence is missing; the essence concerns the cultural background, lives and events involved in the history, and also the history through which the site, objects or relics have been changed, lost, sunk or so forth. This is the point that in situ presentation could assist in providing better understanding of the history of an underwater site. Trailing as one of these methods has been seen as a proper system of visiting and providing information.

- New developments in technology give the possibilities of making underwater building and pathways, which provide visiting the underwater relics in their original location or similar recreated underwater condition. The new ideas for underwater museum in Alexandria in Egypt, is one of the most crucial topics in the world; where the experts are discussing the possible and safe ways of building an underwater museum. Since construction of underwater glass-building could be hazardous due to the natural hazards such as earthquake and underwater storm, still this project is searching and studying the best ways of in situ presentation.

As a result to this part, ancient material in traditional way of study and presentation becomes contemporary material because it takes on fresh 'archaeological' qualities that dictate how the material should be handled, treated, valued and displayed. Considering this fact, as a very tangible treat and action towards the ancient materials-objects and site-, the importance of narrative history should not be ignored. Heritage sites and objects are not only telling the facts about their own, but also their contribution into the whole history and their affects on their surrounding would reveal more about the development of the world culture. Therefore, the final purpose of the modern concept of study and presentation of the heritage is getting to know the input of these heritages into the current life, and inviting the public to a deep understanding of the history and the values of this history. This is where the importance of education and training through museums shows up more. And the context of the heritage becomes of more importance, parallel to the individual objects or sites. Consequently, the recent methods of in situ presentation such as trailing and underwater pathways and museums could be considered as better ways of understanding the individual heritage within their context.

[27] Three Facets of Maritime Archaeology: Society, Landscape and Critique, Antony Firth
[28] J. R. Hunter, Maritime Culture: notes from the land, The international journal of nautical archaeology, 1994, 23,4

In the following parts the challenges for conservation of underwater materials will be discussed. The results will give more understanding of different materials in different conditions and reveals more solution for future decisions.

2-3- Damage assessment and Conservation of underwater relics:

2-3-1- Introduction

The damages on underwater heritage, especially on shipwrecks, are very vast and numerous; some are due to the natural environment and the nature of the materials involved in the sites, and some are more due to the human interventions such as treasure hunting, fishing, or even inappropriate ways of excavation, study and conservation. Since one large part of the future treatment towards these heritages is being aware of the nature and quality of the materials, below, a general overview of main materials involved in such sites have been explained and the world experiences for conservation of these materials have been explained. The Issues related to treasure hunting and fishing are concerning legal facts, which will be discussed more in proper chapter.

In general there are two main kinds of shipwrecks in terms of construction materials; the metal shipwrecks, and the other is the wooden shipwrecks, although, in studying and excavation of underwater sites more variety of objects with different materials are found. They could be divided in two main groups as organic and non-organic materials. There has been a vast study on conservation of these materials, which in case of necessity will be explained.

At this stage the damages due to natural causes on these different materials, underwater, will be explained. Mainly there are two groups of causes can be determined; fouling and biological growth, and the nature of water, environment and its ingredients.

2-3-2- Corrosion due to biofouling:

Maritime growth can contribute to corrosion directly by disturbing surface coating or by producing corrosive metabolites. It can also have an indirect effect by providing conditions in which micro-organism capable of damaging the substratum can thrive. The relationship between marine fouling and corrosion is complex and the main characteristics of the corrosion process are outlined below[29]:

2-3-2-1- Metal objects-Steel:

A natural protective fouling cover reduces corrosion, particularly in areas of high oxygen availability, but under some animals such as Metridium Senile corrosion may be enhanced as the pH is lowered. When the fouling layer becomes sufficiently thick to exclude all oxygen, anaerobic bacteria which can increase corrosion flourish.

[29] R.G.J. Edyvean, L.A. Terry, G.B. Picken, Marine fouling and its effects on offshore structures in the North Sea-A review, Materials and Corrosion/Werkstoffe und Korrosion,Volume 37, Issue 9

One of the major ways in which fouling can enhance corrosion is by providing environments for bacterial action; both aerobic and anaerobic bacteria, particularly the sulphate-reducing bacteria, can enhance corrosion process. Aerobic bacteria such as the Triobacilli and also blue-green algae Oscillatoria can produce sulphoric acids. [30]

As a result of some experiments on carbon steel, the highest corrosion rate suggests that macro-fouling provide a protection against mass loss. [31]

2-3-2-2- Metal objects-Iron:

Up to 70% of all corrosion in water systems is caused or accelerated by microbes. There is increasing recognition that microbes such as bacteria play an even larger role in all forms of corrosion than previously thought. For example, underwater microbes have been eating away at Titanic's iron since the ship sank.

The widely-accepted model for bacterial fouling in water systems involves the following steps:

1. Attachment of organisms to a surface.
2. Absorption and metabolism of simple organic molecules that fuel further metabolic action.
3. Generation of the glycocalyx, a polysaccharide that serves to further anchor the organism and protect it from adverse environmental factors such as changes in temperature, flow, pH, or the action of biocides

Through water channels in the glycocalyx the thriving bacterial colony is able to absorb nutrients and oxygen from the water. However, as growth continues and the depth of the slime layer increases, there is little penetration of oxygen in the layers against the pipe or vessel surface. [Fig. II-01]

2-3-2-3- Wood corrosion:

Marine borers (shipworm, Limnoria), soft rot and tunneling bacteria were wood degraders immediately above the seabed; soft rot, tunneling bacteria (TB), and erosion bacteria were active 10cm below the seabed; erosion bacteria were the only degraders at a depth of 43cm below the seabed. In more saline seawater, shipworm is known to destroy exposed wood rapidly. Only parts embedded in sediment are protected against marine borers. [32]

Erosion bacteria (EB) were not observed in wood exposed above the seabed. When wood was exposed in sediment at 10 and 42cm depth, initial decay could be observed after six, and in most cases, 12 months' exposure. EB were generally most active at 42cm below the seabed. Here, decay was most extensive. Decay by EB was identified by the presence of: (1) typical chequered pattern in cross sections [Fig. II-02a]; (2) by

[30] R.G.J. Edyvean, L.A. Terry, G.B. Picken, Marine fouling and its effects on offshore structures in the North Sea-A review, Materials and Corrosion/Werkstoffe und Korrosion,Volume 37, Issue 9

[31] L.V.R. De Brito, R. Coutinho, E.H.S. Cavalcanti, M. Benchimol , The influence of macro-fouling on the corrosion behavior of carbon steel Biofouling, Volume 23, Issue 3 June 2007

[32] C. G. Bjordal, T. Nilsson, Reburial of shipwrecks in marine sediments: a long-term study on wood degradation, Journal of archaeological science, 19 June 2007

the swollen and slimy appearance of the secondary cell wall [Fig. II-02b]; and (3) by diamond-shaped cavities that appear at the interface between sound and degraded cell walls, when viewed in longitudinal section [Fig. II-02c]. [33] The three wood species, birch, oak and pine, had different durability to the decay forms present in the marine environment, above and beneath the seabed. Birch was significantly the least durable wood species toward all types of decay, except TB. Oak was more durable to decay by shipworm than were birch and pine. Oak was less durable to soft-rot decay than were birch and pine at a depth of 10 cm below the seabed. Pine was the most resistant wood species to decay by EB at the lowest exposure depth; 42 cm, whereas oak was the most durable wood species immediately below the seabed; at 10 cm depth. [34]

There was a significant decrease in decay with depth of burial. Above the seabed, all three wood species were degraded rapidly, primarily by marine borers and secondarily by micro-organisms. At 10 cm below the seabed, degradation declined significantly. Both soft rot and TB were less active than above the seabed, and marine borers were absent. At this level, decay by EB was observed in the wood samples.
When samples were exposed in sediment at a depth of 42 cm, EB were the only active wood degraders. [35]
The slow degradation rate by EB, as well as their incomplete degradation of cell-wall components, results in a degraded wooden structure that appears to be well preserved (Bjordal and Nilsson, 2001). As long as the wood structure is waterlogged, the form, color, and surface information are intact. Such wood can be conserved successfully.

2-3-3- Corrosion due to the water nature and environment:

From the moment of manufacture the various metals and their alloys, except for gold, react with their environment and begin a corrosion process that converts them to more stable compounds. Before competent conservation techniques can be applied to a metal artifact it is essential that the conservator be aware of the corrosion products that result from exposure to different environments. The nature of the corrosion products determines the technique and procedures that can be effectively used. Consequently, corrosion is briefly covered. The corrosion of metals can be discussed in terms of terrestrial environments with temperate, tropical, and desert subdivisions as well as aquatic environments with salt and fresh water subdivisions. A more simplified approach, and more to point, is to look at the corrosion resulting from the interacting effects of wet, dry, aerobic, and anaerobic environments, i.e., the presence of oxygen and moisture. In any environment moisture is a critical variable and since aquatic environments, especially sea water, where most of the shipwrecks lye, dry conditions where metal corrosion is minimal, is not considered. In sea-water the above varies, along with temperature, pH and the presence of aggressive anions, such as chloride in the water, determine the rates and types of corrosion.[36]

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[33] C. G. Bjordal, T. Nilsson, Reburial of shipwrecks in marine sediments: a long-term study on wood degradation, Journal of archaeological science, 19 June 2007
[34] C. G. Bjordal, T. Nilsson, Reburial of shipwrecks in marine sediments: a long-term study on wood degradation, Journal of archaeological science, 19 June 2007
[35] C. G. Bjordal, T. Nilsson, Reburial of shipwrecks in marine sediments: a long-term study on wood degradation, Journal of archaeological science, 19 June 2007
[36] U.S. Defense Department Environmental Network & Information eXchange, https://www.denix.osd.mil/denix/Public/ES-Programs/Conservation/Underwater/3-IRON-1.html

Fig. II-01

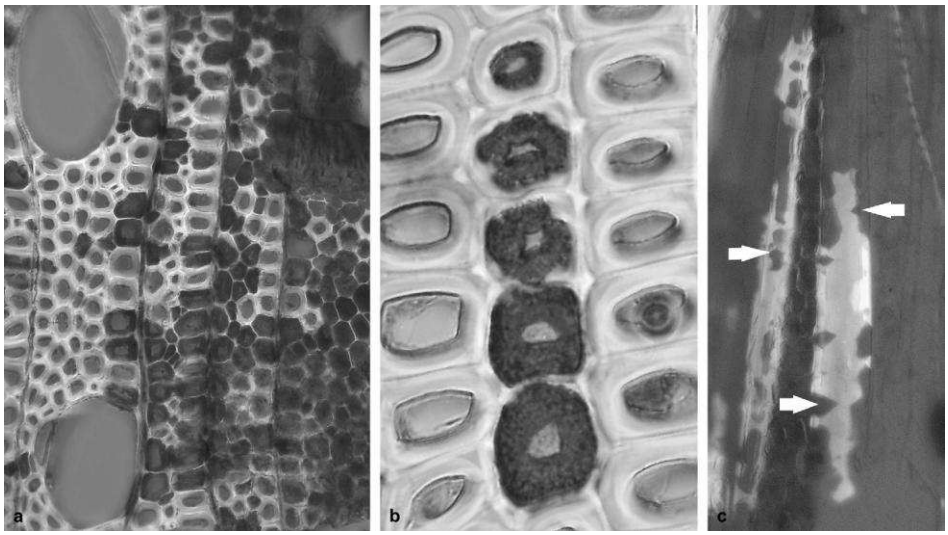

Fig. II-02a, b, c

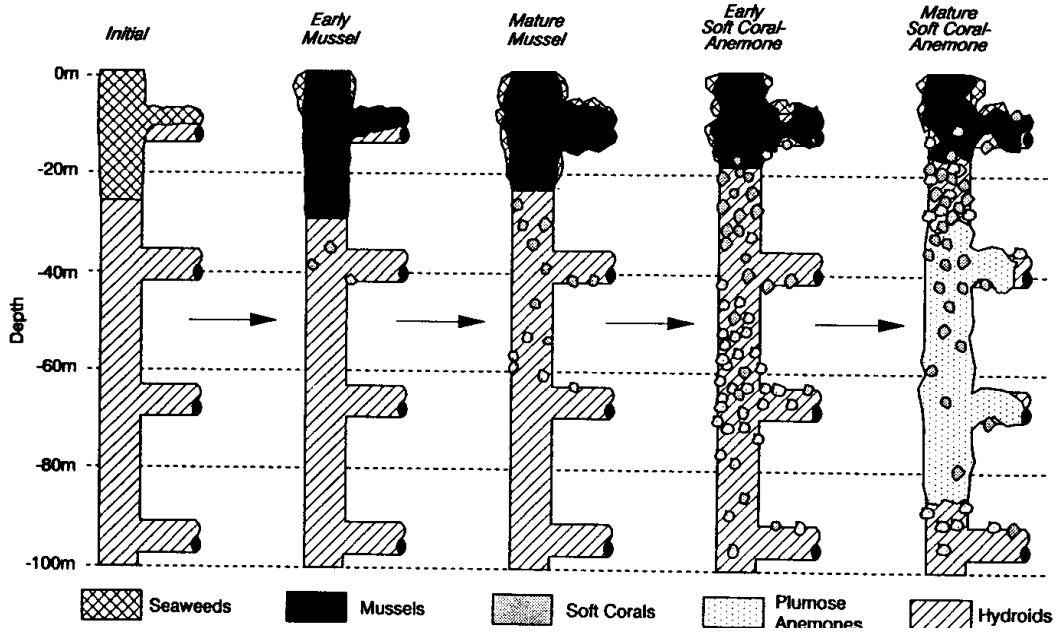

Fig. II-03

Fig. II-01: Iron corrosion
Fig. II-02a: typical chequered pattern in cross sections
Fig. II-02b: The swollen and slimy appearance of the secondary cell.
Fig. II-02c: Diamond-shaped cavities that appear at the interface between sound and degraded cell walls, when viewed in longitudinal section.
Fig. II-03: Schematic outline showing stages in the development of fouling on a hypothetical steel structure in the central North Sea.

2-3-3-1- Iron: [37]

Iron buried in the soils or lying on the ground surface exposed only to ground and air moisture corrodes essentially by an electrochemical process. The corrosion of iron in sea water proceeds in somewhat the same manner but is greatly accelerated because normally water becomes more corrosive as the salt content increases. For example, iron corrodes five times faster in sea-water than in soil and ten times faster in sea water than in air (Cornet 1970:439).

In fact, as much as 60% of the corrosion of iron in salt water can be attributed to bacterial action (Pearson 1972a:35). It accounts for most of the rapid corrosion of buried iron and steel pipelines in waterlogged clay soils in England (Farrer, et al. 1953:80). Sulfate-reducing bacteria, particularly the strains known as Sporovibrio desulphuricans (Pearson 1972a:35) and Desulphovibrio desulphuricans (Farrer, et al. 1953:82) are commonly found in salt water, fresh water, and waterlogged soil. The decaying organic material consumes oxygen and creates localized anaerobic environments. Sea water has a large supply of sulfates and under aerobic conditions these bacteria utilize hydrogen to reduce the sulfates $(SO_4)^{-2}$ to sulfides (S^{-2}) as a metabolic by-product according to the reaction: $H_2SO_4 + 8H \rightarrow H_2S + 4H_2O$

Once iron has been removed from a marine environment the corrosion process will continue, and even accelerate, unless certain precautions are taken. It is essential that they be properly stored in an inhibitive solution to prevent further corrosion. As an example to illustrate the severity of erosion due to fouling a scheme, which is based on studies in central part of North Sea has bee provide. [38] [Fig. II-03]

2-3-3-2- Wood:

As for wood explained before, most of the damages are due to the bacterial and tunneling worms. Wood is an organic material, whose ways of damaging and treatment are different from the non-organic material; rotting and erosion, pealing off and other physical damages are major damages which have been observed on wood.

Being of organic origin, wood normally decays under combined biological and chemical attack when buried in the ground. It can, however, survive prolonged exposure to extremes of dryness or wetness. In general two-fold problem involves in wooden materials which were underwater:

(1) Incorporation of a material into the wood which will consolidate and confer mechanical strength to the wood as the water is removed.

(2) The removal of the excess water by a method which will prevent any shrinkage or distortion of the wood.

[37] U.S. Defense Department Environmental Network & Information eXchange, https://www.denix.osd.mil/denix/Public/ES-Programs/Conservation/Underwater/3-IRON-1.html
[38] Sell D., Maritime Fouling, Proceeding of the Royal Society of Edinburgh, 1998, 169-184, 1992

2-3-4- Corrosion due to water pollution:

The corrosive substances that affect port installations and equipment, floating docks and ships at anchor in port originate directly from the industrial effluents or are formed in situ by biological and chemical conversion of the organic matter supplied by the agricultural and municipal effluents. Various corrosive agents and processes occur in polluted river water and seawater.

Sea ports are central elements of the marine infrastructure, with critical installations and essential equipment for maritime activities that must be protected against corrosion. A typical polluted marine port is located near a city and a hydrology basin, with a river flowing into the sea in the proximity of the port that contributes industrial, agricultural and municipal effluents loaded with pollutants. During biological and chemical decomposition processes, the effluent wastes transform into toxic or corrosive products such as hydrogen sulphide, oxygen, carbon dioxide and ammonia, and heavy metals may be released.

2-3-5- Conservation:

Fouling develops over a period of time through a number of succession communities to reach a climax community when a balance is attained between competition, dominance, death and decolonization by the species making up the community. Cleaning operations and storm action interrupt community development, returning it to an earlier succession stage or altering its characteristics. Usually, growth is rapid and plants can reach lengths of 20-30cm; thus sometimes damage and incomplete cleaning results in an even denser mat.

2-3-5-1-Iron Conservation:[39]

The process by which any metal artifact is cleaned is determined by the preliminary evaluation and only then can the appropriate conservation measures be taken. The conservation treatments accorded an object of iron will be discussed under the five main categories:

1. Electrolytic reduction
2. Alkaline Sulfite
3. Chemical cleaning
4. Annealing
5. Water diffusion in alkaline solutions

2-3-5-2- Wood Conservation:

In shipwreck sites, the wooden components of the hull and small artifacts of wood often survive in good condition, although thoroughly waterlogged. Successful conservation depends upon knowledge of wood structure and types. Trees are divided into two broad categories, hardwoods and softwoods. [40]It is very important to know

[39] U.S. Defense Department Environmental Network & Information eXchange, https://www.denix.osd.mil/denix/Public/ES-Programs/Conservation/Underwater/3-IRON-1.html

[40] Hardwoods are in a taxonomic grouping called Angiosperms and which refers to broadleaf trees which are usually deciduous. They are referred to as porous woods because they have vessel pores.

the category of wood and in many instances, it is critical that one knows the species in order to successfully conserve the waterlogged wood.

Generally speaking, freshly cut, sound wood will, through water loss, shrink ca. 3-6% radically, 5-10% tangentially, and - 0.5% longitudinally. Oak shrinks 4% radically and 8% tangentially when air dried after cutting, while waterlogged oak can shrink 12% radically and ca. 24% tangentially. Proper conservation will control the amount of shrinkage. In practice, a particular conservation technique is often selected because it is known that the treated wood will shrink a desired amount (Patton 1988:43).

The manner in which a board was originally sawn from the log will have an effect on how it is going to shrink after undergoing any conservation treatment. In fact, the method of sawing can make it very difficult to conserve the wood without cracking and warping occurring after treatment.

In anaerobic waterlogged environments there are profound chemical changes and alterations in the composition and microstructure of woods, resulting in great loss of strength while retaining overall shape and form. In other environments wood decays from; 1) physical action (changes in temperature, fluctuations in relative humidity, etc.), 2) insect attack, and 3) fungal decay. Fungal decay, along with anaerobic bacteria, plays the largest role in the breakdown of wood. Fungal decay can be eliminated as long as the wood is kept in a relative humidity of less than 65%.

2-3-5-3- Waterlogged Wood: [41]

The tannin in wood protects it from degradation, and allows some wood, especially those with high tannin contents, to survive in good condition. In all wood, after long periods in wet soil, peat bogs and marine sites, bacterial action causes a degradation of the cellulosic components of cell walls. In general, water soluble substances such as starch and sugar disappear from wood first, along with mineral salts, coloring agents, tanning matters and other bonding materials. In time, through hydrolysis, cellulose in the cell walls disintegrates, leaving a lignin network to support the wood. Even the lignin will break down over a long period of time. As a result of the disintegration of cellulose and lignin, spaces between the cells and molecules increases and the wood become more porous and permeable to water. All the deteriorated parts, all cell cavities and intermolecular spaces are filled with water. The remaining lignin structure of wood cells and the absorbed water preserves the shape of the wood. The loss of the finer cellulose tissue does not cause much alteration in the gross volume of wood, but the porosity is increased and the wood absorbs water like a sponge. As long as the waterlogged wood objects are kept wet they will retain their shape. If the wood is exposed to the air, the excess water evaporates and the resulting the surface tension forces of the evaporating water causes the weakened cell walls to collapse, causing considerable shrinkage and distortion. The amount of shrinkage is dependent upon the degree of disintegration and the amount of water present. The amount of water in waterlogged wood is determined by the formula:

Oak and birch are typical examples of a hardwood. Softwoods or Gynmosperms are needle bearing trees or conifers. They are called nonporous because they lack vessel pores. Pines are a typical example of softwood.

[41] U.S. Defense Department Environmental Network & Information eXchange, https://www.denix.osd.mil/denix/Public/ES-Programs/Conservation/Underwater/3-Wood-1.html

$\%H_20$ = weight of wet wood - weight of oven dried wood X 100 weight of oven dried wood

Anything greater than 200% is considered to be degraded, and it is not uncommon to find wood that has more than 500% water. 1000% water is not uncommon. Waterlogged wood is often classed according to the amount of water is contains.

Class I, over 400% H_20

Class II 185-400% H_20

Class III less than 185% H_20

The Class III hardwoods are the most difficult to conserve.

2-3-5-4- Waterlogged Wood Conservation Methods:[42]

As it is said before, the conservation of waterlogged wood is a two-fold problem that involves (1) consolidating mechanical strength of the wood after removing water, and (2) the removal of the excess water by a method which will prevent any shrinkage or distortion of the wood. All the bulking treatments that use PEG or sugar are examples of the first, while solvent drying and freeze-drying are examples of the last. The most common techniques for treating waterlogged wood are discussed below. In all the treatments discussed below, if the wood was recovered from a salt water environment, it is necessary that the bulk of the soluble salts be removed, otherwise, they will cause a white bloom on the conserved wood and will can adversely affect any remaining iron components in the wood and other material in the same room or environment where the treated wood is stored.

1-Polyethylene Glycol (PEG) Method:

The development of PEG as a conservation process was the first reliable method for treating waterlogged wood that was simple to carry out. The excess water in wood is removed and the wood is bulked in one operation. The waterlogged object is cleaned to remove all dirt on the surface and is placed in a ventilated vat where the temperature is gradually increased until, after a period of days to weeks, it has reached 60^o C (140^o F). During this time the PEG percentage of the solution increases as the solvent (water or alcohol) evaporates of by adding increments of PEG. In the process, the wax slowly diffuses into the wood, displacing the water. At the end of the operation, the wooden object is covered with molten 70- 100% PEG, depending upon the nature of the wood. The object is then removed; the excess wax wiped off and allowed to cool. When cooled, any excess wax on the surface is removed with a hot air gun or with hot water. When carrying out this method using a container in which the PEG concentration is increased by evaporation of the solvent, it is important that the dimensions of the container be such that the starting quantity of wax present will be more than enough to cover the object at the end of the process.

[42] **U.S. D**efense **D**epartment **E**nvironmental **N**etwork & **I**nformation eXchange, The following pages are the direct copy of the experienced done by **U.S.D.D.E.N.I**
https://www.denix.osd.mil/denix/Public/ES-Programs/Conservation/Underwater/3-Wood-1.html

2- SUCROSE method

The sucrose (sugar) method of conserving waterlogged wood was developed as an alternative to more expensive methods (Parrent 1983, 1985). In practice the procedure is for all intent and purpose, identical to that described for PEG, except that sucrose is used. Wood to be conserved should be carefully cleaned by rinsing in baths of fresh water to remove all ingrained dirt and to remove the bulk of any soluble salts that are present.

This solution, from the points of view of some chemists, could be the last possible solution, due to the other problems which sugar might cause such as attracting insects.

3- ACETONE-ROSIN method

The treatment consists of replacing the water in wood with a natural rosin, in this case pine rosin, also called colophony. This treatment was developed to conserve well preserved hardwoods such as oak where the higher molecular weight PEG could not penetrate (McKerrel and Varanyi 1972; Bryce, McKerrell, and Varanyi 1975).

4- ALCOHOL-ETHR method

This method is similar to the process used for drying out biological specimens. If necessary, the wood should be cleaned. The waterlogged object is first immersed in successive baths of alcohol until all the water has been replace by the alcohol. Isopropanol or ethanol is usually used. This is followed by successive baths of acetone. When all water has been replaced by acetone, the object is immersed in successive baths of dim ethyl ether to replace all the acetone with ether. When this has been accomplished the object is dried very quickly by placing it in vacuum so that the ether volatilizes rapidly. Ether is used because it has a very low surface tension of 0.17 dyne/cm compared to 0.72 dyne/cm for water. This means that when the ether evaporates, the surface tension forces are so low that there is no appreciable collapse of the weakened cell wall. If necessary, 10-20% dammar resin, colophony rosin or a mixture of the two can be dissolved in the final bath of ether so that the resin is deposited in the pores of the wood to act as a consolidator. Alternatively PVA can be used on some pieces. The resins consolidate the wood, but more importantly, they seal it off so that it is not as subject to warping due to changes in the relative humidity.

This method has proved to very successful, producing a very natural looking, light (weight & color) wood. It is only economically feasible for the treatment of small objects. The alcohols and especially the ether are highly flammable and extreme caution should be taken. The dehydration process can be very effective, but the alcohols and ether must be water free. For many objects, a dehydration of only alcohol and acetone is effective.

5- Camphor-Alcohol method

This treatment is analogous to the alcohol-ether method. The success of this treatment depends on replacing all the water with a water miscible alcohol, and then replacing the alcohol with camphor, which results in all the cavities and cell walls being filled with camphor. The camphor then slowly sublimates (goes directly from a solid state

to a gas) without exerting any surface tension on the cell walls. Consequently, the wood does not collapse, shrink, or distort. The treatment results in a very aromatic, light weight and light colored wood. The camphor can be dissolved in any of the alcohols. In essence, this treatment is a dehydration method, as describe above, but with a temporary bulking agent added until it sublimates.

6- Freeze-Drying of waterlogged wood

Freeze drying is used with some regularity of small pieces of wood, but the only limitation is access to the proper size freeze drying container Ambrose 1970, 1975; Rosenquist 1975, Watson 1982; McCawley, Grattan and Cook 1982). In the past the main problems that presented themselves was the tendency for the surface of the wood to check and crack. This is caused by the water freezing, and the ice crystals expand and expand and damage the cell walls. Ambrose (1970) found that if the wood was pre-treated by soaking it in a 10% solution of PEG 400, until it was saturated, then it the formation of ice crystals is essentially eliminated. In more recent years, pre-treating in 10% PEG 400 before freezing the wood has become a standard part of freeze drying wood, just as it has become for leather also. More recently, Watson (1987:274-275) soaking in 20% PEG 400, "rather than the 10% recommended by Ambrose in order to prevent bacterial slime from forming in the soaking bath. At concentrations above 20% micro-organisms are dehydrated by osmosis and cannot survive." If you use a PEG solution of less than 20%, a fungicide such as 1% borax/boric acid or Dowicide 1, or other fungicide should be mixed with the PEG solution to stop any slime or mold from growing in the solution during the soaking.

7- Silicon oil treatment

A simplified version of the silicone bulking process that is applicable for the treatment of small wood artifacts and other organic material is as follows:

1. Take waterlogged wood and place directly in a bath of ethanol and hold under a vacuum for approximately one hour.
2. Place the dried wood into a bath of acetone and hold under vacuum for approximately one hour.
3. Remove wood and place it in SFD-1 silicone oil that has had 4% Isobutyltrimethoxysilane added to it. The isobutyltrimethoxysilane is a cross-linker that sets the silicone oil up for curing in the nest steps. Keep wood submerged in this mixture under vacuum over night.
4. Remove wood, and pat dry with a dry rag to remove excess silicone oil on surface
5. Place the wood in a closed container over a small dish containing a small volume of FASCAT Catalyst 4200 in it. Place everything in a furnace heated to 52^{o} C. The heat of the furnace vaporizes the FASCAST and the vapors causes the silicone oil to cure in the wood, stabilizing it.

This chemical material has been suggested to replace PEG, as the experts from the A&M University of Texas claim that “this silicone oil treatment results in a very naturally colored wood that undergoes little to no dimensional changes. The wood is stable and does not require the close environmental controls that some other treated

woods do. Still, it must be kept in mind that this treatment is not reversible, but for that matter most of the other treatments are not either."

Considering all the experiments above, in comparison with most of the practical successful experiences in the world, one of the best solutions to conserve the wood is PEG. The actual experiences can be seen in Vasa museum, and afterwards in Mary Rose and then in smaller scale in some cases to preserve cogs in Germany and Denmark. Although, this resin gives a dark appearance to the wood, but by the time being to conserve wood out of water this is one of the most applicable treatment.

2-3-5-5- Conservation in situ and other experiences:

Although the marine environment may to some extent preserve shipwrecks and their contents (Delgado 1988b), no wreck is completely stable in its environment. All wrecks are to varying extents subject to deterioration and damage from the effects of the marine environment (Hezel & Graham 1997; Kenderdine 1997; Sledge 1977). The extent of deterioration of shipwrecks is determined by depth, topography and composition of the seabed, temperature, salinity, oxygen content, sea conditions, water movement (Jeffery 1990; Kenderdine 1997; Nutley 1996), and the type of material used in the ships construction (Kenderdine 1997).

Shipwrecks located in deep water often remain largely intact and in their original location because they are subject to relatively low levels of chemical, physical and biological deterioration. The structural remains of shipwrecks located in areas where there are strong currents or turbulent, highly oxygenated shallow waters may disappear completely, leaving only scattered items and parts of the ship (Nutley 1996).

Wooden structures and other organic compounds are usually affected by biological processes relatively quickly unless covered by sediment.

Although dissolved oxygen levels generally increase slightly with increasing water depth to a depth of approximately thirty meters, corrosion rate is dependant on the rate of supply of oxygen. The rate of supply of oxygen is increased by water movement which generally decreases significantly with increasing depth, reducing the rate of supply of oxygen and therefore the corrosion rate (MacLeod 1989 & 1997).

The corrosion rate of wrecks is greatly reduced when a layer of ferric hydroxide forms on the metal (Lindemann 1992), and this layer is covered by a layer of marine organisms that form a protective concretion over the surface of the wreck. Concretions prevent the circulation of seawater and slow the natural rate of corrosion (Kenderdine 1997; MacLeod 1992; Nutley 1996) by forming a semi-permeable membrane that separates the two parts of the corrosion cell (MacLeod 1989).

The corrosion rate of metal covered by protective concretion was very sensitive to depth; the corrosion decreases with increasing depth.

Ships sunk upright on sand generally sink into the sand to about the same level that they would normally float in water (Riley 1985).

Vessels that sink upside down are relatively stable, although the upper decks collapse and machinery and fittings fall. Vessels that sink on their side deteriorate quickly, as the unsupported hull sides collapse and the wreck site becomes flat and scattered. Vessels located on a rocky seabed deteriorate the most rapidly, collapsing over and around the rocks (Riley 1985). Submarines deteriorate at a much slower rate due to their cylindrical shape and greater strength and thickness than other types of vessels, and it is considered that submarine wreck sites may remain for centuries (McCarthy 1998; Smith 1999).[43]

There are some new experiences, following the policies of UNESCO convention- conservation in situ- which brings new techniques in order to conserve and protect the underwater relics. This new techniques help scientist to study the relics without fear of conservation, and later on to put back the object on its original or other similar condition place to conserve them for probable future studies and plans.

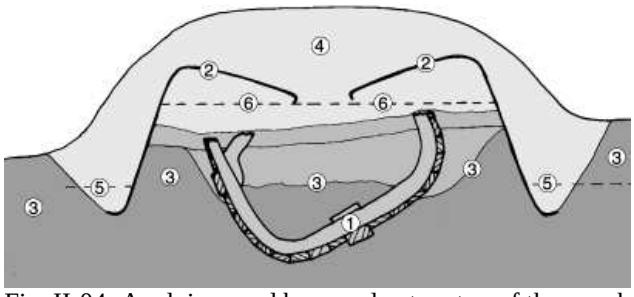

Fig. II-04: Applying sand bags and net on top of the wreck as a reburial method, the elements are as follows:
1. Shipwreck
2. Plastic foil
3. Original sediment
4. Sediment deposited on wreck after placing the plastic foil
5. Ground water level outside the "plastic tub"
6. Ground water level inside the "plastic tub"

In-situ preservation and reburial are two techniques applicable to shipwrecks for their long-term preservation and storage in natural environments. By 'in-situ preservation' the shipwreck will be protected on-site in the marine environment. Reburial means that the shipwreck first is excavated on-site, and afterwards reburied in the same or another environment, either in one piece or dismantled. Both methods mostly use marine sediment as a covering or burial material. Above the sediment or directly on the timber construction, the use of different cover layers, such as sandbags, concrete, geotextile or plastic, has been reported (Oxley, 1996). As it is said previously, one of the first in situ conservation practices has been done in Netherlands on BZN 10 Wreck by applying sand bags and net on top of the wreck. This method has been simplified later and on the image below one of the practical ways has been shown. [Fig. II-04] This method has been applied for protecting shipwrecks in the IJsselmeerpolders. [44]

The methods described above are intended to protect wood from physical and biological degradation (Curci, 2006). The main wood-degraders in seawater worldwide are the marine borers; especially shipworm (Teredinidae) and Limnoria are known rapidly to decompose all wooden constructions exposed above the seabed (Rutherford et al., 1980; Cragg et al., 1999). A large variety of wood degrading fungi and bacteria are also present in seawater (Mouzouras et al., 1986; Eaton and Hale, 1993). Soft rot, tunneling bacteria (TB) and erosion bacteria (EB) start their decay in

[43] Impacts of recreational SCUBA diving on shipwrecks in Australia and the Pacific, Micronesian Journal of the Humanities and Social Sciences, Joanne Edney, Vol. 5, nº1/2 Combined Issue November 2006, A Review.
[44] Rob Oosting, Moss Newsletter, Dec 2003

the surface layer of the wood, and proceed inwards (Blanchette et al., 1990; Kim and Singh, 2000). During decay, a softening of the surface takes place, and owing to the abrasive effect of currents and passing sand particles, the surface layer slowly erodes away. However, the rate of attack is much slower than for marine borers, and does not usually lead to rapid destruction of the wood. [45]

As this technique is called -in-situ preservation and reburial- the question still remains unanswered about the presentation to the public and different methods of informing the public.[46]

Another recent method which has been applied recently for conservation and presentation of a wreck inside an aquarium has been implemented by a group of experts in Sweden. Laboratory experiments, as well as experience from the test aquarium, showed that it might be possible to combine preservation, display and conservation of archaeological waterlogged wood in one process. When wood contains no iron, and when the aquarium remains anaerobic, the impregnation liquid PEG 400 stayed transparent and clean. For objects, processed for freeze-drying, impregnation, may just as well take place in an aquarium for public display rather than in an unapproachable tank. Impregnation time usually varies from a few months to some years, depending on size of the object, wood species and degree of decay.

The display of historical boats or other wooden objects during conservation treatment would undoubtedly add a new dimension for visitors to archaeological and maritime museums.

The Aquarius method has a great potential for archaeological waterlogged wooden artefacts, whether the purpose is public display, storage before conservation, long-term preservation, or conservation. Keeping the wooden objects immersed in anoxic water will prevent possible detrimental effects from atmospheric oxygen present in ordinary museum environments. In wrecks that contain iron, problems occur that are strictly related to iron corrosion. Corrosion experts have an important task to solve, before a wreck safely can be immersed in an anoxic aquarium. [Fig. II-05]

In brief, the results showed that wood can safely be kept in an anoxic aquarium containing water at room temperature. Algae and other microbes may occur initially, but can be removed successfully by appropriate filter systems; the water remains clear. A low-molecular PEG (polyethylene glycol) solution was found to be equally as successful as water, which indicates a future possibility of combining conservation, storage and display in one process. When archaeological wood contain nails or other iron items, the water darkens, owing to an anaerobic corrosion processes which

[45]C. G. Bjordal, T. Nilsson, Reburial of shipwrecks in marine sediments: a long-term study on wood degradation, Journal of archaeological science, June 2007

[46] To consider these methods as only-conservation methods, here is a recommendation and methodology of applying this treatment: 50 cm of sediment is recommended. In order to prevent erosion of the sediment layer after reburial, a top cover of for example geotextile would be appropriate to ensure long term stability. A long term monitoring system of the wood decay at the wreck site, will allow continuous control of the reburial conditions. These measures will ensure that the wrecks will survive for much longer periods than wrecks without protection.

involves black iron products which discolor it. Before a full-scale aquarium dedicated to shipwrecks is built, the iron corrosion problem must be solved. The process which has been done for this project has been summarized in the following table. [47] [Fig. II-06]

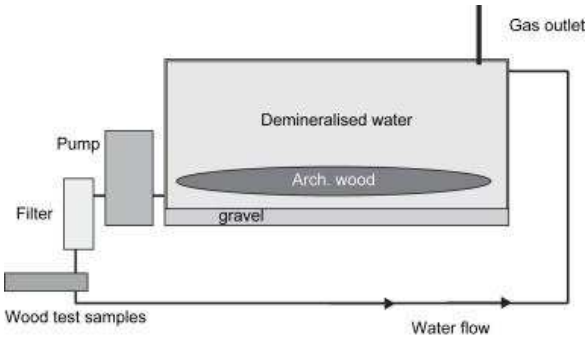

Fig.II-05

Fig.II-05: This illustration shows the design of the aquarium and the direction of water flow.
Fig. II-06: Summery of the process of testing anaerobic corrosion.

Subproject	Observations on:
1	Microbial decay in wood
2	Discoloration of water
3	Discoloration of wood
4	Effect of Biocide/Borax (0. 1%;0,5%)
5	Effect of wood + iron in water
6	Marine wood stored in fresh water
7	Water added PEG 400, 10%
8	Oak in water
9	Water added 30% alcohol

Fig. II-06

As a result to this chapter, some main purposes and ideal perspectives of conservation and presentation of underwater cultural sites have been presented below. The importance of in situ or in similar situ presentation has been high-lightened.

Herewith, the importance of the context and natural environment of the underwater historic sites has been showed up more. To achieve the best result of treating an underwater cultural site, the natural and environmental issues should be considered as the most determining issues. Since current research is going to provide guidelines for Belgium underwater cultural heritage and maritime archaeology, the following chapter will present an overview of the climatic and natural condition of the North Sea, mainly in Belgium territory water.

[47] Preservation, storage and display of waterlogged wood and wrecks in an aquarium: "Project Aquarius", Bjordal CG, Nilsson T , Petterson R, Journal of Archaeological Sciences, 34 (7): 1169-1177 JUL 2007

2-4- Environmental Condition:

2-4-1- Introduction:

Climate and nature of the water where the underwater relics lay are of great importance in order to clarify the methods of conservation as well as complexities and possibilities of presentation to the public.

Climate and atmospheric characteristics affect decision making; the period of rain, fuggy weather, water freezing are some factors affecting planning and scheduling the study, excavation, and further more planning for future destiny of the underwater relics. The underwater currents which can bring several kinds of direct issues- moving the relics, causing damages such as breaking or crack- and indirect issues- moving different kinds of sea animals and biologically affects the body of the relics- influence project's planning in different geographical part of the world. Nature of the water and its characteristics such as visibility and dept, variety of biological growth and biofouling and so on are other aspects of importance of the environmental conditions of the underwater cultural sites. For example, working underwater, diving as a study project or as a recreational activity in Mediterranean seas is completely different with seas and oceans in the northern part of Europe.

The location and the dept of water, as it is said, are of great importance in order to define the strategies for presentation and conservation. The exact definition of "shallow" and "deep" water depends on the maximum wavelength of the swell striking that spot. One other important issue is that in the deep water coarse hydroids[48] only grow on the upward facing surfaces. Accordingly, the importance of the geomorphologic study to the interpretation of any shipwreck site is clear. [49]

2-4-2- The North Sea:

Concerning North Sea in Belgium here a brief introduction to its characteristics and nature has been provided. [Fig. II-07] The North Sea averages about 100 m deep, but reaches down as deep as 700 m and in some areas-mostly in the south parts- can be a mere 15 m deep. The North Sea lies above the junction of three tectonic plates which can cause earthquakes and small tsunamis. However, the sea's coastal features are the result of glacial movements rather than tectonics. Deep fjords and sheer cliffs mark the coastline of the northern part of the North Sea (Areas close to Scottish and Norwegian coasts are rocky.)- The seafloor is comprised mostly of mixed sediments with mud in some more northerly areas- whereas the southern coasts consist of sandy beaches and mudflats. These flatter areas are particularly susceptible to flooding especially as a result of storm tides. Elaborate systems of dikes have been constructed to protect coastal areas.[50]

[48] An invertebrate sea animal with an internal body cavity that lives in colonies, forming growths like tufts
[49] Muckelroy K., Maritime Archaeology, New Study in Archaeology, 1978
[50] http://en.wikipedia.org/wiki/North_Sea

2-4-2-1- Geology:

Geological history

The bed of the North Sea forms two basins. The main northern one lies to the north of a ridge between Norfolk and Frisia, and had its origin in the Devonian. The southern basin, if not flooded, would drain towards the Strait of Dover and thence to the English Channel.

Plate tectonics

The North Sea lies over the intersection of several major tectonic plates. The fault lines along the English Channel cause occasional earthquakes, which can result in damage to structures on land. The Central Grabens of the North Sea is an active area, as well as northwestern Europe's continental slope which is subject to landslides from earthquakes. Although not a site of major earthquakes or tsunamis, there are intra-plate earthquakes which result in the uplifting of the continental crust causing landslides.[51]

2-4-2-2- Hydrology

Basic data

The salinity of the water is dependent on place and time of year but is generally in the range of 15 to 25 parts per thousand (ppt.) around river mouths and up to 32 to 35 ppt. in the northern North Sea, still generally lower than North Atlantic salinity, which averages around 35 ppt.

The water temperature varies depending on the influence of the Atlantic currents, water depth, and time of year, reaching 25 °C (77 °F) in summer and 10 °C (50 °F) in winter, though Arctic currents can be colder. In the deeper northern North Sea the water remains a nearly constant 10 °C (50 °F) year round because of water exchange with the Atlantic. The greatest temperature variations are found on the very shallow Wadden Sea coast, where ice can form in very cold winters.

2-4-2-3- Water circulation and currents:

Along the Danish and Norwegian coasts the water flows back into the Atlantic via the Norwegian Current. This moves at a depth of some 50 to 100 m (165-330 ft). This current has a relatively low salinity due to the brackish water of the Baltic and the fresh water contributed by the rivers and the fjords. A part of the warmer water flowing in from the Atlantic turns northwards again along the Current and results in a warmer stream through the colder waters. In winter the Norwegian Current has a temperature of 2 to 5 °C (36°-41 °F) and the salinity is below 34.8 ppt. The Atlantic

[51] Axel Bojanowski, (October 11, 2006). Tidal Waves in Europe? Study Sees North Sea Tsunami Risk. Spiegel Online. Retrieved on 2007-07-24.

water in the North Sea, divided from the Current by a front, is generally over 6 °C (43 °F) with a salinity of 35 ppt.[52]

Structures in the northern North Sea would be exposed to the slope current, carrying Atlantic water around the northern tip of Shetlands. The structures in the southern and central North Sea would be exposed to either a mixed water mass or costal currents.

2-4-2-4- Tides

The tides are caused by the tide wave from the North Atlantic, as the North Sea itself is too small and too flat to have its own tides. Ebb and flow alternate in a cycle of 12.5 hours. The tide wave, owing to the Coriolis effect, flows around Scotland and then in counter-clockwise direction along the English coast and reaches the German Bight some 12 hours after arriving in Scotland. In so doing, it runs around three amphidromic points: a central point lies shortly before the Straits of Dover. It is formed by the tide wave which is transported across the English Channel. It influences the tides in the narrow area of De Hoofden in the Southern Bight between southern England and the Netherlands.

Storm tides

Storm tides threaten in particular the coasts of the Netherlands, Belgium, Germany, and Denmark. These coasts are quite flat, so even a relatively small increase in the water levels is sufficient to put large stretches of land under water. Storms from the west are especially strong, so the most dangerous places are on the south-east coast. [53]

2-4-2-5- Biology:

Biological growths and bio-fouling:

In this section has been tried to find out which kinds of biological growths and sea animals are harmful for the underwater relics. It should be mentioned that in most of the literatures the process of study in vice-versa; most of the studies regarding biofouling and biological growth have been done in order to save the new sub-aquatic structures such as pipelines, new decks and so on. As a result in most of the cases the suggestions and solutions are dealing with prevention of these phenomenons, and not to deal with a structure fouled for a long time.

Following study is dealing with different kinds of biological growths in the North Sea, and further more it has been tried to figure out which ones are harmful to the structures, should they be removes from the relics or they are providing more stability to the sites.

Generally, structure placed at any depth in the water in this area (the North Sea) will become fouled unless they are protected by antifouling-which it is not the case about the underwater cultural heritage and historic relics. In deep water or at remote locations is not imparted immunity to effects of fouling. The composition of the

[52] Royal Belgian Institute of Natural Sciences, MUMM North Sea facts, <http://www.mumm.ac.be/EN/NorthSea/facts.php>. Retrieved on 19 July 2007
[53] http://en.wikipedia.org/wiki/North_Sea

fouling layer, the rate of its development, and its ultimate thickness, depend on a large number of factors, but it is an inescapable fact that unprotected substrata will became fouled. The species and groups regularly found at large numbers of sites throughout the North Sea are seaweeds. Within some studies which have been done for installation of new sub-aquatic infrastructure in Southern part of the North Sea[54], the results came up as follows:

The marine growth on the bottom of the sea showed the existence of seaweeds including Enteromorpha, Cladophora and species of Rhodophyta. A substantial mussel's community extended from the base of algal band to 12m, with density of over 1000individual/m2. Mussels continued to dominate on horizontal cross members to 15m, possibly because animals cleaned from shallow locations had settled and reattached successfully on deeper members. Significant amount of hydroid were also found in mussels zone, forming a 'turf' up to 2cm thick. The turf consisted of a mixture of hydroids, the remains of byssus threads, entrapped micro-algae and the soft dwelling tubes of amphipod Jassa falcate. This shelter-building habit of J.Falcata helped to consolidate the turf. From the low end of mussel's zone to 19m depth, fouling was dominated by a single species, the anemone Metridium senile, and from 19m to the mud-line there were mainly barnacles Balanus balanus. [55]

There is a preliminary study of the macro-fauna living on a wreck located on the Belgian Continental Shelf (BCS) available. The study revealed an extremely rich sessile[56] and slow moving fauna (at least 40 species), three jellyfish species and eight fish species. The presence of at least 51 species represents a biodiversity of macro-fauna on the wreck that is much higher than that found in nearly all known surrounding soft bottom communities belonging to the BCS. The covering of large parts of the wreck is represented by three species: Sarsia eximia (Hydrozoa) and Jassa herdmanni (Crustacean) associated with Tubularia indivisa (Hydrozoa). It should also be pointed out that 53 % of the species identified in this study are species not included as members of the Belgian marine fauna in a recent list dealing with offshore fauna. Moreover, some, such as Sarsia eximia or Epithonium clathratulum, previously thought to be rare, have been found in large numbers. Furthermore, Diadumene cincta and Caprella tuberculata are new species for the Belgian marine fauna.[57]

Hard bottom substrates at sea allow the development of communities that are often rich in terms of species diversity. Non-biogenic structures such as shipwrecks are an integral part of these substrates[58], even if they have an anthropogenic origin and the species assemblages they harbor could be for that reason qualified as 'exotic'. There are 200 recent shipwrecks on the Belgian Continental Shelf (BCS), which represent a large fraction of the hard substrate available locally; their presence has an additional

[54] Scientifically, in some texts, North Sea has been divided into three main parts to facilitate researches and studies; Northern part, Central, and Southern parts. Belgium territory water has been located in the southern part.

[55] R.G.J. Edyvean, L.A. Terry, G.B. Picken, Marine fouling and its effects on offshore structure in the North Sea- A review, Biofouling Magazine.

[56] Describes an animal that is permanently attached to something rather than free-moving.

57 http://www.vliz.be/projects/bewremabi/results.php

[58] It is generally accepted that artificial reefs can serve a positive function by the creation of new hard-bottom habitat in areas where hard-bottom is naturally lacking

interest if knowing that the major part of the English Channel and Southern Bight of the North Sea consists almost exclusively of soft sediments. Five shipwrecks on the BCS have been studied in order to assess the micro- and macro-faunal diversity using direct observations and scuba sampling techniques. The soft sediments close to shipwrecks have also been studied to serve as model for areas relatively undisturbed by fisheries (untrawled). Added to this, the influence of shipwrecks on local hydrodynamics and sediment transport favor the colonization by fragile epibenthic species and as a consequence increase habitat complexity.[59] The study above can be summarized in a graph in Fig. II-08. [60][Fig. II-08, 09]

There are some issues about biological growth in the deep and shallow water:

In deep water (more that 40-50m) is the behavior of deepwater sediments; there could be some mobile sediment which is affecting the sites.

In the shallow water the principle fouling organisms are mussels, seaweeds and hydroids, in mid-water zone where fouling mainly consisted of closely-packed mosaic of soft corals, plumose anemones and hydroids, and less well defined deep-water zone mostly hydroid-dominated assemblage, with a significant proportion of anemones and soft corals. [61]

To have a general overview on the fouling in the North Sea a graph has been provide through studies in the North Sea.[62] [Fig. II-10]. This graph has been provided for the new sub-aquatic installation; therefore, it just covers a short span of time. Also, it is a study on steel materials. To provide better understanding of the underwater sites, such studies are needed for different materials.

59 http://www.vliz.be/projects/bewremabi/results.php
[60] Sell D., Maritime Fouling, Proceeding of the Royal Society of Edinburgh, 1998, 169-184, 1992
[61] Sell D., Maritime Fouling, Proceeding of the Royal Society of Edinburgh, 1998, 169-184, 1992
[62] Sell D., Maritime Fouling, Proceeding of the Royal Society of Edinburgh, 1998, 169-184, 1992

Fig. II-07

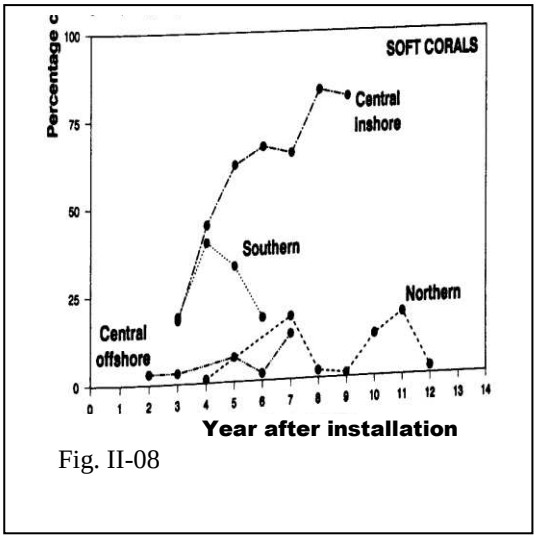

Fig. II-08

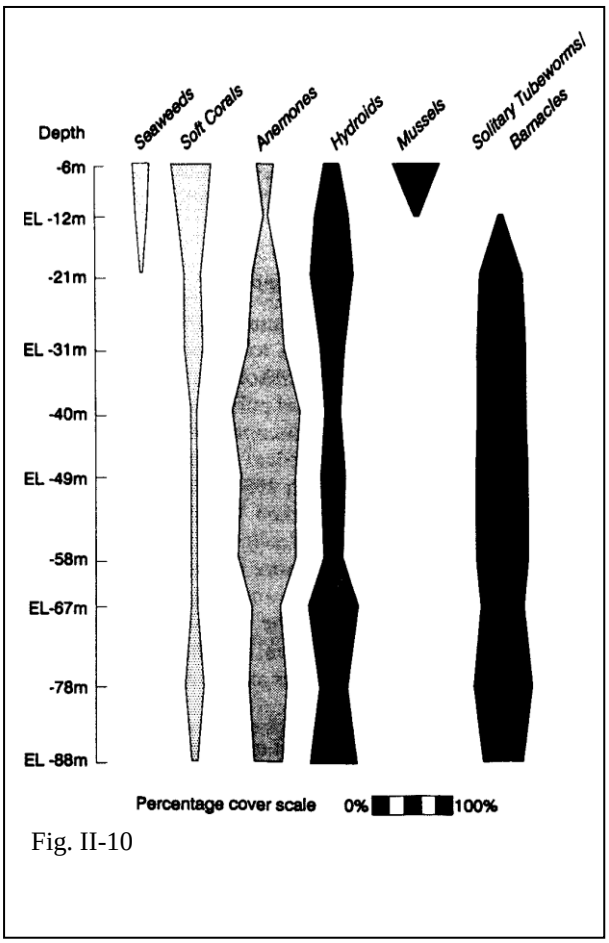

Fig. II-10

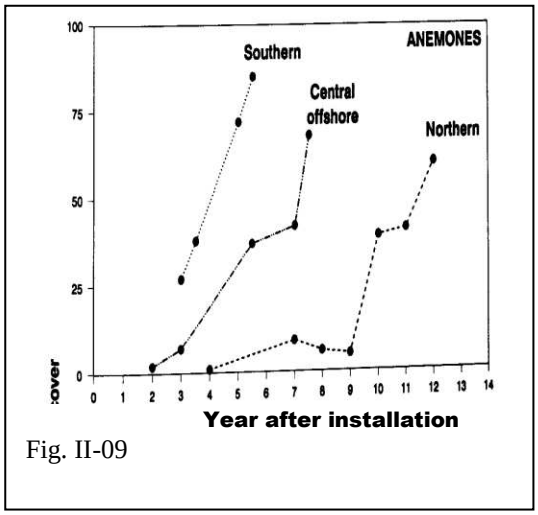

Fig. II-09

Fig. II-07: North Sea
Fig. II-08: Percentage covers by anemones and soft corals in relation to time after installation on the steel jackets in different parts of the North Sea.
Fig. II-09: Percentage covers by anemones and soft corals in relation to time after installation on the steel jackets in different parts of the North Sea.
Fig. II-10: A general overview on the fouling in the North Sea

Since it will be important for any future conservation and presentation of the relics in situ, here a table of factors which have effects on the patterns of micro-fouling and biological growth in the North sea (and also in general), according to David Sell's researches, has been presented as follows.

Factor	Effect
Depth	Depth tolerance can determine community composition (see text). Growth could be slower in colder, nutrient impoverished deeper waters below the thermocline (Wright & Bryce 1983).
Distance from shore or from other fouled structures	Inshore, or shallow-water structures may readily be fouled by dispersal stages of coastal or sublittoral fouling organisms (see text). Established populations or fouling organisms may regenerate continually or may shed dispersal stages that could 'infect' adjacent structures. Other factors, such as location of the fabrication site, immersion during tow out and movement of nearby shipping could also affect the degree and spread of fouling.
Temperature and season	In colder northern waters, rates of development and growth of fouling organisms are slower than in warmer waters of the central and southern North Sea (see text). The dominance of certain organisms may be seasonally dependent, e.g. seaweeds, and hydroids at shallower depths die back in winter. Times of settlement are also seasonal e.g. soft corals and bryozoans settle in winter; barnacles settle in spring; hydroids, anemones and tubeworms settle in summer; mussels may settle all the year round (Goodman & Ralph, 1981).
Exposure	Wave action due to storms can significantly reduce the levels of fouling in the shallow depth zone. Old or dead organisms thus removed will leave bare surfaces to be recolonised. Similarly, scour from resuspended sediments near the seabed can affect the viability of fouling communities.
Water masses/water currents	Different North Sea water masses contain a characteristic complement of planktonic plants and animals (Adams 1983). Coastal water masses may contain the largest quantities of fouling dispersal stages. Oceanic waters in the northern North Sea may contain fewer dispersal stages (see text).
Food availability	Coastal water masses are likely to be richer in nutrients than oceanic water masses; this may partly account for the slower growth rates of organisms on northern North Sea structures. In summer, a stable thermocline will prevent upwelling and mixing of the water column in depths greater than −40 m. Nutrient-rich water will be confined to depths that are shallower than the thermocline. In summer food availability to mid-water and deep-water fouling communities in the northern and central North sea will be less than to the corresponding communities in the southern sector. At depths that are shallower than 40 m there is no thermocline and upwelling continually recycles nutrients from the seabed. In winter, the thermocline breaks down throughout the North Sea (Wright & Bryce 1983).
Competition and interactions between organisms	The succession of fouling organisms on offshore structures is well defined (see text). One group of fouling organisms could potentially, delay the settlement of, or could outcomplete, another later fouling organism. Predators may also alter the normal successional pattern. For example, starfish feeding on mussels may greatly reduce the density of mussel beds on a framing (Forteath *et al.* 1982).
Imposition of other environmental stresses	This broad category includes: discharge of production water, sewage, drilling muds and cuttings and other chemicals; corrosion protection systems; antifouling systems; and platform cleaning. Each may significantly effect the viability of fouling communities or the rates of development of the fouling process.
Genetic differences	An example of genetic differences is given by the plumose anemone, *Metridium senile* which has a wide continuum of forms between the tall var. *dianthus* and the squat var. *pallidus* (Manuel 1981).
Environmental tolerance	Many examples of environmental tolerance could be quoted; these include the intolerance of sedimentary deposition by the soft coral, *Alcyonium digitatum*, which could partially explain an apparent scarcity of these in the more turbid waters of the southern North Sea.

2-4-3- Analysis and evaluation:

As it is said before, museums are not any longer the same places as they had been in 15th century. They have been transformed and there was a long evolution in their shapes, concepts of forming and the knowledge that they want to provide to the visitors. With the new conventions of world heritage organizations, especially UNESCO, and their demands and stress on more in situ preservation there have been some movements to innovate new ways of presentation of the cultural heritage and historic sites to the public. Along with "in situ preservation" concept, there are some more issues involved about educational aspects and training through heritage. Hence, the proper knowledge that might be expected from the new museums or way of presentation becomes high-lightened.

In order to have all the aspects above together, we need a range of issues which should come along. In one hand, in situ preservation and conservation is an assuring concept to preserve the cultural heritage for the future generation, on the other hand, presentation and training aspects are sometimes more complicated to get along with this concept of in situ preservation. For most of the on-land historic sites and monuments or archaeological sites the above issues can come together. As a result, we could see archaeological parks and open monuments and so on. However it is different for underwater cultural heritage.

As for the underwater cultural heritage, some new aspects and conditions are needed to come into the account; the environments in which these relics are located are not as common as for the on-land ones. Apart from all the issues and complications which should be considered for preservation and conservation of these relics in an aquatic environment, the issues involved presentation and education need to be observed with a different perspective.

The fact that these relics had not been supposed to be underwater, and a calamity or a natural event made them to be underwater should not be forgotten as well. This issue is a part of their being a heritage. As it has been said before, this event made them an "underwater" heritage. The memorial and intangible aspects of these heritages are all dedicated to that event. Never the less, it will be unfaithful to present them without considering that forgetting and vanishing their memory of being underwater is in fact banishing a part of the history and their values.

Therefore, all three issues above; in situ conservation, presentation and proper knowledge plus the memorial aspect of underwater cultural heritage, make them of new consideration to innovate new ways of presentation. In this case we are facing with a new generation of presentation systems and museology. This new generation has not yet been got to a proper solution, but in some cases we could see very good solutions.

Considering the in situ preservation as the first step towards preserving and conserving underwater cultural heritage for the future generation or future studies, there are some newly developed experiences in the world. Reburial as it is discussed in the conservation section is one of the convenient ways of in situ preservation of a relic. Apart from that, the new experiment for conserving and showing the underwater relics inside an aquarium is another developing idea for conservation and presentation

in-similar-situ. As for the latest experience, some part of the memorial aspects of being underwater has been saved for the heritage.

In all these aspects involved underwater cultural heritage, at this point the question of authenticity is rising up. As for the on-land relics there are different charters and conventions and discussions related to the authenticity involved. The authenticity in its very brief refers to the truthfulness of origins, attributions, commitments, sincerity, devotion, and intentions. For monuments and historic sites, according to Nara document, an authentic site or building or so on, has authenticity in its material, function, form and architecture and so forth. For the current research, three points of Nara document on Authenticity are fundamental. These points are as follows:

In point number 9 of this document it is said that "Conservation of cultural heritage in all its forms and historical periods is rooted in the values attributed to the heritage. Our ability to understand these values depends, in part, on the degree to which information sources about these values may be understood as credible or truthful. Knowledge and understanding of these sources of information, in relation to original and subsequent characteristics of the cultural heritage, and their meaning, is a requisite basis for assessing all aspects of authenticity." As a result, a very deep understanding of the values of a heritage is a basic requisite for its conservation. These values are tangible values such as forms, architectural values, functions and so on, as well as intangible values such as techniques of construction, craftsmanship, and memorial aspects such as histories involved in such a heritage, people who lived, been saved or died during the history related to the heritage, their traditions, believes and so forth. These values at the present time also involve other aspects, such as nature, environment, aesthetic values, people expectations of a heritage, the knowledge laid down in these heritages and the like.

The point number 11 of Nara Document on Authenticity claims that "all judgments about values attributed to cultural properties as well as the credibility of related information sources may differ from culture to culture, and even within the same culture. It is thus not possible to base judgments of values and authenticity within fixed criteria. On the contrary, the respect due to all cultures requires that heritage properties must be considered and be judged within the cultural contexts to which they belong." In this point the importance of the culture in which the heritage lays down or to which it belongs has been high-lightened. As for the underwater cultural heritage, this culture and the context of this culture is significantly different. And also, we should keep it in mind that it is different as for the shipwrecks to for the villages or sites underwater. As for the villages, cities or sites, there are similarities with the sites on-land. Since these sites have been connected to a stable life in one location, one culture of life and place, such as other cities or villages, it is not very difficult to identify their cultural values within their context. However, as for the underwater shipwreck it is different; the cultural context of these heritages as they have been sea-vessels shows some more complication to identify their cultural context. "The shipwreck is the event by which a highly organized and dynamic assemblage of artifacts is transformed into a static and disorganized state with long-term stability."[63]

[63] K. Muckelroy, Maritime Archaeology-New Study in Maritime Archaeology, 1978

Accordingly, the cultural context of such heritage is comparatively differs from ones on-land. According to Muckelroy there are some aspects which should come to the consideration while we want to decide about an underwater shipwreck;
1- The ship as a machine designed for harnessing a source of power in order to serve a means for transport.
2- The ship as an element in a military or economic system, providing its basic "*reason d'etre.*"
3- The ship as a closed community, with a hierarchy, customs and conventions.

Accordingly, the cultural context of the shipwreck involves the original function, techniques of construction, as well as people who were transported on it, and the purpose of transportation. A ship is a moving society through which not only people and artifacts transported, but also it is a mean to transport different culture. And when this mean of transport has been wrecked and sunk, a capsule of culture has been sunk. In addition the reason of wreckage should come into account; was the wreckage a consequence of battle, or natural event, or lack of technical and constructional issue? Therefore, the cultural context of an underwater heritage includes all purposes and events involved in such a heritage.

To finalize this part, it is hard to say that to which culture a shipwreck belongs; either to its original land from which it moved to its unknown destiny, or to the land to which it was transporting artifacts, or to a battle in which it couldn't survived, or to the small society in which people were living for a while and people who have died and buried along with the wreck.

On number 13 of Nara document we read: "Depending on the nature of the cultural heritage, its cultural context, and its evolution through time, authenticity judgments may be linked to the worth of a great variety of sources of information. Aspects of the sources may include form and design, materials and substance, use and function, traditions and techniques, location and setting, and spirit and feeling, and other internal and external factors. The use of these sources permits elaboration of the specific artistic, historic, social, and scientific dimensions of the cultural heritage being examined."

As for the shipwrecks first we should define its context. It could be different from one to the other. Sometimes a wreck is just an object which shows the importance of its construction methods, or a small part of the history, or just as an object with an aesthetic value. Sometimes the scale of values is lager; these values not only include the old techniques of construction, but also they involve in a part of history either from the technical points of view-such as Vasa-, or involving in the human history and a big event in the history, or involving in a present memory of people such as shipwrecks in which still remains of corps could be found-such as Titanic- and they are accepted as an underwater cemetery, or a group of shipwrecks which shows the history of a bay and so on. Accordingly, deciding about the future of these shipwrecks involve other aspects. Should we face with a shipwreck as an object or as a site with its surroundings? Should it be displayed as it was in original shape before its wreckage or should it remain in its wreckage location or similar condition? These are the questions which are making difference in the strategies that we should apply for conservation and presentation of a shipwreck considering its context in order to respect its authenticity.

Following Nara Document on authenticity, RLICC developed a working methodology in the form of a grid identifying crossing points between "aspects and dimensions" as used in Nara Document. This grid allows to summarize information and to check for missing ones, it helps identifying heritage values.[64] Nara Document and later the grid have been applied for on land heritage. In these cases, this system works properly. As a suggestion for evaluating the underwater cultural heritage, this part of the research attempt to test the workability of this system for underwater cultural heritage as well. Since we call the underwater relics: "Cultural Heritage", the need to adopt the charters, criteria and so on in order to evaluate these heritages arise as well. As it is said about the Nara grid "the grid offers an understanding of the balance between, and mutual relations among the assigned values, which might help to identify the strengths and weaknesses of the heritage site, as well as problems and opportunities for the future conservation of the site.[65] Therefore, if adopting this grid would be possible for underwater cultural heritage, then a large number of questions to decide for the future of these heritages could be answered. This grid at least could help to develop a kind of ground to respond to the question of ranking underwater cultural heritage in order to distinguish between the ones that might worth to present to the public, and the ones that might be more useful for study, and the ones that might be postponed for the future studies and investments.

This grid has been shaped according to the items and values which have been mentioned in Nara Document. Shortly, the aspects of the sources such as form and design, material and substances, use and function, tradition and techniques, location and settling, and sprit and feeling will be evaluated through the dimensions of heritage such as artistic, historic, social and scientific. With a small glimpse, it is obvious that this document is adoptable for underwater cultural heritage. The only aspects that should be considered as one of the main factors, is the extraordinary location of these kinds of heritages and their tight with another kind of environment.

This location has not been decided for these kinds of heritages beforehand. As a result, their item of "location and settling" for these heritages depends on other different factors. As for these factors, there is a check list developed through archaeological excavation by Mackelroy, which could come into account in order to define some criteria with the help of Nara Document.[66] This check list includes the states of following items with different conditions:

1- Structural remains: could be extensive; elements; fragments. Depending on the amount of elements and fragments the strategies vary.

2- Objects found within the shipwreck site: could be many; some; and few, and in each state they could be scattered or united.

3- Distribution of the site: could be coherent; scattered in order or disordered.

[64] Conservation in changing societies, Heritage and development, Edited by: Patricio T., Van Balen K. De Jonge K., RLICC-30 years
[65] Conservation in changing societies, Heritage and development, Edited by: Patricio T., Van Balen K. De Jonge K., RLICC-30 years
[66] These factors are mainly about shipwrecks and are not supposed to include submerged cities and sites.

4- Geologically the site could be sandy and substrate; rocky, intermediate (rocky and sandy); slop.

5- Organic growth on the site could be many; some; few and they could be covered completely, partially or there could be no cohesion. [67]

According to the last two factors above, the other aspect of underwater heritage involves the natural values of an underwater site. This issue has two faces. One is the importance of the colonies of some species of plants and animals which their lives depend on these artificial reefs. The other side of this fact is the aesthetic values of some of these biological growth and animals. A part of attraction of these underwater sites is because of the extraordinary and amazing views that involve the underwater site and its natural surrounding.

As a result to the mentioned factors above, one important issue involve the sea horizon or seabed-scape. This factor should be considered as one of the aesthetic, natural and historical study-values of a wreck-site. The degree of its importance and its strength would play a significant role in future decision making for presentation and conservation of underwater cultural heritage.

On the other hand the affects of the nature on the relics are of importance. Sometimes the biofouling and the sea animals are harmful for the materials underwater. And sometimes these fouling play protective roles. As a result, it is important to know the different sorts of fouling, sea animals and their colonies, and their physical and chemical affects on different materials. These issues come more to the light, when the in situ preservation and presentation become the destiny of these relics. According to Mackelroy, while studying the underwater archaeological site the condition of organic growth should be considered as an important part of the study. He suggests that at least the amount of coverage should be observed; if it is many (the site completely or near completely covered), if it is some (partially covered), or if it is a few (there is no cohesion). He saw this issue mostly from the points of view of an archaeologist.

In addition to the issues mentioned above, one of the main aspects of public presentation and access considers the condition of the site. All the issues involving damage assessment and risk management would here come into account. Florida Underwater Archaeology, as one of the successful society for underwater cultural heritage suggests a regulation for public access. Accordingly, in general, public access to shipwrecks shall be regulated, including zoning, when[68]:

a. A shipwreck is extremely fragile and in danger of collapsing;

b. A shipwreck is suffering extensive deterioration or attrition due to prior unregulated access;

c. A permittee who is recovering a shipwreck under a valid permit requests that access be regulated during the term of the permit;

[67] K. Muckelroy, Maritime Archaeology-New Study in Maritime Archaeology, 1978
[68] 25 September 2007 , http://floridakeys.noaa.gov/sanctuary_resources/scr_programatic_agremnt.html

d. A shipwreck site presents an unacceptable risk to human safety and/or the visitor does not assume full responsibility for his or her safety; or

The last issue (e) [69] is regarding the national law on the Underwater Cultural heritage Sites, which might be differs from country to country.

As it has previously been said, the public presentation should follow certain goals; the goals involve the knowledge which is supposed to be transferred to the visitors. "Public interpretations that include archaeology could be much improved if they, first, conveyed the broad context within which archaeologists construct their understanding of the past, and, second, used the remains of recent past as a bridge to the present, the better to engage the visitors in historical and contemporary issues." [70]

As a pre-conception, some main purposes and ideal perspective of conservation and presentation of underwater cultural sites have been presented below. The importance of in situ or in similar situ presentation has been high-lightened.

Educational value: Wrecks contain information that reflects the behavioral characteristics and patterns of individuals and groups on board the ship (Delgado 1988a), the culture that produced the ship, and the history of the ports visited and the area where the ship was wrecked (Delgado 1988a & b; Kenderdine 1997).

Historically ships have been important to society for exploration, trade, defense, communication, migration, passenger transport, fisheries and recreation (AIMA & CDO 1994; Delgado 1988b; Henderson 1986; Jewell 2004; Kenderdine 1997). Therefore, shipwrecks can contain valuable information about naval architecture, shipbuilding, defense, engineering skills, technology, commerce and culture (Heritage Office 1994b; Heritage Victoria 2000) and are important records and repositories of information about our past (Coroneos 1997).

The sinking of a ship often results in the loss of human lives and shipwrecks are therefore often important graves or **memorials**, and many are associated with war (Delgado 1988a).

Ruins are interesting and evocative, and offer perspectives on the past and as ruins, shipwrecks have considerable aesthetic appeal to divers (Delgado 1988a; Kenderdine 1997).

It is **the aesthetic appeal** of seeing a shipwreck on the bottom of the sea, the rich variety and abundance of marine life attracted to the wreck, and the ability to explore

[69] e. A shipwreck is subject to sovereign immunity and the applicable Federal Government agency or foreign nation provides instructions on regulating public access to the shipwreck. In the absence of specific instructions from the applicable sovereign, under customary international law, access by any U.S. national to shipwrecks entitled to sovereign immunity is prohibited. When a sovereign grants permission, it generally limits access to named individuals for specified purposes. As a matter of policy, the U.S. Navy does not abandon its vessels and permission generally is not given to access, or salvage, sunken Navy vessels.

[70] Barbara J. Little, The public historian, vol.20, N0. 4, Fall 1998, Considering the context of Historical Archaeology for Museum Interpretation

ruins in a foreign environment that few other people have access to, that attracts divers to wrecks (Delgado 1988a; Jeffery 1990; McCarthy 1983).

It has been recognized that the recreational value of the wrecks is largely due to the opportunity to see the contents of the wrecks such as aircraft, tanks, vehicles, guns and armament, and that protecting these resources in-situ protects the tourism values of the wrecks (Delgado 1988a).

In the following chapter, the different conventions, charters and guidelines on underwater cultural heritage, and also in general the charters and the world, national and local conventions about cultural heritage will be discussed. According to the values and dimensions mentioned above, and the results from the chapter II, considering the conditions in Belgium and in the North Sea, in the third chapter the practical upshot will provide the tools to decide about certain sites in Belgium territory water.

3- Chapter II

Underwater Cultural Heritage in the Light of Conventions and Guidelines

3- Chapter II

3-1- Introduction:

This part of the research intends to provide a guideline for the management of underwater cultural heritage for the public in Belgium. In fact, this management plan will come after all the general guidelines to outline a set of principles that should govern the broad approach of anyone planning to deal with historic shipwreck sites and related archaeological collections, and after establishing a program, the research process and the core day-to-day practical issues facing the maritime archaeologist charged with the implementation of that program. Therefore, considering the fact that these two parts-the general governmental strategy and the research procedures-have been established, and were the pre-consideration of any future decision, in this part of the research, different guidelines (or part of guidelines) for managing underwater cultural heritage for the public, the criteria of being valuable to be displayed and different international and national approaches to this purpose will be discussed.

The first part is going through international charters and conventions, mainly UNESCO convention on underwater cultural heritage (2001) and ICCOMOS charter (1996 Draft of the charter). As it has been mentioned previous chapter, the Nara Document on Authenticity is also one of the references in order to clarify and classify some significance for Cultural Heritage in general.

Second part will provide a general overview on different national guidelines and legislation on Underwater Cultural Heritage in different countries, especially the countries which are avanguard and successful in practical experiences.

The focus of all these studies is on the parts which deal with the public presentation and significances which make these heritages entitled to be displayed to the public. Not all the cultural heritage has the same value or possibility to be invested and worked on to be presentable to the public, although it is not denying the importance of all cultural heritages to be safeguarded for the future generations. Therefore, the guidelines which will be extracted from the international and national legislations and practices are dealing with present condition and the main purpose is to have a scheme to classify and prioritize the underwater heritage in Belgium to be presented to the public. Among all issues involved, apart from historical and cultural values, the economic and technical issues should come into account. The final purpose is to have a balance between the values and the possibilities.

3-2- Development of the Conventions:

3-2-1- World Heritage Conventions:

UNESCO has been interested in the protection of underwater cultural heritage for a long time. Its first Recommendation in 1956[71]was expressly extended to cover it. The main axes of the meeting were about the definition of underwater heritage, the criteria to define an underwater site or object as a heritage, the protection of sites and their landscapes, exclusion of warships, the criteria to recognize a ship as a warship, possible cultural heritage zone, the problem of ownership of the ships and cargos, indivisibility of underwater cultural heritage and its significances for all humanity, and methods of excavation and study. Two methods of defining underwater cultural heritage were considered possible. The first was through a general listing system; the second was a more philosophical approach which was considered as being more adaptable to modern archaeology, taking account of the fact that specific objects have an environmental and scientific context. Both methods are reflected in contemporary national legislation for the protection of underwater cultural heritage. It was agreed that it was premature to make a choice at this stage and that it would depend upon the mechanism of protection that is adopted.

In October 1996 following the UNESCO meeting of May-1996, ICOMOS came drafted the charter on the protection and management of Underwater Cultural Heritage.[72] In this meeting the importance of ownership, threads and possible damages[73] were discussed. The result was 15 Articles on fundamental principles; project design; funding; time table; research objectives, methodology and techniques, and qualifications; responsibilities and experience; preliminary investigations; documentation; material conservation; site management and maintenance; health and safety; reporting; and international cooperation. Some issues are of great importance from the perspective of conservation; the public information and accessibility, conservation in situ, the methods of study and investigation, plus criteria of being heritage.

The next important step in order to manage underwater cultural heritage was the General Conference of the United Nations Educational, Scientific and Cultural Organization held in Paris from 15 October to 3 November 2001. The main topics of the discussion, which shape the core of the charter, were as follows:

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[71] The very first of these Recommendations to be developed was the Recommendation on International Principles Applicable to Archaeological Excavations 1956. It sets out basic provisions such as the requirement for excavation permits, conservation, publication and placement of finds primarily in the museums of the host country. It is notable that Principle 1 defines excavation as:" Any research aimed at the discovery of objects of archaeological character, whether such research involves digging of the ground or systematic exploration of its surface or is carried out on the bed or in the sub-soil of inland or territorial waters of a Member State.

[72] Charter on the Protection and Management of Underwater Cultural Heritage (1996), ratified by the 11th ICOMOS General Assembly, held in Sofia, Bulgaria, from 5-9 October 1996, http://www.international.icomos.org/under_e.htm

[73] Underwater Cultural Heritage may be threatened by construction work that alters the shore and seabed or alters the flow of current, sediment and pollutant. UCH may also be threatened by insensitive exploitation of living and non-living resources. Furthermore, inappropriate forms of access and the incremental impact of removing “souvenirs” can have a deleterious effect.

"Realizing the importance of protecting and preserving the underwater cultural heritage and that responsibility therefore rests with all States.
Noting growing public interest in and public appreciation of underwater cultural heritage,
Convinced of the importance of research, information and education to the protection and preservation of underwater cultural heritage,
Convinced of the public's right to enjoy the educational and recreational benefits of responsible non-intrusive access to in situ underwater cultural heritage, and of the value of public education to contribute to awareness, appreciation and protection of that heritage,
Aware of the fact that underwater cultural heritage is threatened by unauthorized activities directed at it, and of the need for stronger measures to prevent such activities,
Conscious of the need to respond appropriately to the possible negative impact on underwater cultural heritage of legitimate activities that may incidentally affect it,
Deeply concerned by the increasing commercial exploitation of underwater cultural heritage, and in particular by certain activities aimed at the sale, acquisition or barter of underwater cultural heritage,
Aware of the availability of advanced technology that enhances discovery of and access to underwater cultural heritage,
Believing that cooperation among States, international organizations, scientific institutions, professional organizations, archaeologists, divers, other interested parties and the public in general is essential for the protection of underwater cultural heritage,
Considering that survey, excavation and protection of underwater cultural heritage necessitate the availability and application of special scientific methods and the use of suitable techniques and equipment as well as a high degree of professional specialization, all of which indicate a need for uniform governing criteria,
Realizing the need to codify and progressively develop rules relating to the protection and preservation of underwater cultural heritage in conformity with international law and practice, including the UNESCO Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property of 14 November 1970, the UNESCO Convention for the Protection of the World Cultural and Natural Heritage of 16 November 1972 and the United Nations Convention on the Law of the Sea of 10 December 1982,
Committed to improve the effectiveness of measures at international, national and regional levels for the preservation in situ or, if necessary for scientific or protective purposes, the careful recovery of underwater cultural heritage,
Having decided at its twenty-ninth session that this question should be made the *subject of an international convention."*[74]

Apart from the main text of the convention there are some issues that have been pointed out in annex of this convention; passing fast through the rules which are dealing with the national legislations, research procedures, non destructive techniques and survey methods, concerning this part of this study, following rules are related to the management of underwater heritage for the public:

[74] Convention on the protection of underwater cultural heritage, UNESCO, Paris, 2 November 2001

"Rule 7. Public access to in situ underwater cultural heritage shall be promoted, *except where such access is incompatible with protection and management."*

"Rule 25. The site management program shall provide for the protection and management in situ of underwater cultural heritage, in the course of and upon termination of fieldwork. The program shall include public information, reasonable provision for site stabilization, monitoring, and protection against interference*."*

These two rules emphasize on in situ conservation and access to the underwater cultural sites. The main issue which should be kept in mind is that although it is recommended that all studied and non-studied site conserved in situ, but not all the studied sites needs to be or could be accessible in situ for the time being. Therefore, there should be a series of criteria defining which sites with what significances and with what possibilities could be accessible and presentable in situ.

Following rule is dealing with the quality of the report on the under water cultural sites. This rule is important to be mentioned here, in order to define the basic data that a site needs to carry in order to be evaluated through the criteria of being eligible to be studied and invested for public presentation.

Rule 31. Reports shall include:
(a) An account of the objectives;
(b) An account of the methods and techniques employed;
(c) An account of the results achieved;
(d) Basic graphic and photographic documentation on all phases of the activity;
(e) Recommendations concerning conservation and curation of the site and of any underwater cultural heritage removed; and
(f) Recommendations for future activities.

These two main world heritage convention and charter are the bases of some principles in national legislation and charters for safeguarding underwater heritage. Although they seem rather theoretical, the practical sides become clearer when they started to be applied in different projects. It should be mentioned that there could be a general principles to manage any kind of cultural heritage- and in this specific case underwater cultural heritage- but not all the cultural heritages could be generalized. Each case should be treated according to its condition, values and significances, and its related country national legislations. Also considering the fact that Underwater Cultural Heritage is a subdivision of Cultural heritage, in many cases we can notice that the structures of the conventions, charters and legislation extracted from the general rules and guidelines of Cultural Heritage.

3-2-2- Example of first-rate National Guidelines:

3-2-2-1- *Guidelines for the Management of Australia's Shipwrecks*

One of the most noticeable guidelines is the **Guidelines for the Management of Australia's Shipwrecks**[75], in which some parts of the criteria have been largely

[75] Guidelines for the Management of Australia's Shipwrecks, Australian Institute for maritime Archaeology Inc, and the Australian Cultural Development Office Canberra 1994

adopted from the **"**Criteria and Application Guidelines prepared by Joan Domiceli in December 1989 for the New South Wales", and this guideline had an eye on the Burra Charter[76] as well. As stated in the first chapter, Australia has a good reputation in managing Underwater Cultural Heritage. Therefore as the first guidelines, the **Guidelines for the Management of Australia's Shipwrecks** has been chosen to be studied.

In the **Guidelines for the Management of Australia's Shipwrecks**- apart from the issues related to the governmental procedures, research, site and artifacts management, funding, training and volunteer programs and so on- are some parts which deal with public presentation and access. In general the significances and criteria which accordingly an underwater site is considered as a heritage could come into account in order to evaluate the stage of importance and necessity to be presented and be accessible to the public, furthermore, these criteria could come into account in order to find the most possible and suitable way of presentation.

As stated in the beginning of these Guidelines, *"Code of ethics need to be developed* to a code of practice*."* In brief *"These Guidelines provide a common basis for the* management of shipwrecks nationally by identifying strategies and practices for management and administration of the resource. They provide administrators with useful measures of the cultural and heritage values of shipwrecks and aid the identification and assessment of wrecks according to their historic, technical, social, *archaeological (scientific), and interpretive values."* Herewith, the basis on which the criteria of being an underwater cultural heritage are clear.

According to these guidelines, first of all the shipwreck or the site needs to be evaluated. This evaluation should be done in accord with agreed criteria, some of which have been stated above and later they will be discussed more. (Point 6.1 of the Guidelines) according to the point 6.2 of the Guidelines "the resulting statement of significance should serve as a guide to the development of appropriate management strategies." This point means a general strategy to manage the site, which should be specified for the future destiny-which could be presentation in possible way, or conservation and safeguarding for the future. And the projects still open for future decisions therefore "Shipwrecks [or sites] should be reassessed from time to time." (Point 6.3 of the Guidelines)

These four guidelines point out the importance of the possibilities of studying and conserving the underwater sites as well as public presentation. In some cases due to the vulnerability of the site or other problems access to the site is prohibited. Therefore other ways of illustration are recommended-such as constructing a model or replica of the site, or underwater filming.

According to the points 10.5, 10.6 and 10.7 of these guidelines, information and list of sites which have recreational value should be provide and access should be encouraged to the shipwrecks and underwater sites in parks and reserves. The recovered materials and information from the underwater sites should be provided for all interested groups.

[76] The Burra Charter, The Australia ICOMOS charter for the conservation of places of cultural significance, 1999

As stated before, the importance of a series of criteria through which the significances and values of a site assessed is necessary. In the Australian Guidelines, in the part 6 these criteria have been finalized; these criteria assess the importance of a site in two ways; one is the criteria which deal with the nature of the significances, and the other is the degree of the significances. These criteria are in accord with agreed criteria consistent with the Burra Charter. Since these criteria came into account for future evaluation schemes which evaluate a site for its future management plan and public ways of presentation, a summery of them has been presented below:

The Nature of Significance:

Criterion 1: Historic (concerned with the range of context) Significant in the evolution and pattern of history. Important in relation to a figure, event, phase or activity of historic influence.

Criterion 2: Technical (concerned with technical or creative accomplishment) Significant in possessing or contributing to technical or creative accomplishment. Important in demonstrating a high degree of technical or creative achievement for the period in question.

Criterion 3: Social (concerned with community regard or esteem) Significant through association with a community or communities in Australia today for social, cultural or spiritual reasons. Important as cultural items or places highly valued for reasons of social, cultural, religious, spiritual, aesthetic or educational associations by a community today.

Criterion 4: Archaeological (concerned with the research potential of material remains) Significant for the potential to yield information contributing to an understanding of history, technological accomplishments and social developments. Important for its potential to yield information contributing to a wider understanding of the history of human activity.

Criterion 5: Scientific (concerned with research potential through repeatable measured tests) Significant in the potential to yield information about the composition and history of cultural remains and associated natural phenomena, particularly the biota, through examination of physical, chemical and biological processes. Important in the generation or testing of hypotheses concerning biological processes, the composition of cultural remains, the effects of original use and the effects of other environmental factors.

Criterion 6: Interpretive (concerned with public education values) Significant for its potential to contribute towards public education. Important for its potential for public education through on-site (or other) interpretation.

Criterion 7: Rare (concerned with the uncommon or exceptional) Significant in possessing rare, endangered or uncommon aspects of history. Important in demonstrating a distinctive way of life, custom, process, waterway use, function or design which is no longer practiced, is in danger of being lost or is of exceptional interest to the community.

Criterion 8: Representative (concerned with the typical or characteristic) Significant in demonstrating the characteristics of a class of cultural items. Important in demonstrating the principal characteristics of the range of human activities (including way of life, philosophy, custom, process, water-way use, function, design or technique).

"The resulting statement of significance should serve as a guide to the development of appropriate management strategies"[77]. Following this Guidelines- after assessing the significances of a site- there are some guidelines related to the public presentation and public access. The part of guidelines, relating to the public access and presentation has some points, amongst which the most important ones- in order to have a concept for managing underwater cultural heritage for the public- are as follows:

9.2 Shipwrecks and associated relics [and sites] should be interpreted for all interest groups.

9.7 **Models of vessels should be built, and interpretative illustrations produced.**
9.7.1 Models of archaeologically and historically significant ships, as they were prior to being wrecked, should be made to provide detailed, small scale orientation and interpretation for divers and non-divers. Models would be particularly useful when diving is difficult or restricted, or when sufficient public interest exists.
9.7.2 The process of building models can itself be a popular and successful activity.
9.7.3 Community groups should be involved in building models.
9.7.4 For all these reasons interpretative illustrations can also be useful.

9.8 **Interpretative materials should be included in parks and reserves, and in any other appropriate forum.**
9.8.1 Underwater parks or reserves and underwater shipwreck trails can be used to effectively interpret shipwreck sites and other maritime archaeological sites for divers.
9.8.2 Trails and wreck sites should be marked with permanent signs underwater or above water as appropriate.

As it could be implied from these points, major focus is on in situ preservation and presentation-when possible-, and using models and illustration in order to give more appropriate information to the interested people. What is important in order to have an ideal presentation is consideration of majority of stakeholders involved in the underwater heritage, as well as people and communities involvement in every step of the projects. Therefore, the importance of the project and study process will be transferred to the people. And the result is not just a museum or underwater park which gives a temporary satisfaction and enjoyment, but there will be a continue-process of study, presentation and visiting. According to the outcomes of these guidelines *"Managed access by the public is beneficial for tourism, recreation, public enjoyment and the furthering of shipwreck programs."*[78]

[77] Guidelines for the Management of Australia's Shipwrecks, Australian Institute for maritime Archaeology Inc, and the Australian Cultural Development Office Canberra 1994
[78] Guidelines for the Management of Australia's Shipwrecks, Australian Institute for maritime Archaeology Inc, and the Australian Cultural Development Office Canberra 1994

Assessed through the criteria, the review found that the Solway's significance extended beyond the superficial historical association as one of the first ships known to have been lost in South Australia. The wreck of the Solway is also of historical significance because it symbolized the economic and logistical follies committed by the initial European settlers to South Australia. The site had enhanced archaeological significance as it possibly contained cultural material evidence of the first German settlers to the State.[79]

Accordingly, the allocation of the limited resources available to protect this heritage is prioritized through balancing competing cultural heritage values of individual sites with an assessment of threat to that site's physical integrity. Therefore, assessing all values and possibilities and implications the final decision was in situ preservation. [Fig. II-11] Although this final decision was not in favor of divers and in situ visitors, the best way to safeguard this heritage for the future was in situ preservation.[80]

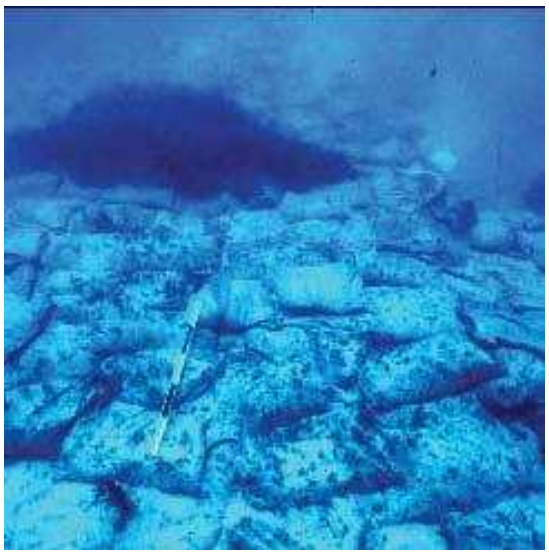
Fig.II-11: Sandbags on the Solway (C. Coroneos**)**

The test excavation revealed that the site had considerable archaeological and research potential, and this decision has been made after taking all the criteria into account.

Another example of the in situ preservation and public access is the Lady Darling site. The Lady Darling site has been assessed as an important local reminder of the dangers of coastal maritime trade in the 19th-century. Its engine and associated machinery survive as a rare Australian example of a specific development period in marine engineering last century. The shipwreck and its associated in situ artifacts retain high recreational importance as the most intact shipwreck for diver visitation in the Eurobodalla Shire region.

This site has been assessed through the criteria of underwater cultural heritage in Australia. On this basis the Heritage Office developed a management strategy to ensure the retention of these values, while also fostering public access. The relative isolation of the site also meant that effective policing of visitation was difficult. With

[79] A Cheap and Effective Method of Protecting Underwater Cultural Heritage, Cosmos Coroneos, Director Cosmos Archaeology Pty LtdAustralia

[80] The method used to protect the site involved the placement of bags filled with sand over exposed parts of partially buried timbers. The use of sandbags in this way is not uncommon in Australia and is a much used instrument in the tool kit of the underwater cultural resource manager. Such a method, of course, is not applicable in all circumstances; it is most effective when dealing with low relief sites of which a significant proportion is buried in sediment.

the support of the finders of the wreck site, a 150 meters radius Protected Zone was established around the wreck site.[81]

The management of the Lady Darling site has been a successful partnership. This partnership has included the local dive industry, local council, other key interest groups as well as the State Government through the NSW Heritage Office and the Australian Government through the Historic Shipwrecks Program. Most importantly, the system could not work so effectively without local interest in historical values and long term recreational viability of this site. It is this sense of partnership that is critical to the successful implementation of the UNESCO Convention for the underwater cultural heritage.[82]

These were some successful examples of in situ preservation and also in situ presentation. The very evident understanding of these practical experiences and considering the criteria, through which a shipwreck or underwater site has been nominated as a heritage with a specific significance, is the need of different treating. E.g. a shipwreck which reveals a high technical development in the history of shipbuilding is technically-significant; therefore its display should show this value more than the other value. (Example of an eligible item under this criterion Technical: Clarence (1841-50), significant in contributing to knowledge of the growth of shipbuilding technology in Australia.[83]) And this case differs from a shipwreck which had a historical/memorial significant; a shipwreck which played a historical role, with lots of stories around it needs another kind of treatment and a different way of display in order to reveal the historical and memorial values. (Example of an eligible item under criterion Historic: Yarra Yarra (186577), significant in the evolution of sea safety in Australia. [84]) As a result, the final decision about the future way exhibiting an underwater site partially depends on its significances and the level of the criteria, from which these significances have been extracted.

3-2-2-2- National Park service, U.S. Abandoned Shipwreck Act Guidelines:

Similar to other guidelines, this guideline also has different parts relating to the governmental, research, training, and presentation. Concerning the topic of this study, herewith the parts which are related to the public presentation guidelines will be introduced.

Section 4(b) of the Act encourages the States to create underwater parks or areas to provide additional protection for shipwreck sites. The creation of underwater parks or preserves provides many other positive benefits as well, such as increasing the public's awareness of and appreciation for the nation's maritime heritage, providing additional recreational opportunities for sport divers and fishermen, generating tourism revenues, and providing additional protection for natural resources and habitat areas located within the boundaries of the park or area. In addition, underwater parks or preserves could be linked with existing maritime museums,

[81] H @ R ,2006 HERITAGE AT RISK, Protected Zones and Partnerships: Their Application and Importance to Underwater Cultural Heritage Management, David Nutley
[82] H @ R ,2006 HERITAGE AT RISK, Protected Zones and Partnerships: Their Application and Importance to Underwater Cultural Heritage Management, David Nutley
[83] Guidelines for the Management of Australia's Shipwrecks, Australian Institute for maritime Archaeology Inc, and the Australian Cultural Development Office Canberra 1994
[84] Guidelines for the Management of Australia's Shipwrecks, Australian Institute for maritime Archaeology Inc, and the Australian Cultural Development Office Canberra 1994

floating historic vessels, lighthouses, and lifesaving stations to provide the public with a broader interpretation of the nation's maritime history.[85]

Following this brief, there are seven main guidelines in order to manage underwater cultural heritage for the public. In these guidelines the importance of involvement of different stakeholders, the importance of precautions of planning, founding and recourse management plus environmental effects have been clearly outlined. These guidelines are as follows:

Guideline 1: Consult with the various interest groups.
This guideline is highlighting the importance of pre-planning and pre-execution of the projects. All stakeholders involved in the projects should be consulted before any decision making. These stakeholders include local people and communities, sport divers, dive clubs, dive boat operators, governmental agencies and so on.

Guideline 2: Prepare an environmental and economic impact assessment.
Prior to creating an underwater park or preserve, an assessment of the environmental and economic impacts that would result should be prepared. Assessments should include descriptions of known historic and non-historic shipwrecks, other cultural resources, natural resources, and habitat areas located within the proposed boundaries of the park or preserve; current uses and potential impacts to the shipwrecks, other resources and areas; potential recreational, educational, preservation and tourism benefits; potential impacts to businesses (such as commercial fishing); and budget estimates of costs for initial development and subsequent annual operation of the proposed park or preserve.

Guideline 3: Specify the unit's purpose, significance, boundaries, and any special conditions and constraints.
Any decision needs to be according to the legislation and agreed criteria. The significances of a site will be the main criteria to decide about its future condition and destiny.

Guideline 4: Develop a general management plan.
A general management plan should be prepared to guide future planning and actions for each underwater park or preserve. A general management plan should discuss the unit's legislated purpose and significance; identify major issues affecting management and use of the unit and its resources; and identify management objectives, planning needs, and priorities.

Guideline 5: Develop a resource management plan.
A resource management plan should be prepared for each underwater park or preserve. A resource management plan should discuss the significance and condition of known natural and cultural resources; assess the potential presence of as yet unknown resources; identify survey, identification, documentation, evaluation, interpretation, protection, and long-term preservation needs, priorities, and cost estimates; and discuss impacts to the natural and cultural resources from natural causes, visitor use, park development, and other activities. In order to have long-term

[85] Abandoned Shipwreck Act Guidelines, National Park service, US department of Interior, http://www.nps.gov/history/archeology/submerged/Definitions.htm

conservation and presentation process, periodical report of the site is required. Therefore, any future changes in the site will be recorded in order to have an up to date short-term management plan.

Guideline 6: Interpret and facilitate public access to shipwreck sites in underwater parks and preserves.

Providing necessary and enough data about the site is recommended. The sites should be marked, and also all hazards involving the sites condition and also site visiting should be announced to the people associated to the site. Also considering the fact that these kinds of site are interested for non-divers, the guidelines has a part in which it is stated that: *"Recognizing that shipwreck sites are of interest to non*-divers as well as divers, interpretive materials should be developed for both interest groups. For example, permanent signs could be placed in and around the shipwreck as part of an underwater trail. In addition, pamphlets and other publications describing the unit's shipwrecks and the area's maritime history could be made available. Dock side exhibit areas and a maritime museum could be established in the unit or interpretive materials could be made available to the local community's museum or historical society. Videotapes of shipwreck sites also could be shown in an exhibit area or *museum and made available for purchase."*

Guideline 7: Protect shipwreck sites located within underwater parks and preserves.
Comparable to on-land Cultural Heritage Sites, in this Guideline the importance of determining a buffer zone in order to protect the site environment and safeguarding it against human hazards is recommended.

These Guidelines are very clear about the steps which should be taken in order to manage underwater cultural heritage for the public. The practical outcome of these guidelines could be seen in Florida Underwater Park, which have been discussed before in the chapter of World Best Practices.

3-3- Joint Projects:

3-3-1- Moss:

Apart from these individual National Guidelines, there are some joint national guidelines, which are among some countries. One of the first guidelines of this kind is the Moss Project, which is a joint project among Sweden, Germany, Finland and Holland.

The MoSS project has three main themes: monitoring, safeguarding and visualizing shipwrecks. The first theme includes monitoring the condition of the wrecks, or in other words doing research on the degradation of shipwrecks under water.

The aim of this theme is to develop and improve the methods used in monitoring the physical and environmental conditions of shipwrecks. The second theme is safeguarding, which aims at outlining and developing models to protect shipwrecks so that also the needs of different public groups are taken into account. The third theme is visualizing.

The four shipwreck sites will be made physically visible using underwater and other images. The project will be advertised multilingually to the European public.[86]

The first phase of surveying is always a non-intrusive assessment. Just "things" sticking out of the bottom – which is often quite a bit – are measured and drawn. Questions that have to be answered as quickly as possible are amongst others: which parts of the ship construction are still there and what is their layout? What kind of ship was it and when was it built? What is left of the cargo, supplies, armament, personal belongings etcetera and what can we deduce from it as far as the ship's last voyage is concerned, or the date of wrecking? What is important is that after this survey we would have a fairly accurate idea of the potential for further archaeological research.[87]

According to the guidelines of these projects, which have also an eye on the UNESCO Convention 2001, the non-destructive survey is recommended. Furthermore, the importance of participation of different stakeholders, public awareness and presentation methods have been pointed out. The final decisions for these projects have been taken according to the feasibilities and implications.

3-3-2- Cultural Heritage in the Baltic Sea States[88]

Another remarkable joint work is the one in the Baltic Sea States, which is among the countries of Denmark, Finland, Latvia, Poland, Russian Federation and Sweden.[89]

Although after several meeting the group could not have reached to an agreement. There were some out comes from these meetings in a long term perspective. The part which concerns public presentation has been presented below:

Baltic Sea Wreck trail

On the basis of experience from Finland the group has studied the possibility to establish a network of underwater cultural parks with interesting and accessible wrecks representing different periods and functions in the marine traffic of the Baltic Sea. Suitable wreck-sites have been nominated by Finland and Sweden but other countries have declared their willingness to participate. The purpose of the network will be to exchange experience in the management of such "underwater parks" and eventually to establish joint marketing of this "wreck-trail". Other suggestions have been recommended, due to the lack of agreement, and lack of enough funding some have been rejected, such as Travel Exhibition.[90]

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[86] Moss Newsletter/Issue 5/ Dec. 2003**,** Sallamaria Tikkanen, Riikka Alvik, The Maritime Museum of Finland

[87] Moss Newsletter/Issue 5/ Dec. 2003**,** Sallamaria Tikkanen, Riikka Alvik, The Maritime Museum of Finland

[88] Working group "Underwater Cultural Heritage", Progress report 2000 – 2001, balticheritage.raa.se/reports/water1.pdf

[89] The group was mandated by the Monitoring group to explore the possibility to draft a regional agreement among the Baltic Sea States for the protection and management of the underwater cultural heritage and to develop other appropriate themes for co-operation in this field.

[90] Cultural Heritage in the Baltic Sea States Working group "Underwater Cultural Heritage", Progress report 2000 – 2001, balticheritage.raa.se/reports/water1.pdf

It should be mentioned that in all convention and guidelines the preference given to in situ preservation as the first option is in order to first, stress the importance of and the respect for the historical context of the cultural object and its scientific significance; and second, recognize that such heritage is under normal circumstances well preserved under water owing to the low deterioration rate and lack of oxygen and therefore not necessarily as such in danger. In situ preservation is the priority decision, but not always the final decision. Therefore, the assessment through its criteria, and possibilities and implications of conservation and presentation will define the final decision.

3-4- Examples of Projects Management Plans:

Following the World Heritage and National Conventions and Guideline in order to manage Underwater Cultural Heritage, there are some project drew out. These individual projects follow the same general pattern of the conventions and guidelines, but more with each unique project's details. The importance of these examples is to have an insight to the successful approaches in order to manage the underwater cultural heritage.

3-4-1- Management plan of the wreck of Vrouw Maria-Finland[91]:

This management plan is a step by step study, research, survey, and approach to the final project. The site has been assessed through the defined criteria of being a cultural heritage. And it includes certain significances which give the eligibility of spending expertise and funding in order to preserve and present the site. These steps are as follows:

- Study on the Environmental context including Coastal Geology, Climate, Flora and Fauna, and Human impacts.
- Size of research area and Depth
- The legal aspects concerning ownership, and study period and so on.
- Recognized threats
- Previous studies and Historical context
- Assessment of the site such issues as Description of research assignment, Reference to working standards, Research objectives, Expected results.

Management plan of Vrouw Maria includes Natural sciences, applied sciences and other research, Environmental research, Physical condition, Finds visible on surface, Completeness, Completeness of wreck parts, Stratigraphy intact, Mobilia in situ, Relation between mobilia and wreck parts, Relations between mobilia, Stability of natural environment, State of preservation, Organic wreck parts, Inorganic wreck parts, Organic mobilia, Inorganic mobilia. [Fig. III-02]

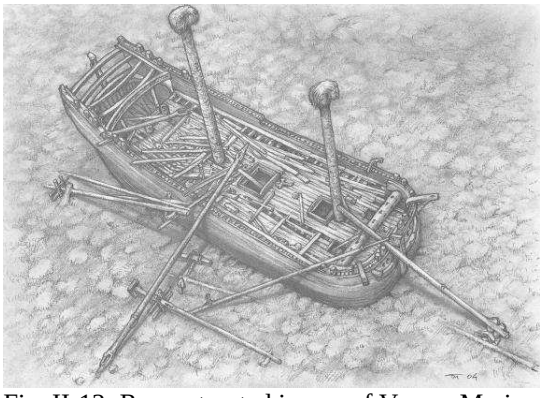

Fig. II-12: Reconstructed image of Vrouw Maria

[91] Finland, The Department of Archaeology / Section for Maritime Archaeology 2004

- Cultural-historic and archaeological data include Identification, Cultural context, Century, Exact dating, Function, Type, Operating area, Propulsion, Size, Material, Building tradition, Inventory, Cargo, Personal belongings, Constructional features
- Risk assessment, Natural impact, and Human impact.
- Cultural valuation of Vrouw Maria assessed through Experience aspects (quality), Aesthetic values, Visibility

And finally Management plan Vrouw Maria according to all criteria, significances, studies and possibilities concerns the following issues:
Visibility as a landscape element, Visibility as an exposition element, Memory value, Historical value, Physical quality, Structural integrity, Presence of ship construction, Completeness of the wreck parts, Stratigraphical conditions, Mobilia (portable antiquities) in situ, Relation between mobilia and ship parts, Relations between mobilia, Stability of the natural environment, State of preservation, Wreck parts, Organic material, Inorganic material, Composite material, Artefacts, material, Inorganic, Composite, Quality of archaeological information, Representative value, Chronological information, Regional information, Significance of information, Geographical significance, Historical or archaeological significance
All the data above come into account in order to establish a practical site management which provides the Cost-benefit analysis, Site management agenda (short-term, mid-term and long-term programs), Safeguarding strategies, Legal and Physical safeguarding tools, Monitoring program, Visualizing possibilities, Finance available, Date of re-assessment / re-evaluation.

3-4-2- Titanic:

A very well-known site is the underwater site of Titanic. Herewith a brief of the final guidelines established for safeguarding and future activities on Titanic by the agency of National Oceanic and Atmospheric Administration, Department of Commerce has been presented.[92] This is an example of a joint project.[93]

One of the most important significances of Titanic is the memorial aspect. Titanic has been recognized as a Grave Site. Therefore, the scientific and archaeological approach advocated by these guidelines is applicable to a Maritime Memorial as it is consistent with the Congressional intent to recognize the scientific, cultural, and historical significance of the site.[94]
Again apart from legal aspects, survey issues, funding problems and so on, there are some issues related to the preservation and public presentation of Titanic. They are as presented follow the same as they have been written in the Guidelines.

In-situ Preservation

[92] Federal Register / Vol. 66, No. 71 / Thursday, April 12, 2001 / Notices
[93] These final guidelines have been developed for future research on, exploration of, and if appropriate, salvage of RMS Titanic. As directed by the RMS Titanic Maritime Memorial Act of 1986 (Act), the guidelines were developed in consultation with the United Kingdom, France, Canada and others. The broad and diverse public interest in RMS Titanic was also considered in developing the guidelines. While the guidelines set forth a preferred policy of in-situ preservation of RMS Titanic, they also set forth the parameters for the research, recovery and conservation of RMS Titanic artifacts for the benefit of the public.
[94] Federal Register / Vol. 66, No. 71 / Thursday, April 12, 2001 / Notices

Some stakeholders were opposed the concept of in situ preservation of Titanic. But based on the available information on the rate of deterioration, NOAA[95] understands that the wreckage of the RMS Titanic is in a state of decay and expects that the hull and structure of the ship may collapse to the ocean floor within the next 50 years, perhaps sooner. The intent of the guidelines, in keeping with the intent of the Act, is to discourage activities that would accelerate the ship's deterioration. Such activities include cutting holes in the ship's hull to access artifacts in the interior of the wreckage. Consistent with an in situ preservation approach, it is also the intent of the guidelines to preserve the wreckage of the RMS Titanic as a memorial for those who perished when the ship sank and thus to preserve the integrity of the wreckage. While the concept of in situ preservation promotes and encourages maintaining the wreckage as it currently exists, it will not prevent recovery or salvage that is determined to be in the public interest. Nor does this approach detract from the educational value of the ship or inhibit the public access to the wreck-site or to any recovered or salvaged artifacts by the general public. If followed correctly, the guidelines will help salvager and archaeologists plan and execute their recovery of artifacts that have educational, scientific, or cultural importance in such a manner so that they are properly preserved and consequently properly displayed for the general public. Furthermore, the guidelines do not discourage the use of remotely operated vehicles (ROVs) within the hull of the ship. Videos and photographs taken from ROVs are as valuable as artifact recovery, if not more so, in exposing the public to the wreckage and educating them about it. As a result of the apparent misconception of the in situ preservation principle, NOAA has made some slight changes to the wording of the guidelines.[96]

Public Interest Comment

The guidelines, based on domestic and international standards as reflected in the draft international agreement on the protection of the RMS Titanic, represent the most widely accepted public and professional archaeological and historical preservation principles currently known. Following these guidelines is in the public interest because artifacts will be preserved and recorded so that historical information can be extracted from the wreck without destroying it or compromising the ship's integrity. Not following the guidelines may cause artifacts to be sold individually, historical information to be lost forever, and the deterioration of the ship to be accelerated. These are in all likelihood contrary to the public interest.[97]

As a result to these deferent conventions, charters and national guidelines, and going through the practices which have been taking these guidelines into the account, and as shipwreck programs develop, it is possible to assess the significance of any shipwreck in the context of larger geographical, type or thematic groupings of sites. The significance of a site, along with destructive impacts, competing uses and limited resources provides the basis for a Management Plan which is the policy framework for any decisions regarding what happens to that site. [98]

[95] National Oceanic and Atmospheric Administration
[96] Federal Register / Vol. 66, No. 71 / Thursday, April 12, 2001 / Notices
[97] Federal Register / Vol. 66, No. 71 / Thursday, April 12, 2001 / Notices
[98] Guidelines for the Management of Australia's Shipwrecks, Australian Institute for maritime Archaeology Inc, and the Australian Cultural Development Office Canberra 1994

In addition to historical and archaeological research, an environmental assessment should be carried out with practitioners from a relevant discipline to identify physical and chemical processes affecting site longevity and archaeological significance. The strategy and its resourcing should be appropriate to the significance of a site and its level of threat.

Evaluation criteria provide a mechanism for assessing and describing the significance of shipwrecks. The resulting statement of significance serves as a guide to the development of appropriate management strategies. Changes in cultural values, unavoidable attrition of our cultural heritage and increased knowledge and experience alter our perceptions of relative importance. It is therefore desirable that shipwrecks be re-assessed from time to time to determine whether appreciable changes have occurred that may affect their significance. This may lead to a restructuring of the management strategies previously adopted. [99]

The in situ protection of archaeological objects has become an important issue over the years, above, as well as underwater. The reason for protecting underwater sites is partly the large amount of archaeologically interesting shipwrecks and partly because of the growing notion of protecting a representative part of our maritime heritage for future generations. Article 1 of the ICOMOS-charter of 1996 as well as Article 1 of the UNESCO Convention on the Protection of Maritime Heritage of 2001 put emphasis on the fact that protection in situ should be the first option. [100]

Still there are some questions need to be answered while the in situ preservation would be a solution or considered as the future plan;

If in situ protection is going to be the standard procedure, what does it mean? When can or do we want to protect shipwrecks underwater? From what are we protecting them? For how long can we protect a shipwreck?

These questions could be rose on every kind of underwater cultural heritage site. And answering to these questions needs to consider all the conventions, criteria and guidelines, as well as detailed survey and study of each individual site, concerning its physical condition and its environmental situation. And these questions need to be followed by the questions of the way of presentation and the purpose of presentation. These questions have been mentioned at the Museology chapter.

Next part is going to provide evaluation tables. These tables will work as preliminary schemes in order to make the decision for the future of the underwater cultural and historic sites.

[99] Guidelines for the Management of Australia's Shipwrecks, Australian Institute for maritime Archaeology Inc, and the Australian Cultural Development Office Canberra 1994
[100] H @ R ,2006 HERITAGE AT RISK, The In Situ Protection of a 17th-Century Trading Vessel in the Netherlands, M. R. Manders

3-5- Tables of Evaluation:

Following the previous parts, according to the world heritage conventions and charters, and also the national guidelines of underwater cultural heritage management, herewith the results are coming up in the shape of some charts and tables. These tables will help to assess a site in order to find its eligibility and importance of conservation and presentation.

In order to produce these evaluation charts, all the analysis from the latter chapters, the results from the study on the best practices in the world and the basic rules of conventions, charters and guidelines, as well as philosophical aspects of museology and cultural heritage public presentation have been taken into account.

There are six main tables that I have developed concerning the assessment of the eligibility and importance to be conserved and presented. In brief they are as follow:

1- Archaeological table (Context of the site)

2- Conservation table (State of safeguarding and conservation)

3- Table of Significances: Historical
Scientific
Social
Archaeological
Technical
Interpretive

4- Degree of significance: Rare
Representative

5- Size and quantity of the site

6- Funding/Possibilities/Implications

3-5-1- Archaeological Tables

These tables have been shaped according to the studies in the first chapter, from the basics which K. Muckelroy-underwater archaeologist- has been established, and followed by lots of projects. Although this seems to be related only to archaeology, these bases are important to assess the physical condition, the importance, quality and quantity of an underwater site.

1- Structural remains	Extensive		Elements		Fragments	
	Scattered	United	Scattered	United	Scattered	United

2- Objects found within the shipwreck site	Many		Some		A few	
	Scattered	United	Scattered	United	Scattered	United

3- Distribution of the site	Scattered		Coherent
	Inorder	Disordered	

4- Geologically of the site	Sandy and substrate	Rocky	Intermediate (rocky and sandy)	Slop

5- Organic growth on the site	Many			Some			A few		
	Covered completely	Covered Partialy	No cohision	Covered completely	Covered Partialy	No cohision	Covered completely	Covered Partialy	No cohision

This table should be followed by the detailed data about the materials, objects and the kind of fouling and nature around the site. This gives an idea of the site and its condition.

Indicating scattered on the able 1 should be followed by the reasons of this condition. If this scattered condition has mostly been due to the first accident and wreckage? Or is this dispersion due the continuity of erosion and other on-going reasons?

Again for the table 2 the reason of being scattered should be investigated. Also if there are a few objects found by the wreck or the site, it should be studied if there were more objects which have been disappeared due to the salvage, souvenir collection, moving off by the stream of water and so on. The existence and delicacy of the materials and objects is very important. The level of rarity of the objects and material should be evaluated. It should be considered that the amount of the objects within the site plus the form of their dispersion is important in order to define the final management plan of how they are going to be displayed and conserved. Furthermore, it is important to say that sometimes these objects shape a very important part of the site contexts. Taking out the whole objects or broken part of the site might cause the disintegrity of the whole context and the site.

To be clearer about the way of studying a site in order to evaluate it through archaeological value, according to the Australia Guidelines for management of Underwater Cultural Heritage, there is an inclusion/exclusion guideline available;

Inclusion Guidelines:
Shipwrecks or places for which there is a strong presumption of research potential in one of a wide variety of fields which may contribute to the understanding of history (e.g. ship construction and design, trade, passengers, exploration, transport).
Shipwrecks or places with physical evidence likely to be of technological or cultural value, where that evidence is not available through other research techniques.
Exclusion Guidelines:
Shipwrecks or places for which there is no presumption of research potential;
Shipwrecks or places valued for unusual features mentioned in documentary sources which are no longer part of the surviving fabric; Shipwrecks or places of a type already well studied and documented and not requiring additional research;
Shipwrecks or places whose research potential is exhausted. [101]

The integration of archaeology and heritage issues at the "ground level" in the development process is consequently more likely to ensure a better outcome with regards to the preservation of underwater cultural heritage.[102]

3-5-2- Conservation table:

There are some point regarding the conservation and physical state of the underwater sites. A major part of the future decision depends upon these points. The study about the state of preservation and conservation should provide a set of comprehensive information about:

[101] Guidelines for the Management of Australia's Shipwrecks, Australian Institute for maritime Archaeology Inc, and the Australian Cultural Development Office Canberra 1994
[102] H @ R ,2006 HERITAGE AT RISK, The Sad Case of the SS Maori, John Gribble

1. Natural erosion and scouring caused by sea and weather
2. Objects being moved all over the site
3. Material-eating (erosion) organisms
4. Looting
5. Fishing activities
6. Chemical degradation, including the corrosion of metal objects (if possible)
7- Environmental conditions (the changes to the seabed flora and topography and human-influenced changes in the environmental conditions caused by factors such as nearby channel dredging, the scallop fishery and changes to)[103]

In order to provide better understanding of the condition of a site Test Excavation is recommended- keeping in mind that according to the UNESCO Guidelines, always non-destructive methods of survey are recommended. The main aim of the test excavation program was to produce a detailed site plan to aid in future management of the site, and a secondary aim was to conduct research into the stowage methods used aboard the vessel.

The table on the next page shows a general evaluation items in order to assess the state of preservation and conservation of an underwater site.

[103] H @ R ,2006 HERITAGE AT RISK ,The In Situ Protection of a Dutch Colonial Vessel in Sri Lankan Waters M. R. Manders

Table of Conservation:

1- Natural erosion caused by sea and weather	In the long term		Continuous and in process	Recent, due to the global changing
	Minor	Major		

2- Objects by the site	All excavated or accessible	More available but not visible and accessible

3- Material-eating organisms	Organic								Inorganic							
	Main structure				Objects				Main structure				Objects			
	Well - preserved		Endanger		Well - preserved		Endanger		Well - preserved		Endanger		Well - preserved		Endanger	
	On the surface	Under the sediments	Natural threats	Treasure hunting / bad intervention	On the surface	Under the sediments	Natural threats	Treasure hunting / bad intervention	On the surface	Under the sediments	Natural threats	Treasure hunting / bad intervention	On the surface	Under the sediments	Natural threats	Treasure hunting / bad intervention

4- Environmental conditions Flora, fauna, chemical changes in the sea combination, geological changes, new seabed infrastructure and so on	Stable	Various			
		Periodical changes		Recent changes	
		Not harmful	Destructing	Not harmful	Destructing

3-5-3-Table of Significances:

General significances for Cultural Heritage and unique significances for Underwater Cultural Heritage have previously been mentioned. Herewith, they are again named and also the inclusion and exclusion of the sites according to holding these significances have been presented. This part has been shaped according to the criteria for cultural heritage mentioned in Burra Charter and Nara Document, as well as the Guidelines to manage Underwater Cultural Heritage in Australia.

"3-5-3-1- Historical[104]:

Inclusion Guidelines:
Shipwrecks or places representing influential, seminal or other 'landmark' activities, phases, events or figures in history. Places whose elements illustrate the layering of activities or events in a single locality or the relationship between landform and human history.
Exclusion Guidelines:
Shipwrecks or places whose association with the significant activity phase, event or person's life or work is tenuous, brief, transitory, incidental or unsubstantiated; shipwrecks or places associated with activities, phases, events or lives whose historical significance is unsubstantiated.

As dealing with Historical, the factor of "aging" also should be considered as a sub-significance of being historical. In different conventions and guidelines this factor varies; in UNESCO Convention any shipwreck or site more that 100 years old considered as historic. But in some other national guidelines also we could see the 75 years old as a criterion to be considered as historic.

Assessment of the Historical significance of a site is one of the first criteria which should be studied. This significant comes into account with other criteria in order to evaluate the site for its future destiny.

3-5-3-2- Technical:

Inclusion Guidelines:
Shipwrecks or places, (being any humanly created or affected place), which: demonstrate appropriate and conceptually strong solutions to a technical problem, by expanding established or developing new technology; are creative either through their innovative departure from or their perfection of, established norms in some field of design; display a high degree of integrity in their technical or aesthetic qualities.
Exclusion Guidelines:
Shipwrecks or places, where the integrity of technical or aesthetic qualities is no longer intact. Shipwrecks or places which are the work of an outstanding designer but are not in themselves creatively or technically outstanding." [105]

[104] This significance and other five coming ones cover the criteria mentioned in Nara Document on authenticity, Burra Charter and other national and international criteria to consider a site as an valuable cultural heritage.

Once a site is important due to its technical values, the importance of studying issues related to the construction development and history of innovations raise. Displaying a site with high technical values needs to demonstrate these values and the importance of research on its construction, linking with similar sites and techniques and also following the technical development during the time should come into the account. Sometimes the final decision could be raising the sites or parts of it and reassembling its parts, or there could be other options such as visualization through images, videos, or modeling.

"3-5-3-3- Social:

Inclusion Guidelines:
Shipwrecks or places whose strong association with a community is demonstrated to be of a social, cultural, spiritual or educational nature; shipwrecks or places which are held in high esteem by the community or by some significant and identifiable segment of that community, such esteem being demonstrated to be beyond the normal regard felt by any community for its familiar surroundings.
Exclusion Guidelines:
Shipwrecks or places not demonstrably held in high regard either by the community or by an identifiable group within it."[106]

This criterion is more intangible. Linking with the memories, culture and so on needs respect to the cultural and traditional value of a place and a group of people. Sometimes these values connect to the identity of a community. And sometimes there are some unknown values correlate with a specific site, which shouldn't be disturbed before sufficient precautions.

3-5-3-4- Archaeological:

This criterion has been already discussed in a separate table, considering all the issues involve in the archaeological value and research significances.

"3-5-3-5- Scientific:

Inclusion Guidelines: Shipwrecks or places where there is a strong presumption that scientific investigation of organic and/or inorganic components and associated biota will lead to the generation of, or contradiction of, important hypotheses related to the natural sciences or the behavior of manufactured materials in submerged environmental conditions. Shipwrecks or places where there is significant potential for the development, testing and evaluation of in situ protective measures.
Exclusion Guidelines: Shipwrecks or other places where there is no presumption of scientific research potential. Shipwrecks or other places of a type, composition and

[105] Guidelines for the Management of Australia's Shipwrecks, Australian Institute for maritime Archaeology Inc, and the Australian Cultural Development Office Canberra 1994
[106] Guidelines for the Management of Australia's Shipwrecks, Australian Institute for maritime Archaeology Inc, and the Australian Cultural Development Office Canberra 1994

context already well studied and not requiring additional research; Shipwrecks or other places whose research potential is exhausted.*"* [107]

"3-5-3-6- Interpretive:

Inclusion Guidelines:
Shipwrecks or places which, by virtue of accessibility, setting, integrity etc., are suitable for on-site (or other) interpretation which highlights their specific heritage value and heritage values in general.
Exclusion Guidelines:
Shipwrecks or places whose educational attributes are modest.*"*[108]

3-5-3-7- Aesthetic:

This criterion is dealing with a site itself or the site as a part of its surrounding. A site could be appealing and of aesthetic values by itself, therefore dislocation of the site will not cause any harm for this value. On the other hand, there are sites which their aesthetic values are associated with their environment, and nature play an important role in creating this value. In these two cases the way of approach to present a site is different. In such cases the issues regarding seabed-scape also come into account. They all need to be studied to have a proper final decision.

According to Nara Document on authenticity the different aspects of a site such as form and design, material and substances, use and function, tradition and techniques, location and settling, and sprit and feeling should be evaluated through the dimensions and criteria of heritage which have been explained above. Although some aspects are different for underwater cultural heritage, and also they vary in different kinds of underwater heritage; the way of confronting with shipwreck sites and their values differs from the underwater remains of cities and sites.

Following there is the table which will provide the information in order to how to assess a site through its significances.

[107] Guidelines for the Management of Australia's Shipwrecks, Australian Institute for maritime Archaeology Inc, and the Australian Cultural Development Office Canberra 1994
[108] Guidelines for the Management of Australia's Shipwrecks, Australian Institute for maritime Archaeology Inc, and the Australian Cultural Development Office Canberra 1994

Tables of Significances:

Aspects / Criteria	Form and design	Material and substances	Use and function	Tradition and techniques	Location and settling	Sprit and feeling	Being underwater
Historical	Traces of historical design background	Traces of material used before	Stories of the site function(s) during the history	Result of development or follower by historic tradition or techniques of construction	Original location, or moved by the stream, the condition of its location	Histories associated with the tradition, feeling, or etc.	Historical event, Stories within the events. etc
Technical	Influence of a technique on shaping the site	Technical aspects relating to fabricated the materials of the site	Techniques which have been developed due to certain use or function	Techniques which are correlated to certain traditions	Is any technique or craftsmanship involved in the location and settling the site?	Any spiritual or traditional attachment to apply a certain kind of construction technique.	Any technical issues caused the event of being underwater. :construction problems, flowing water, dam construction, etc
Social	Forms follow any social value?	Any social reason concerning applying certain materials?	Function of the site had any social value for the community, or a group of people involved in the site?	Tradition and techniques are a result of social progress or social act?	Has the location of the site any social value for a community or group of people?	Any intangible value related to the site.	True history along with the stories and folks correlated to the site and people.
Interpretive	Highlightin g any important issue relating to the form and design of the site.	Extracting date from the materials and substances used in the site.	Implying any information related to the function of a site or in comparison with other sites.	On-site interpretation of techniques and traditions involved in a certain site.	Accessibility which provide wide range of information.	On-site values which are linked with other surrounding sites, cities or places. (Common history)	Common stories involving with a group of sites and areas, in way that missing one will cause problem in reading the whole history.
Aesthetic	The forms or designs which are of a unique aesthetic value.	Materials or substances which carry a unique aesthetic value.	Function or use of the whole or part of the site which provide a unique scenery.	Any technique which corresponded with producing an object or a site with aesthetic values.	Previous or current location considering environmental issues and the influences of the nature which make a site of further aesthetic values.	Intangible aspects, such as craftsmanshi p, skills, folks and so on which related to the artistic aspects of a site.	The issues involve the over flooding or wreckage which added more attraction and beauty and excitement to the site.
Scientific	Any scientific value related to the design and form of the site.	Science and skills associated with the fabrication of the materials and substances of the sites.	Development of any function and use in the history of innovation and development .	More detailed data about the development of the construction and production techniques.	Any geological, climatic, constructive information relating to the location and settling of the site.	Any intangible aspects relating to the science of construction function, and so on.	Any scientific reason for the wreckage, broken, and over flooding of the site.

3-5-4- Degree of Significance:

Another important issue to define final decision for management of an underwater site is the degree of the significances. There are three main groups of the sites which could be evaluated through their level of significance:

1- Rare
2- Representative
3- Typical

These groups have been explained before. Herewith, according to the Australian Guidelines the sites which could be included or excluded of these groups are explained.

1- Rare:

Inclusion Guidelines:
Shipwrecks or places of established scarcity, either as the result of a process which produced few such items or as the result of subsequent destruction or decay. Shipwrecks or places offering unusually accurate evidence of a particular human activity, through the integrity of their surviving remains.
Exclusion Guidelines:
Shipwrecks or places whose rarity is suspected, through the absence of survey information to the contrary, but have not been established. Shipwrecks or places of a currently numerous class which are potentially under threat. [109]

2- Representative:

Inclusion Guidelines:
Shipwrecks or places that are good examples of their type:
· by combining the most indicative characteristics of the type; as significant variants of the type; as part of a group of shipwrecks or places collectively illustrating a range of variation within the type; or
· by representing the type's seminal or optimal development. Shipwrecks or places which, amongst a number of their type, stand out for their integrity, condition or association with their setting.
Exclusion Guidelines:
Shipwrecks or places which not represent well the combination of characteristics which make up an established type or a significant variant of it. [110]

3- Typical:

These are the shipwrecks which in comparing with the two groups above are more common and carry less important values and significances. These shipwrecks, if their being cultural heritage justified, have also the value of presentation and conservation under certain condition and priorities.

[109] Guidelines for the Management of Australia's Shipwrecks, Australian Institute for maritime Archaeology Inc, and the Australian Cultural Development Office Canberra 1994
[110] Guidelines for the Management of Australia's Shipwrecks, Australian Institute for maritime Archaeology Inc, and the Australian Cultural Development Office Canberra 1994

3-5-5- Size and quantity of the underwater cultural heritage:

This item could determine an underwater cultural heritage to be considered as an object or as a site. Considering the environment and the degree of involvement of the heritage with its surrounding nature, also give an indication to evaluate it as an object or as a site. Being a cultural heritage site require other kind of intervention strategy, that being an object. The mobility of an object is more understandable than dislocation of a whole site. Also there are lots of concerns in the case of dislocating a site; considering the UNESCO rules in the case of dislocation of a site, it become clear that this action should be applied under certain condition. Plus, the conservation and presentation of a site differs with conservation and presentation of objects. This part has exclusively been explained in the museology chapters.

3-5-6- Funding/possibilities/ implications:

This part is mostly related to the legal aspects of a national project. While a government decides to deal with its underwater cultural heritage, there should be enough information about the available funding and possibilities that could be provided for the project. According to these potentials the management plan for a project could have practical supports; otherwise all will remains in a conceptual level.

According to the mentioned tables and criteria, each Underwater Site should be evaluated. This evaluation helps to determine the degree of importance of a site, the values which the site carries, the possibilities and implications of preservation and presentation. At this level of study the decision is going to be made. There are two main possible domains of act. Choosing between these two domains on one hand depends on the actual possibilities, and on the other hand depends on the philosophy and conceptual ideas of the people in charge of the project:

1- In situ
2- Displacement on-land

Again for in situ action, there are two main treatments:

In a crucial situation, when the level of vulnerability, or importance or threats or as such reasons is too high the presentation in situ is impossible. Therefore, one of the in situ preservation methods should be applied. These methods could be coverage with net and sand bags [Fig. II-13], artificial grass matting [Fig. II-14, 15] or any other possible ways of reburial. [Fig. II-16] The necessary information and knowledge will be presented through model reconstruction, underwater filming and so on.

As an option- in favor of some conventions and also stakeholders- for in situ presentation, the possibilities, risks and all stated issues should be come into account. There might be the final plan for in situ or similar situ presentation; such as underwater parks and trails. And also there could be new ideas such as in aquarium presentation and so on. [Fig. II-17]

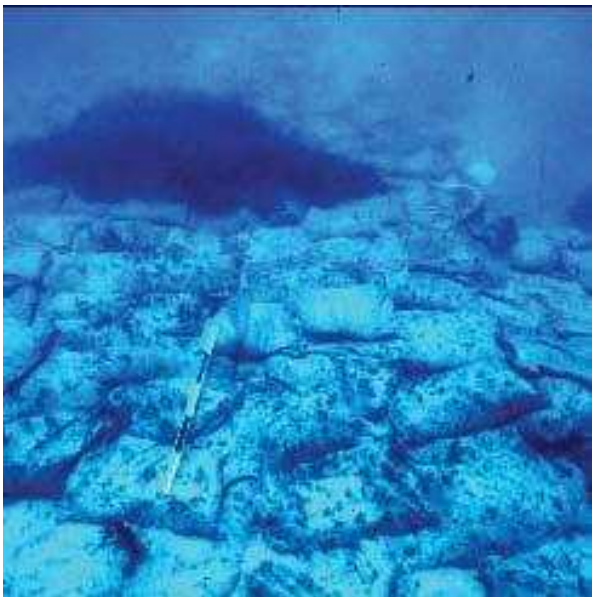

Fig. II-13

Fig. II-14

Fig. II-15

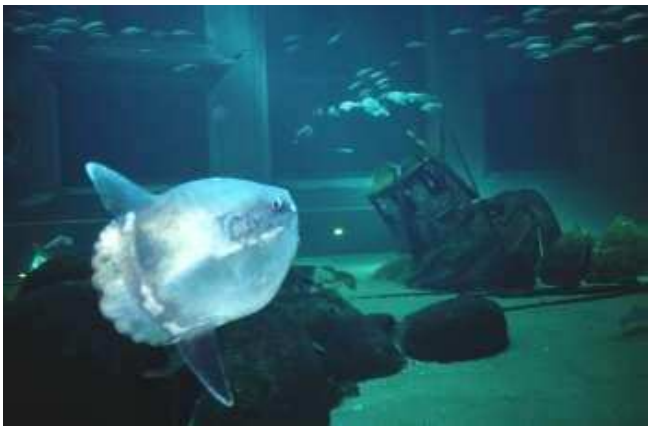

Fig. II-17

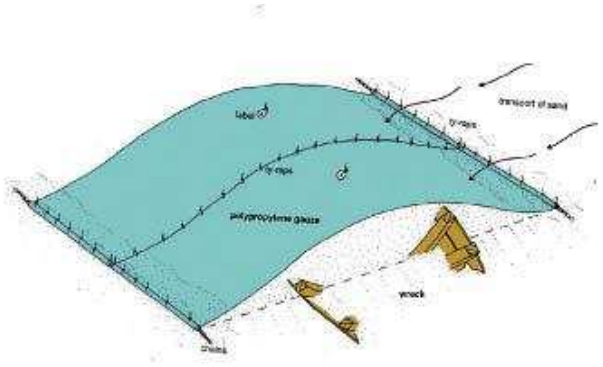

Fig. II-16

Fig. II-13: Sandbags on the Solway (C. Coroneos)
Fig. II-14: Moving sea grass matting into position (M. Staniforth)
Fig. II-15: Sand is penetrating the little holes in the net, covering the wreck-site with a protective sediment layer (R. Muthucumarana)
Fig. II-16: The method of physical protection used on several sites in the Wadden Sea. Sand that is moved over the seabed by the currents penetrates the holes of the net and settles on the site. Within a few weeks, the whole site is covered again with a thick layer of sediment (Drawing M. Manders/M. Kosian)
Fig. II-17: Displaying a shipwreck into an aquarium, The Oceanarium, Nordsoemuseet, Denmark

At this stage of the study, there are enough tools in order to evaluate a site, and plan for its management. The most essential issue is regarding complete and extensive information about the site. The collected in situ data, historical, social and scientific studies, plus the expectations and possibilities are the preoccupation of any project, and all these data will facilitate to have a proper plan for a site.

In the following part a general overview of the Belgium Underwater Cultural Heritage will be introduced. And some cases will be assessed through the mentioned assessment tools.

4- Chapter III

Belgium UWCH

4- Chapter III

4-1- Introduction:

In this part of the study, a general overview of the Belgium Underwater Cultural heritage has been presented. First a review of the general laws of the sea with a focus on the Belgium part of the North Sea has been highlighted, together with the issues which involve flora and fauna and also the damages which could be brought out through pollution and human activities. This will lead the study not only to focus on underwater cultural heritage through one side, but also considering the other side, as natural issues involved within these heritage. In this regard the importance of underwater heritage as both culturally and naturally will be highlighted.

Following the general studies above, three examples of maritime and underwater cultural heritage will be studied and the possible proposals for their future will be presented. These three cases will be evaluated through the framework of the study which has been done previously in the present research; the cases will be evaluated through the tables which have been presented in the previous chapter. To get to final decision, the possible methods, potentials and the long term programs in Belgium will be studied. Since there are some ongoing projects in Belgium, the purpose of this study is to make a balance between the consequences of comparison of the best practices in the world, and the actual condition and possibilities in Belgium.

If we consider the underwater relics and cultural heritage in Belgium as an entire and united topic, the necessity of having a general and master plan would be felt. Considering this fact in the present research, three cases have been studied, and a sample master plan for these three cases will be presented. But still for the whole Underwater Cultural Heritage in Belgium, a comprehensive guidelines would be essential.

The present master plan is consisted of three main stages;

4-1-1 - Short term program:

This stage is considered as the urgent treatment; after having had a clear image of the condition of the cases, damage assessment and historical and evaluation, the most urgent action in order to conserve and preserve the relics will be presented. For example in the case that we have on going degradation and vanishing off the property, the most possible-even temporary-action should be applied to preserve the relics. In general the following actions might be applied:

- Removing the relic partially, totally or some objects.
- Suggestion for study, and reburial of the relic after completion of study.
- The advices of conservation or restoration of the relics or the object within it.
- In some special cases more advices might be presented.

4-1-2- Mid-term program:

Following the study on the relics and starting the short term activity to preserve the relics, more suggestion for study might seem necessary. In these cases the importance of the further studies will be clarified and explained, and the purpose of this stage will come into account for the long term program. Also some further activities might be suggested in order to promote the conservation and presentation process.

4-1-3- Long-term program:

A general overview of the future activities of underwater cultural heritage and archaeology in Belgium will be provided through the long term proposals. At this stage the importance of having a national or international or between-countries programs will be studied. The potential of having a vaster view towards the underwater cultural heritage activity in Belgium clears the necessity of having a National Guideline for Belgium Underwater Cultural Heritage. These guidelines need an inclusive study about the law of the seas, the existing guidelines on the cultural heritage in Belgium and a comparative study of different guidelines in the world. In order to bring up the level of Underwater Cultural Heritage on the international level different aspects of further activity should be analyzed. As for the result of this more comprehensive study Belgium might be able to have its own underwater park in an actual or virtual way. As for a country with an especial climate, the methods of conservation and presentation of underwater cultural heritage is very crucial.

4-2- Division of the maritime zones in the North Sea according to the law of the sea:

In order to take measures for the protection of the maritime environment, knowledge on the spatial distribution of the different uses of the North Sea and on the natural values of the Belgian maritime water is required. For an integrated coastal zone and marine management it is important to get a clear view on the overlap and possible conflicts between the different user groups and the natural values of the environment. The aim of this part of the study is to provide an overview of the most important user functions of Belgian part of the North Sea.

There are six maritime zones in the North Sea within jurisdiction of the coastal states: internal waters[111], territorial seas[112], contiguous zones[113], continental shelves[114], exclusive economic zones[115], and fishery zones[116].

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[111] Internal waters are those waters on the landward side of the baseline, under the full sovereignty of the coastal states. They include bays, estuaries, coastal harbors, and waters enclosed by straight baselines.

[112] The territorial sea is that part of the sea which is adjacent to the land territory and internal waters of the coastal states, up to a limit not exceeding 12 nautical miles from the baseline.

[113] The contiguous zone is a zone adjacent to territorial sea, extending no further than 24 nautical miles from the baseline.

[114] Beyond the territorial seas of the North Sea, each coastal state is entitled to a continental shelf which is the natural extension of the land territory.

[115] Under the 1982 Law of the Sea Convention, coastal states are entitled to an exclusive economic zone extending no further than 200 nautical miles from the baseline.

[116] In the late seventies the fishery zones of the North Sea were extended to 200 nautical miles, as requested by the Council of the European Community. The boundaries of the North Sea fishery zones are set by existing agreement as to the limits of the continental shelves.

The Belgian maritime zones are measured from a normal baseline, which is the low-water line along the coast as indicated on official large-scale charts. Other zones such as territorial sea, contiguous zone and continental shelf are determined according to this base line. These zones are important as a part of this study in order to show different activities which are being done underwater and their effects on underwater relics. For instance the impact of fishery, sand and gravel extraction, dredging, industrial activities such as pipelines and telephone lines and so on, some times cause damages on underwater sites. Not only have these activities caused physical damages to the underwater relics, sometimes the chemical influences and changes in the water substance have irreversible damages on the site itself and also on its natural environment. The importance of the Ramsar Convention[117] on the wetlands should also come into account. Applying the guidelines of this convention will be useful to conserve the natural environment of the sites.

Following these conventions and Law of the Sea, there is a map of Belgian Territory Water available, on which the different underwater sites have been indicated. There is one map available with navigational system in order to avoid accidents between the sea vessels and the underwater sites (especially the shipwrecks in low-waters). [Fig. III-01]]

Herewith, it seems necessary to mention that there is no especific legislation or criteria for underwater cultural heritage in Belgium and most of the projects and action have a look on other general legislations for cultural heritage, and underwater cultural activities are done following the principles of these laws.[118] To have a general legal overview towards these legislations, a brief has been provided as follow:

"Protection as monument (built heritage)(March 3, 1976 decree on the protection of monuments and of city and town sites, amended by the decree of 18 December 1992, 22 February 1995, 22 December 1995, 8 December 1998, 18 May 1999, 7 December 2001, 21 November 2003 en 30 April 2004)
a moveable property, made by man or nature or both, which has general interest because of its artistic, scientific, historical, folkloristic, industrial-archaeological or other social and cultural values, including the cultural properties which are an integral part of these monuments, except the accompanying equipment and decorative elements

Protection as urban and rural site
-a group of one or more monuments and/or unmovable properties together with the surrounding elements, such as plantations, fences, watercourses, bridges, roads, streets and squares which has general interest because of its artistic, scientific, historical, folkloristic, industrial-archaeological or other social and cultural values
-the direct, immediately linked visual environment of a monument which does justice to the intrinsic value of the monument, because of its visually qualifying character, or

[117] Convention on Wetlands of International Importance, Ramsar, Iran, 2 February 1971, published in 11 ILM 963 (1972); Law of 22 February 1979, BC 12 April 1979.
[118] It should be mentioned that there is a federal law available for salvage and ownership of the underwater relics, but still more efforts need to be done to protect this part of Belgium Cultural Heritage.

which is able to guarantee, by its physical properties, the preservation and maintenance of the monument

Protection as landscape (April 16, 1996 Decree on the protection of landscapes, amended by the December 8, 2000 decree and of the December 21, 2001 decree.)
A limited surface area with low density building and a coherence of which the manifestation and the coherence are the results of natural processes and social development

Protection of archaeological sites (June 30, 1993 Decree on the protection of the archaeological heritage)
Archaeological monuments are the remains and objects, or any other trace of human existence, which give evidence of eras and civilizations of which excavations or findings are (one of) the most important sources of information. They can be either moveable or unmovable
Archaeological sites are territories which are of scientific and cultural-historical interest because of the presence of archaeological monuments"[119]

Considering the fact that there are more than 300 shipwrecks, and some remains of old villages on shore in Belgium, as well as finding remains of two cogs on land, the necessity the existence of a Guideline for underwater and maritime cultural heritage in Belgium is evident. Although in this study has been tried to make up the basis for this guideline, the scope of this study is not enough to finalize it. Therefore, herewith on accord with this research, just three cases have been studied.

According to the present knowledge of this research, there are four categories of underwater cultural and maritime heritage in Belgium, towards each, different strategies should be applied.

The four categories are as follows:

1- Shipwrecks underwater older than 100 years old.[120]
2- World War shipwrecks.
3- Underwater remains of village and sites.
4- On land remains of sea vessels or ports and so on.

Each site or relic should be evaluated through the tables of evaluation, in order to have a relevant short, mid and long term plan.

In cooperation with VIOE, three cases which are in priority have been suggested to work on; one is the remains of two cogs- so called Doel Cogs- which have been found during excavation work for the harbor of Antwerp. The other is a wooden shipwreck- situated on the sand bank of Buiten Ratel-, which is still under water in the North Sea, and the third is a metal warship wreck- Bourrasque- from World War II.

[119] A summery of different legislation about Cultural Heritage from UNESCO official website.
[120] This age has been mentioned according to the UNESCO Underwater Cultural Heritage definitions but it could be variable according to the significances of a relic.

4-3- Doel Cogs:

Cogs in general were sea-going vessels during the middle ages, which were mostly used in the northern and northwestern areas of Europe.[121] Of these kinds of vessels a few has remained; none of them is complete, and usually they have been found near the shores of rivers or seas.[122] As it has previously been said in chapter "I", one of the best examples of these cogs has been found in the river Weser close to Bremen in Germany, which is now on exhibition in the Maritime Museum of Bremerhaven.

4-3-1- History- Old and New:

In general there is not that much information about the Doel Cogs available. No written information or no evidences in the history has been found about these relics and no indicative object has been found within the site. Even the location of its finding gives no more information. There are some theories about its location but none has been approved as the original one.

Most of the information about these cogs came from their excavation and the studies on their physical condition. The two Doel Cogs of Belgium have been found during an excavation for construction site, in August 2000, about 4 m under the earth, in the left bank of the river Scheldt, northeast of Antwerp. One of the cogs is larger, and has been damaged due to the excavation. [Fig. III-02, 03] These cogs are wooden vessels with planks of thickness between 4 and 6 cm. The total length of the larger vessel is 20 m and its width is 7 m. This cog could be considered as the first complete medieval boat discovered in Flanders since XIX century. [123] The on-time informing of ADW[124] was a proper reaction from the contractor's side.

Some cultural activities have been done during and after its excavation which showed the public eagerness towards such projects. In an opening day more than 10,000 people came to visit the cog which was still upside down after its recovery from the soil. [125]

4-3-2- Condition after the excavation:

The first problem for conservation of the wood was raised by the site itself. The problem of accessibility to the site as well as the process of drying wood because of being exposed to the air were the most obvious difficulties of keeping the cog in the site. For a span of two months the wood was covered with an unwoven geotextile saturated with water as frequently as possible.[126]

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[121] http://en.wikipedia.org/wiki/Cog_%28ship%29

[122] From the interview with Prof. Hoffman, the director/scientific from Maritime Museum of Bremerhaven, and Per Hoffmann, James A. Spriggs, Tara Grant, Clifford Cook, Andrea Recht, Proceeding of the 8th ICOM Group on Wet Organic Archaeological Materials Conference, Stockholm, 2001

[123] According to VIOE and ADW scientists.

[124] ADW stands for "Archiologische Dienst Waasland".

[125] Rudiger Van Hove, De Doel Kogge(n) Maritiem Erfgoed Van Europees Formaat, M&L, Monuenten, Landschappen & Archeologie, 24/4, Toeemaandelijks, Juli-Augustus 2005, p. 50-69

[126] Rudiger Van Hove, De Doel Kogge(n) Maritiem Erfgoed Van Europees Formaat, M&L, Monuenten, Landschappen & Archeologie, 24/4, Toeemaandelijks, Juli-Augustus 2005, p. 50-69

The wooden shell had been covered with a very strong crust of iron corrosion deposit, sand and fragment of shells. A superficially cleaning has been done with a high pressure vapor cleaning system prior to scanning. After having examined[127] and documentation of each part, the cog has been dismantled into different parts which each part has been numbered and its location has been documented.

"Pushed by the short delay, but helped by the fact that all iron nails of the hull had completely disappeared by corrosion leaving the planks only fastened to the frames by the treenails, it was decided- after deliberation with NISA experts- to remove the boat in pieces of 4.5 m maximum length for the planks, leaving the keel, transverse beams and mast-step each in one piece of maximum 7m the possible recovery of the entire boat in one piece, would have raised the problem of the large amount of deposit inside of the hull, meaning an important weight to displace; anyway, before starting the recovering we didn't have the time to contact contractors and to make a serious preliminary study of the problems raised by such a removal and the possible solution." [128]

In brief the following technical activities and documentations have been done after its recovery by ADW[129] and prior to its dismantling:

1- Drawings and sketches made during the salvage recovery.
2- The three-dimensional model generated from the laser scanned data. [Fig. III-04]
3- A rudimentary inventory of sectioned parts and their location. [Fig. III-05]
4- Images of the excavation and timber storage condition. [Fig. III-06]
5- Interviews with key personnel.
6- Planning documents that have been proposed to date.

During all these data gathering and documentation, it was tried to keep the planks as wet as possible. And the final and possible decision for these planks was to put them into 26 steel tanks of the 5 by 2.5 by 1m and three tanks of 8 by 2.5 by 1m.[130] it was anticipated that these tanks might be suitable for future treatment of the wood with hot PEG, but never has been tested. These efforts lasted till end of January 2001.

Finally all the planks, covered in a coating layer have been put in the tanks; they have to be ballasted with concrete blocks, which cause some inevitable damages to the surface coating. This solution was supposed to be a short term operation to keep the planks as safe as possible in order to take a final decision for further treatment of the waterlogged wood. [131]

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[127] The state of each plank was estimated simply by pushing down the same knife in the wood at different places and always by the same operator; in this way the softness of the wood was between 0.5 and 1.5 cm.

[128] Alfred Terfve, Happiness is a 20 m upside-down cog at Doel (Belgium), A report after finding and excavation of Duel Cog done for ADW, IAP, VIOE (?)

[129] Berichten van de Archeologische dienst Waasland, Overdruk uit annalen van de koninklijke oudheidkundige kring van het land waas 104 (2001), p. 437-484

[130] The size of the containers being subjected to traffic regulations.)

[131] Alfred Terfve, Happiness is a 20 m upside-down cog at Doel (Belgium), A report after finding and excavation of Duel Cog done for ADW, IAP, VIOE (?)

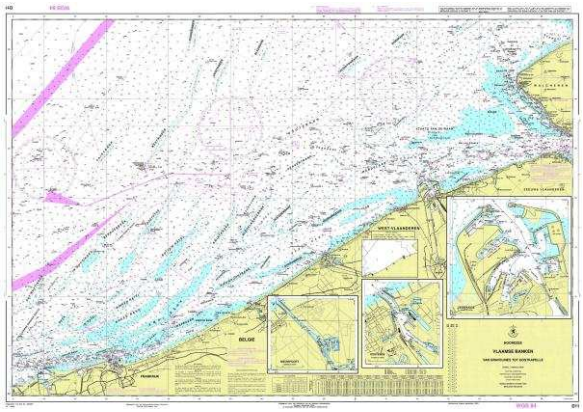

Fig. III-01

Fig. III-02

Fig. III-03

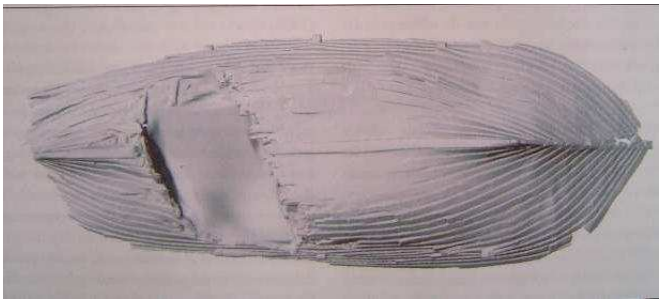

Fig. III-04

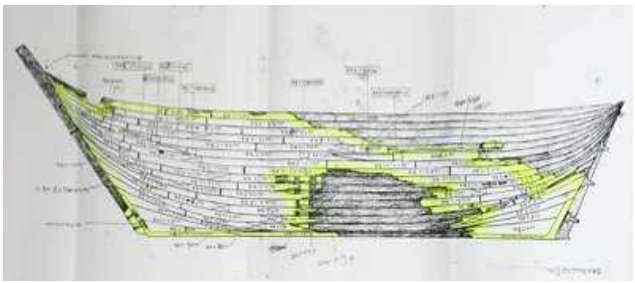

Fig. III-05

Fig. III-06

Fig. III-02, 03: The condition of the Doel cog after excavation.
Fig. III-04: The 3D image produces by 3D scanner.
Fig. III-05: One of the inventories of the cog which shows the position of the planks and the connecting iron nails.
Fig. III-06: The plastic coverage of the planks, and storage before having transferred.

4-3-3- Present Condition:[132]

The cog timber is currently stored in 29 tanks, in a grassy field, on the edged of an industrial area near the entrance to Fort Liefkenshoek, in the north east of Antwerp.

The last extensive study which has been done on this relic was done through a joint project between VIOE and A&M- University of Texas. The expert from A&M provided a report which includes Visual Observation, Analytic Sampling and Document Review.

Following the lack of access to all planks in the tanks, visual observation to all parts was not possible. It should be mentioned due to this lack some planks haven't been examined or observed for seven years. Therefore, there is no clear view of the condition of all planks.

Analytic sampling included testing the water's pH, mechanical assessment of the depth of timber degradation, and evaluation of bacterial content and aggressively in the storage water.

There are a series of damages which occurred to the planks due to the manner of their storage. [133] [Fig.III-07] These damages could be briefly named as follows:

4-3-3-1- Dehydration:

Any portion of the wood that is allowed to uncontrollably dehydrate will shrink, distort, check, or split due to the weakened nature of the cell structure, and the external pressure placed on the wood by moisture gradient occurring during dehydration. The major threat is that once the cell structure collapses, it is impossible to return a wooden waterlogged artifact to its previous proportion. [134] [Fig. III-08]

4-3-3-2- Acidic condition:

The other threat to the planks is the water chemistry. Although the water is getting refreshed once a year the tanks are not cleaned of accumulated bio-mass. Therefore, most organisms that use cellulose as their source of carbon for growth and development, in particular most fungi and bacteria and bacteria, reside in acidic aqueous mediums. Assessment of the water chemistry pH in late July yielded a range from a pH of 5.5 to 7.3 with a water temperature around 23-25◦C in the 15 tanks that were evaluated. [135]

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[132] This part of the study is the result of my own interviews with ADW experts, as well as the study which has recently (July 2007) been mainly done as a joint project between VIOE and Center for Maritime Archaeology and Conservation of Texas A&M University, and my own interviews with an expert from this university, and data from VIOE.

[133] The border of the tank farm is a chain-link fence about 1.75 m high with an additional three strands of barbed wire approximately 0.5 m high encircling the top. The tanks sit in rows directly on the grass, but the ground undulates under the four corners of the tanks and supporting soil is not always firm enough to prevent the heavy corners from sinking below grade.

[134] Peter Fix, Moving Forward-Planning, Part II (The report of Peter Fix, an expert from A&M to provide consultation on the Doel Cogs)

[135] Peter Fix, Moving Forward-Planning, Part II (The report of Peter Fix, an expert from A&M to provide consultation on the Doel Cogs)

The most likely source of the acidic conditions originates from the fact that the tanks are not covered, remain in direct sun light, are not regularly filtered, and no effort has been made to chemically control bio-mass growth. These factors plus negative impacts of the low level of waters create the most harmful storage condition for timber. [136]

4-3-3-3- Bacterial activities:

In some tanks bacterial activity has been assessed by use of Biological Activity Reaction Tests (BARTs TM) to evaluate the water for iron related bacteria, sulfate reducing bacteria, acid producing bacteria, and heterotrophic bacteria. There is a significant amount of iron incorporated into the cog's construction, in addition considering the fact that the relic was buried in an aerobic environment for about 650 years implies that there would be potential presence of some sorts of microorganisms.

As a very important fact, it should be noticed that heterotrophic aerobic bacteria are a type of microorganism with the ability to metabolize organic materials as their source of energy and carbon. In other word, in high enough quantities, it may be this type of bacteria, which is aiding in the deterioration of the timber. [137]

4-3-3-4- Biological growth:

Seeds, mold spores and fungus blown in by the wind have a very suitable environment for germination and sustainable growth. Each tank has been covered with a thick layer (more than 2 cm) of brown algae suspended on top of every flat surface. In some tanks green algae was also observed to be attaching to the wood surfaces. [138]

The roots of larger multi-celled plats are developed under the plastic fabric and down beneath the stretcher layers. In some cases the timber is as a base for the plants. The roots of these plants are so severe and hard. [Fig. III-09, 10]

[136] Peter Fix, Moving Forward-Planning, Part II (The report of Peter Fix, an expert from A&M to provide consultation on the Doel Cogs)
[137] Peter Fix, Moving Forward-Planning, Part II (The report of Peter Fix, an expert from A&M to provide consultation on the Doel Cogs)
[138] Peter Fix, Moving Forward-Planning, Part II (The report of Peter Fix, an expert from A&M to provide consultation on the Doel Cogs)

Fig. III-07


Fig. III-08


Fig. III-09


Fig. III-10

Fig. III-07: The present condition of the planks and the water tanks where the planks are kept in.
Fig. III-08: Uncontrolled dehydration the waterlogged wood, the cracks are obviously fragmenting and weakening the wood.
Fig. III-09: The end of one of the cross beams, severely damaged and degraded. Algae are beginning to form extensive colonies.
Fig. III-10: The vegetation problem encountered the vats. This is the result of the vats being left uncovered and no bio-deterrent. The white arrow indicates the separation of the wood components.

Herewith, a survey has been done by ADW shows the diversity of different plants species which growth in the tanks and on the timber:

Scientific Name	Common Name	Height (Max.)	Root Dept (Max.)	Anaerobic Tolerance	CaCO3 Tolerance	pH Requirement	Salinity Tolerance	Shade Tolerance
Agrostis stolonifera L.	Creeping bentgrass	2'	12"	High	Medium	5.1-7.0	Medium	Intolerant
Alisma plantagoaquatica L.	European water plantain	3'	16"	High	KNA	6.3-7.5	None	Intolerant
Juncus articulatus L.	Joint leaf rush	2'	8"	High	Medium	4.8-7.5	Low	Intermediate
Juncus bufonius L.	Toad rush	1'	6"	High	Medium	4.6-7.6	Medium	Intolerant
Juncus geradi ?Loisel.	Salt-meadow rush	1.5'	8"	High	Medium	5.2-7.0	Medium	Intolerant
Phragmites australis	Common reed	13.1'	20"		Medium	4.5-8.0	Low	Intolerant
Photamogeton berchtoldii Fieb.	Small pondweed	KNA(?)[139]	KNA	KNA	KNA	KNA	KNA	KNA
Potamogeton trichoides	Hair like pondweed	KNA	KNA	KNA	KNA	KNA	KNA	KNA
Ranunculus sceleratus L.	Cursed buttercup	2'	6"	High	Medium	4.8-8.4	Low	Tolerant
Salix alba L.	White willow	55'	24"	High	Low	4.5-7.8	Low	Intolerant
Salix cinerea L.	Large grey willow	30'	20"	High	Low	4.5-7.5	Low	Intolerant
Taraxacum sectie ruderalia	Common dandelion	1.5'	18"	High	KNA	KNA		KNA
Typha latifolia L.	Broadleaf cattail	5'	14"	High	Medium	5.5-7.5	Low	Intermediate

4-3-4- Evaluation of Doel Cog:

In regard with researches done previously and the production of the tables for evaluation, herewith a series of evaluation will be done through those table for Doel Cog.

It should be kept in mind that this cog has been found in water saturated sediment in an anaerobic condition similar to under water condition, therefore the same treatment should be applied in order to conserve and restore the relic, but, in some tables and points superfluous explanation seemed necessary. Also it should be mentioned that this cog has already been displaced. During these years some extra damages have occurred on the wooden plate, which needs more considerations and treatments. On the other hand there is no information from its state of its life-time; if it was complete and in a good state by its time, or if it was suffering from some damages.

[139] Marked by Peter Fix the expert from A&M, it is not obvious what KNA indicates.

4-3-4-1- Archaeological Tables: (Doel Gog)

1- Structural remains	**Extensive**		Elements		Fragments	
	Scattered	**United**	Scattered	United	Scattered	United

2- Objects found within the shipwreck site	Many		Some		A few		**None**
	Scattered	United	Scattered	United	Scattered	United	

3- Distribution of the site	Scattered		**Coherent**
	Inorder	Disordered	

4- Geologically of the site	**Sandy substrate**	Rocky	Intermediate (rocky and sandy)	Slop
This point is not relevant to this relic, since it has been displaced from its finding location. Although the site where it has been found was sandy.				

5- Organic growth on the site	Many			Some			A few		
	Covered	Covered Partialy	No cohision	Covered	Covered Partialy	No cohision	Covered	Covered Partialy	No cohision
This point is not relevant to this relic, since it has been displaced from its finding location. The relic had been found under the soil, there was no organic growth found within the site.									

4-3-4-2- Conservation Table: (Doel Cog)

1- Natural erosion caused by sea and weather	**In the long term**		**Continuous and in process**	**Recent**, due to the global changing
	Minor	Major		
The major damage has been occurred after the recovery of the relic from the soil. The long period of putting it into water without enough attention caused lots of damages, which have been explained in detail previously in the Damage Assessment Part.				

2- Objects by the site	All excavated or accessible	More available but not visible and accessible	**None**

3-Material-eating (Erosion) organisms	**Organic**								Inorganic							
	Main structure				**Objects (None)**				Main structure				Objects			
	Well - preserved		**Endanger**		Well - preserved		Endanger		Well - preserved		Endanger		Well - preserved		Endanger	
	On the surface	Under the sediments	**Natural threats**	Treasure hunting / bad intervention	On the surface	Under the sediments	Natural threats	Treasure hunting / bad intervention	On the surface	Under the sediments	Natural threats	Treasure hunting / bad intervention	On the surface	Under the sediments	Natural threats	Treasure hunting / bad intervention
This threat is due to displacement of the relic and put it into water for a long time has been accrued. The damages which have been caused due to the natural factors, in long term will cause severe and irreversible damages.																

4- Environmental conditions Flora, fauna, chemical changes in the sea combination, geological changes, new seabed infrastructure and so on	Stable	**Various**			
		Periodical changes		Recent changes	
		Not harmful	Destructing	Not harmful	Destructing
This damage is due to improper way of conserving the materials, and it could be controlled if the necessary actions take place.					

4-3-4-3- Table of Significances: (Doel Cog)

Aspects / Criteria	Form and design	Material and substances	Use and function	Tradition and techniques	Location and settling	Spirit and feeling	Being underwater
Historical	**Traces of historical design background**	Traces of material used before	**Stories of the site function during the history**	**Result of development or follower by historic tradition or techniques of construction**	Original location, or moved by the stream, the condition of its location **No info.**	Histories associated with the tradition, feeling, or etc.	Historical event, Stories within the events. etc
Technical	Influence of a technique on shaping the site	**Technical aspects relating to fabricated the materials of the site**	Techniques which have been developed due to certain use or function	**Techniques which are correlated to certain traditions** **The importance of religious iconography**	Is any technique or craftsmanship involved in the location and settling the site?	**Any spiritual or traditional attachment to apply a certain kind of construction technique.** **The importance of religious iconography**	**Any technical issues caused the event of being underwater. Regarding the shipwreck it could be construction problems, and as for the cities and sites could be related to flowing water and dam construction , etc** **The question of its location has not yet been answered.**
Social	Forms follow any social value?	**Any social reason concerning applying certain materials?** **Nordic sea vessels.**	**Function of the site had any social value for the community, or a group of people involved in the site?** **The importance of such vessels in Nordic community + Local people concerns of having such heritage.**	Tradition and techniques are a result of social progress or social act?	**Has the location of the site any social value for a community or group of people?** **The question of its location has not yet been answered**	Any intangible value related to the site.	**True history along with the stories and folks correlated to the site and people.** **Maybe the stories of its location, later, could correlate with the relic.**

Interpretive	Highlighting any important issue relating to the form and design of the site.	Extracting date from the materials and substances used in the site.	**Implying any information related to the function of a site or in comparison with other sites.** **Further data might give more information about its finding location.**	On-site interpretation of techniques and traditions involved in a certain site.	**Accessibility which provide wide range of information.** **Further investigation suggested.**	**On-site values which are linked with other surrounding sites, cities or places. (Common history)** **Further investigation suggested.**	**Common stories involving with a group of sites and areas, in a way that missing one will cause problem in reading the whole history.** **Further investigation suggested.**
Aesthetic	The forms or designs which are of a unique aesthetic value.	Materials or substances which carry a unique aesthetic value.	Function or use of the whole or part of the site which provide a unique scenery.	Any technique which corresponded with producing an object or a site with aesthetic values.	Previous location or current location considering the environmental issues and the influences of the nature which make a site of further aesthetic values.	**Intangible aspects, such as craftsmanship, skills, folks and so on which related to the artistic aspects of a site.** **The influence on religious iconography.**	**The issues involve the over flooding or wreckage which added more attraction and beauty and excitement to the site.** **Further investigation suggested.**
Scientific	**Any scientific value related to the design and form of the site.** **This technique is a unique technique of sea vessels construction.**	Science and skills associated with the fabrication of the materials and substances of the sites.	Development of any function and use in the history of innovation and development.	More detailed data about the development of the construction and production techniques.	**Any geological, climatic, constructive information relating to the location and settling of the site.** **Further investigation might provide data about the ship yards and so on.**	**Any intangible aspects relating to the science of construction function, and so on.**	**Any scientific reason for the wreckage, broken, and over flooding of the site.** **The answer might answer the question of its position (upside down) while found.**

4-3-4-4- Degree of Significance:
This relic is considered as one of the rare examples of its kind. There are a handful number of these vessels have been found; this one is also unique due to its completeness.

4-3-4-5- Size and quantity:

The bigger cog is relatively large (20m by 7m) in dimension, without attachment to other sites or relics or the nature, and also no object has been found within the site related to this relic.

4-3-4-6- Funding/possibilities/ implications:

Following problems should be considered as vital threats towards the relic:

- The problem of financing in order to provide water to conserve the planks submerged into tanks, plus the problem of financing in order to employ expert and labors to take care and monitor the tanks.

- The problem of cooperation and getting to a common decision with ADW and VIOE and possible financiers.

There are other issues relating to the official affairs and governmental issues which are out of the scopes of this study.

4-3-5- Preliminarily Conclusion and Considerations for Doel Cogs:

Due to the relic's displacement, and the present condition-which has been dismantled-, and no attachment to the nature or its surrounding, this relic could be considered as an object which needs to find some correlation to other objects or within another site to be studied, conserved and presented to the visitors.

The project of finding a location for its future displaying[140] has provided some alternatives. As for this research, according to the information available about the wreck, this relic is better to be seen as a part of larger project, in order to have more possibility to study, comparison and visitation/presentation.

It should be noticed that public interest and their involvement in the process of conservation and presentation could be a part of the plan, considering the fact that, previously, at the beginning of its finding, people showed their enthusiasm toward this relic. As for the presentation and public attraction towards this important relic, some points should be considered as the main in order to shape the general concept of Doel Cogs presentation. These points are as follows:

- These two cogs were of interest of the public since the time they have been found.

[140] Doel Koggen, Museale Haalbaarheidsstudie, Sien 2008, A study done for VIOE

- The process of their conservation could be shaped in an attractive manner in order to increase the public sensitivity.
- The importance of displaying their condition, when found, is one of the main points to shape the presentation methodology.
- Using the data and gathered information during its finding and studies could be avoided wasting of some parts of energy and money which have already been spent. For instance, using the 3D model, which was done by 3D scanner, will be helpful to reconstruct or display the condition of cogs when found.
- Showing the importance of these relics as one of the rarest of its kinds should come into account.
- And finally being combined within a larger context in order to have more possibility to study, comparison as well as attraction for the visitors could be effective in its presentation method.

The consequences of the Bremen Cog in Germany, which is a very similar example to this cog, should be taken into account; the degree of success of that project in different aspects such as conservation, presentation, integration with other such kind and so forth should be used as an assessment factor for future of the Duel Cog. The conservation and restoration methodology of Bremen Cog has been successful, although the importance of that Cog as one of the rarest examples of cogs in the world has not been shown into the maritime museum of Bermenhaven.

At this stage with the relatively little information available about the relic, more study on other underwater relics and sites is required. The policies of Flemish authority is also important to see if there would a possibility to develop a project to give a better understanding of whole maritime and underwater cultural heritage in a national and international level.

4-3-6- Considerations for Doel Cogs:

In brief, the stages would be suggested as follows:

4-3-6-1- Short-term program:

Since the condition of the planks is threatening and the wooden plank are starting to loose their component, a very urgent action towards its conservation should be applied. Following the successful method of conservation of the Bremen Cog in Germany, a similar method suggested to be applied to dry up the wood. The application of PEG is suggested. This process will take about seven (could be variable)[141] years. Conservation of wood should be started immediately, in addition, finding a proper location for conservation and presentation. It is recommended to start the process of conservation at the same place where it is going to be displayed.[142]

[141] According to the previous experiences of this kind.

[142] There is already a project of location finding for this cog. The idea of the possibility of exhibiting the cog in the Antwerp complex could be considered as one of the possibilities. Or if there is other complex predicted to be constructed for underwater cultural heritage and archaeology activities, it is recommended to see this cog as a part of that complex. A proper complex needs to include all facilities for conservation, laboratory activities, storage, displaying spaces and so forth, as it should be consulted as a multidisciplinary project.

Considering the fact that the planks have already been cut into smaller portion in order to be fit into the water tanks, and also the fact that after such a long time these waterlog wood might have different kind of reaction to the drying, also taking into account the problems and the expensive long term restoration of the wooden plank, also with consultation which has already done with A&M University of Texas expert, it is recommended to reassemble the cog in upside-down position-the way in which it had been found. This way of restoration will have some heritage-based-value advantages as well as the advantages which have been mentioned above; this way of conservation would display the archaeological procedures of its finding, therefore a part of its history will be conserved and displayed. This way of conservation will provide the future possibility of putting it in the upright position as well. Also this way of restoration makes the probable future displacement easier.

4-3-6-2- Mid-term program:

Involving the public in the process of conservation; exhibition of its process, showing the finding story and so on should be a part of this step.
More studies and conferences and seminars in cooperation with the similar world experiences could be helpful to enhance the knowledge about this kind of vessel. Cooperating with the similar world project will be effective to answer the unanswered questions. At this stage also there might be the possibility to find a better future location for its displaying, or a better integration into a bigger project.
At the same time reconstructing a replica of the cog could be helpful for the original cog's restoration as well as promoting handicraft as a part of intangible aspects of cultural heritage. A similar experience has been done for the Kamper Kogge in Germany.[143]

4-3-6-3- Long-term program:[144]

To consider this relic as a part of larger project, in order to integrate all future underwater cultural heritage activities.

The architects advisory should be considered as a great fact for the simultaneous presentation of the conservation steps. One of the negative points about the museum in Bermenhaven is that the cog is almost big, and the relatively short space around it doesn't allow the visitors to have a good and complete perspective and picture of the relic. The distances, heights and displaying space should be calculated and designed according to the size of the relics. (In should be kept in mind that if the relic is going to be displayed in the right position, or if its displacement is predicted, all the considerations during designing and constructing its exhibition area should be taken into account.)

The idea of restoring and displaying the relic in an upside down position and also showing the archaeological process of its finding, brought up the concept of walk-able area around the relic, while it is shown in a similar environment where it had been found; a construction site. The two relic will be displayed in a labyrinth shaping space, allowing visitors to have an understanding of its finding condition and also

[143] A. J. van den Heuvel, Kampen, Die Rekonstruktion der Kamper Kogge, DAS LOGBUCH 34, Jg. 1998, H. 2
[144] A general Long-Term Program will be recommended at the end of this chapter.

some projections and information boards to provide more data to the visitors. [Fig. III-11, 12, 13]

The main focus will be on the relic by applying light on it, while the rest of the space is in a neutral color of gray and light brown. The light will direct visitors from the big relic to the smaller one, as well as some eye-attracting projection on the walls. Visitors have the opportunity to see the relics from the top; also they can go down and see more details. During its reconstruction, there might be no accessibility to visit the relics in a close up way, but still they will be visit-able from the upper level.

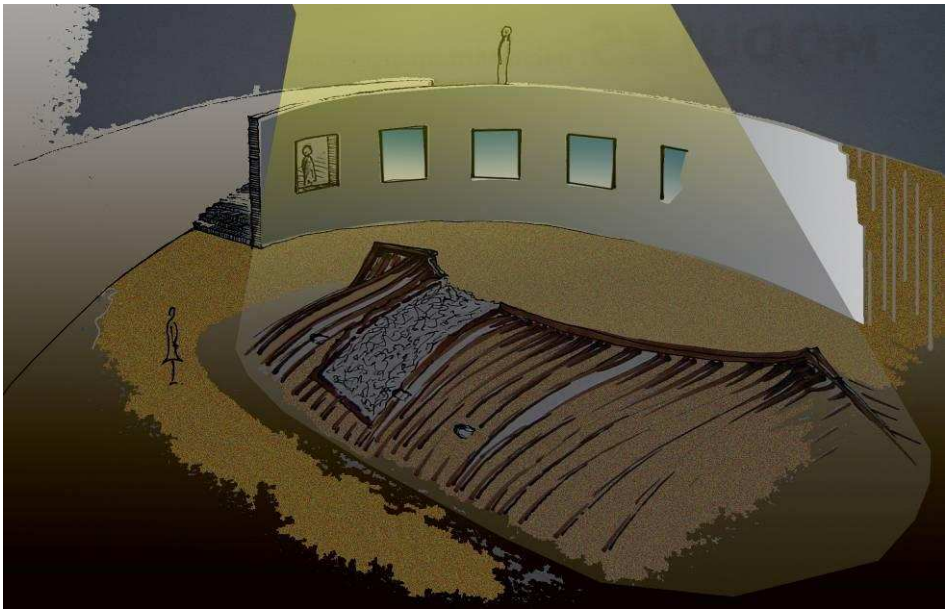

Fig. III- 11

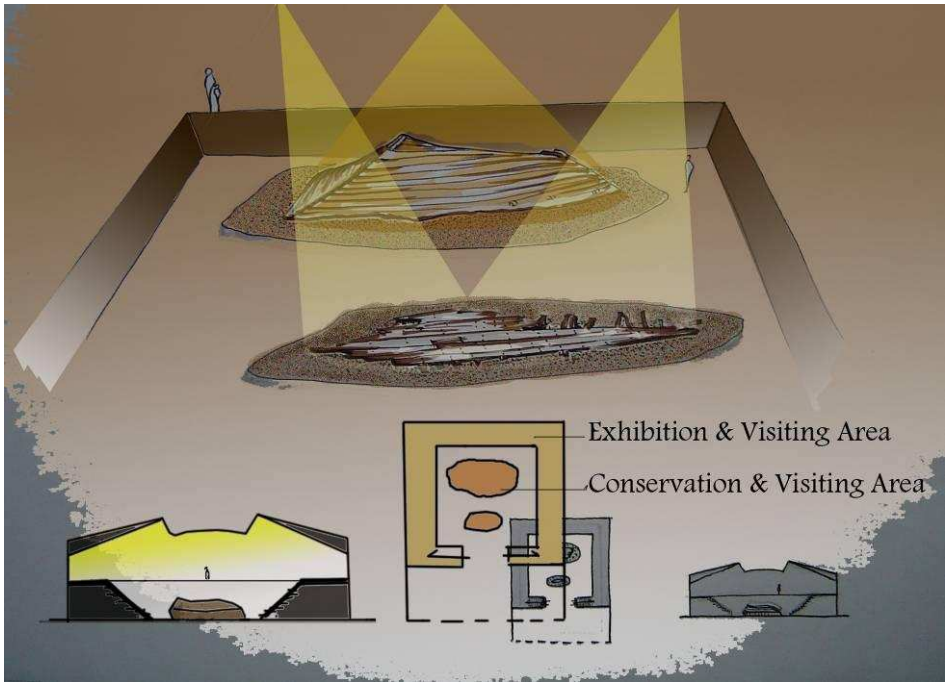

Fig. III-12

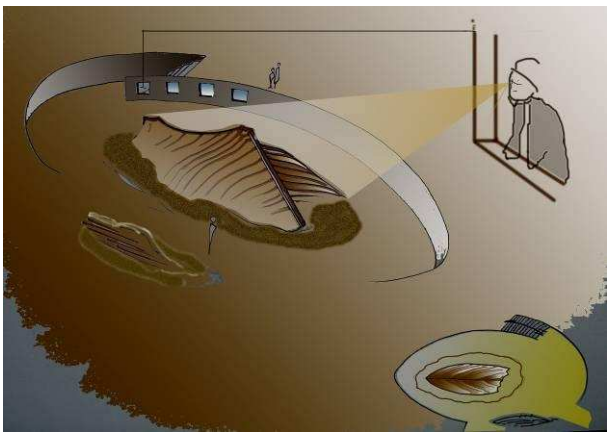

Fig. III-13

Fig. III-11, 12, 13: Some ideas of how to present the cog in the upside-down position. Applying spot lights on the relics, as well as creating an environment similar to where the cog has been found. The idea is not difficult and expensive to accomplish, the space has the possibility to use as a conservation site as well as visiting area. The cogs will be transferable.

4-4- Buiten Ratel Shipwreck:

From this wreck, just little information is available according to the site visits and some studies.

4-4-1- History:

Buiten Ratel wreck was a sail shipwreck from 18th century. [145] Its name is taken from its location; the area where the wreck lies, called Buiten Ratel.

4-4-2- Present Location:

It is located on latitude 51° 14, 432 N, and longitude 02° 30, 191 E under the water in the North Sea, in the Belgium territory water. The site is a flat sand component, in the depth of 10 to 12 (Maximum and minimum depth has been measured during the tides.). The site is lay down with the orientation of 45° northeast ( ), on the slop of 7° up ( ), and the inclination of the wreck is 8°p. ( ) [146]

4-4-3- Context and Measurements:

According to the estimation method of measurement the height of the site is about 2 m. It is a ship from 17420 to 17280, from which, only a few numbers of wooden structure, canon balls and the anchor are visible. [Fig. III-14, 15] There are some artifacts found within the site, they are as follows:

The counting includes 26277 objects from the site. The objects consist of[147]:

31 wooden segments
25858 metal (22592 nails),
191 ceramics,
2 textiles,
18 glasses,
167 stone,
1 bone,
5 composed from different materials [i].
1 sulfur
1 wax
1 vermillion
Also wine and cork are preserved.

The objects which have been found within the site, mostly, have been transferred out of water; some have been examined and studied in the laboratory. [148] From which the intact ceramics and a cargo full of metal nails are noticeable. [Fig. III-16, 17, 18, 19, 20]

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[145] http://www.maritieme-archeologie.be/
[146] http://www.maritieme-archeologie.be/
[147] Report from the excavations and studies done by VIOE.
[148] From author visit to the laboratory in Zelik where the objects stored and the test having done on them.

Fig. III-14

Fig. III-15

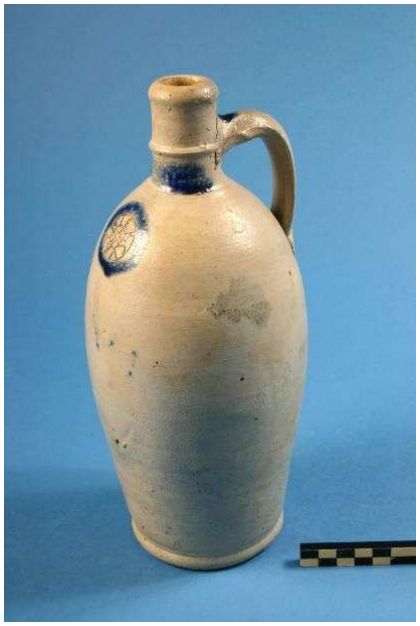
Fig. III-16


Fig. III-19


Fig. III-17


Fig. III-20


Fig. III-18

Fig. III-14: Some visible parts of Buiten Ratel shipwreck.
Fig. III-15: The anchor of Buiten Ratel wreck.
Fig. III-16: Intact ceramic jar
Fig. III-17: Segments of glass.
Fig. III-18: Different material found in the wreck, iron hanger, etc. They are kept in the water as a part of conservation process.
Fig. III-19: One of the wooden barrels.
Fig. III-20: Metal nails which are inside the barrels.

Some measurements, done by Side Scan sonar[149], Multi-Beam[150] are available, from which the orientation, the general view of the site and its condition are clear. The position of the anchor on the site, and some remains of the site are visible on the photos. [Fig. 21, 22, 23]

4-4-4- Current Condition:

According to the information provided through VIOE, still a great amount of the site is under the sediment. It is expected that there are more objects under sediment within the relic.

According to non-professional diver's observations the condition of the site is variable in different seasons; there are times of the year that almost nothing of the wreck is visible, but there are times that large part of the shipwreck is visible. This condition is very threatening for the relic. Not only the underwater currents cause more erosion, also the variable condition of the environment brings more damage to the site.

The growth of large amount of Algae- mostly when the water temperature raises up- changes the chemical condition of water, and introduces more Oxygen into water. Also, the growth of Algae causes bad visibility underwater. Thus in some times of the year the visibility is not more than 20cm.[151]

4-4-5- Evaluation of the Buiten Ratel Shipwreck:

The following tables provide a good understanding of the condition of the wreck.

[149] Side scan uses a sonar device that emits fan-shaped pulses down toward the seafloor across a wide angle perpendicular to the path of the sensor through the water, which may be towed from a surface vessel or submarine, or mounted on the ship's hull. The intensity of the acoustic reflections from the seafloor of this fan-shaped beam is recorded in a series of cross-track slices. When stitched together along the direction of motion, these slices form an image of the sea bottom within the swath (coverage width) of the beam. http://en.wikipedia.org/wiki/Side-scan_sonar

[150] Multibeam sonar systems provide fan-shaped coverage of the seafloor similar to side scan sonar, but the output data is in the form of depths rather than images.
http://chartmaker.ncd.noaa.gov/HSD/wrecks.html

[151] Interview with Dr. Marnix Pieters, The head of Underwater Archaeology Department of VIOE.

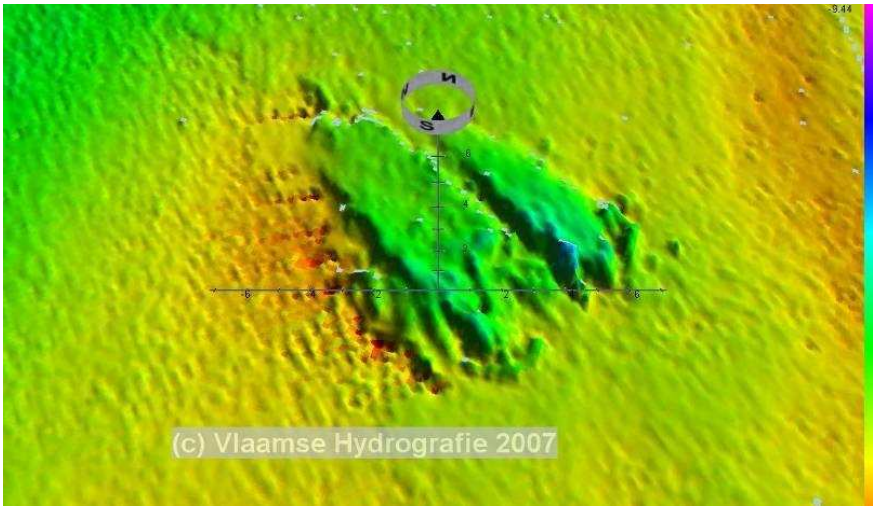

Fig. III-21

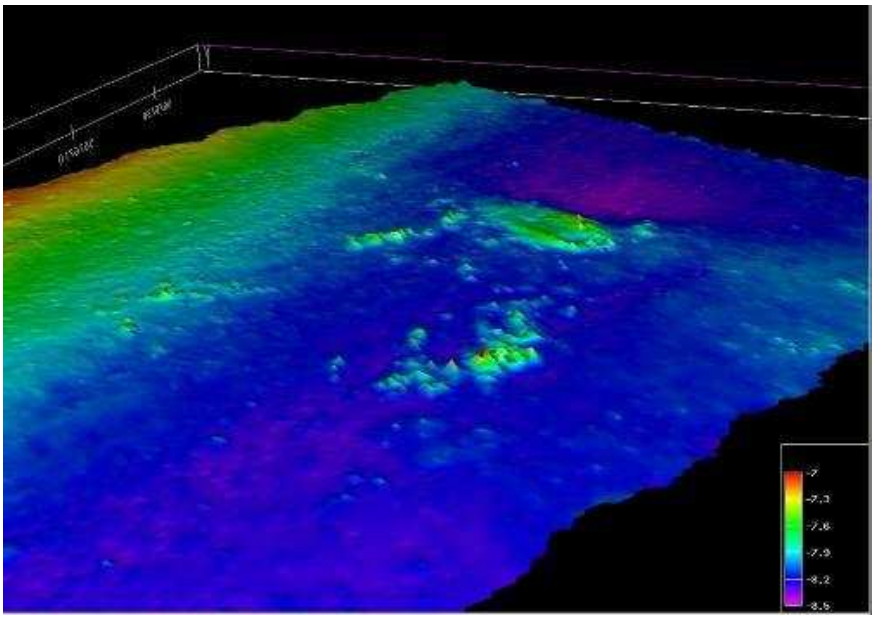

Fig. III-22

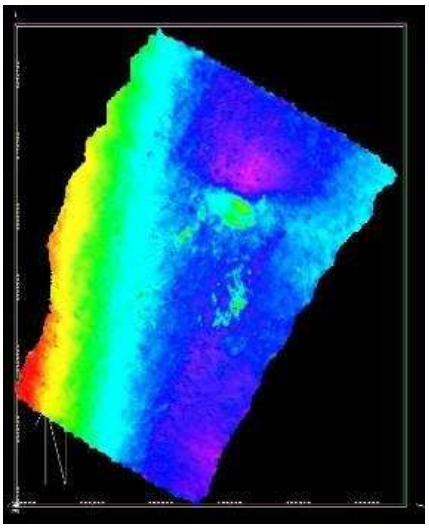

Fig. III-23

Fig. III-21: The image provided by Hydrographic method from the wreck; the anchor is visible.
Fig. III-22, 23: The images which have been produced through Side Scan sonar, MultiBeam methods.

4-4-5-1- Archaeological Tables: (Buiten Ratle)

1- Structural remains	**Extensive**		Elements		Fragments	
	Scattered	United	Scattered	United	Scattered	United

2- Objects found within the shipwreck site	**Many**		Some		A few		None
	Scattered	**United**	Scattered	United	Scattered	United	

3- Distribution of the site	Scattered		**Coherent**
	Inorder	Disordered	

4- Geologically of the site	**Sandy and not stable**	Rocky	Intermediate (rocky and sandy)	Slop
The amount of sand coverage on site is variable.				

5- Organic growth on the site	Many			**Some**			A few		
	Covered completely	Covered Partialy	No cohision	Covered Completely	**Covered Partialy**	No cohision	Covered completely	Covered Partialy	No cohision

4-4-5-2- Conservation table: (Buiten Ratel)

1- Natural erosion caused by sea and weather	**In the long term**		**Continuous and in process**	**Recent**, due to the global changing
	Minor	**Major**		

2- Objects by the site	All excavated or accessible	**More available but not visible and accessible**	**None**

3- Material-eating (Erosion) organisms	**Organic**								**Inorganic**							
	Main structure				**Objects**				**Main structure**				**Objects**			
	Well – preserved		**Endanger**		**Well – preserved**		**Endanger**		**Well – preserved**		**Endanger**		**Well – preserved**		Endanger	
	On the surface	**Under the sediments**	**Natural threats**	Treasure hunting / bad intervention	On the surface	**Under the sediments**	**Natural threats**	Treasure hunting / bad intervention	**On the surface**	**Under the sediments??**	**Natural threats**	Treasure hunting / bad intervention	**On the surface**	**Under the sediments**	**Natural threats**	Treasure hunting / bad intervention

4-Environmental conditions Flora, fauna, chemical changes in the sea combination, geological changes, new seabed infrastructure and so on	Stable	**Various**			
		Periodical changes		Recent changes	
		Not harmful	**Destructing**	Not harmful	Destructing

4-4-5-3- Table of Significances: (Buiten Ratel)

Aspects / Criteria	Form and design	Material and substances	Use and function	Tradition and techniques	Location and settling	Spirit and feeling	Being underwater
Historical	Traces of historical design	Traces of material used before	Stories of the site function(s) during the history	Result of development or follower by historic tradition or techniques of construction	**Original location**, or moved by the stream, the condition of its location	**people believed it was an Armada-wreck, or a VOC-wreck: these known historical facts or companies always arouse a lot of interest**	**Historical event, Stories within the events. Etc**
Technical	**Influence of a technique on shaping the site**	**Technical aspects relating to fabricated the materials of the site**	**Techniques which have been developed due to certain use or function**	**Techniques which are correlated to certain traditions**	**Is any technique or craftsmanship involved in the location and settling the site?**	**Any spiritual or traditional attachment to apply a certain kind of construction technique.**	**Any technical issues caused the event of being underwater. Regarding the shipwreck it could be construction problems, and as for the cities and sites could be related to flowing water and dam construction, etc**
Social	**Forms follow any social value?**	**Any social reason concerning applying certain materials?**	**Function of the site had any social value for the community, or a group of people involved in the site?**	**Tradition and techniques are a result of social progress or social act?**	**Has the location of the site any social value for a community or group of people?**	**Any intangible value related to the site.**	**True history along with the stories and folks correlated to the site and people.**
Interpretive	Highlighting any important issue relating to the form and design of the site.	Extracting date from the materials and substances used in the site. **The importance of the cargo-nail and also the remaining of the wine is of importance.**	Implying any information related to the function of a site or in comparison with other sites.	On-site interpretation of techniques and traditions involved in a certain site.	Accessibility provide wide range of information **Home-port and destination are of value. Any data relating to the home-port and destination provide more information for display.**	On-site values which are linked with other surrounding sites, cities or places. **Always it was of interest of some groupsof people**	Common stories involving with a group of sites and areas, in a way that missing one will cause problem in reading the whole history.

Aesthetic	The forms or designs which are of a unique aesthetic value.	Materials or substances which carry a unique aesthetic value. **The visibility of the anchor, as well as the objects which can be seen**	Function or use of the whole or part of the site which provide a unique scenery.	Any technique which corresponded with producing an object or a site with aesthetic values.	Previous location or current location considering the environmental issues and the influences of the nature which make a site of further aesthetic values. **Existence of flora is expected.**	Intangible aspects, such as craftsmanship, skills, folks and so on which related to the artistic aspects of a site.	The issues involve the over flooding or wreckage which added more attraction and beauty and excitement to the site.
Scientific	Any scientific value related to the design and form of the site.	Science and skills associated with the fabrication of the materials and substances of the sites. **Study on the objects and materials found in the site, such as wine, iron nails and etc**	Development of any function and use in the history of innovation and development.	More detailed data about the development of the construction and production techniques.	Any geological, climatic, constructive information relating to the location and settling of the site.	Any intangible aspects relating to the science of construction function, and so on.	Any scientific reason for the wreckage, broken, and over flooding of the site.

4-4-5-4- Degree of Significance:

For Belgium, it is the only 18th century shipwreck which is known of.[152] This wreck has been studied more than 10 years by the amateur archaeologists and has already produced a lot of information through the objects found within it.

The people dealing with the wreck are also very cooperative and willing to collaborate to this research. These people are mostly aforementioned amateur-archaeologists, and they collaborate just out of interest into the story and they want to learn about maritime archaeology.

There are some more strategic reasons involve within this wreck which make it of importance; for instance its closeness to an area of sand- extraction make in of importance from different point s view which one could be the possible damages which threat the site.

All the reasons above give it a priority to be studied, conserved and presented to the public. Still it can not be considered as one of the rarest examples of the shipwrecks, or representative- since there are not any other shipwrecks of its kind to be compared with. It is not a typical one either. At the moment it should be considered as the one existing example of its kind, found in Belgium water, which is of importance and priority to put effort on.

4-4-5-5- Size and quantity:

Still there is not an exact measurement of the size of the wreck available; as it is said before, some parts are buried in the sediment. The importance of the objects found within the site, and predicted to be under the sediment, make it of importance of more study.

4-4-5-6- Funding/possibilities/ implications:

According to the VIOE experts, the VIOE program is to study of all the available information; later to start some underwater work and to do some excavations. Therefore a kind of master plan is needed to be design for the arrangement of the data produced through the excavations, in addition to presentation strategies.

4-4-6- Considerations and Conclusions for Buiten Ratel Wreck:

Due to the excavations, studies and data available, since some objects of the wreck have been moved on land, it is suggested in cooperation with a larger project, the presentation and further studies implemented.

Considering the fact that the wreck is located in an area close to sand extraction, and the fact that the condition of the sand is not stable and this issue causes damages to the relic and its remains, the following programs are recommended for the future of the site and the relic:

[152] The only wreck of which the location is known and of which the objects have been studied in detail. (Marnix Pieters-Author's interview, June 2008)

4-4-6-1- Short-Term Program:

More study and excavation will help to extract more data from the site. In the case that seems necessary even transferring some part on land could be acceptable. To continuing holding exhibition could also be of importance of attracting more attention to this specific relic, as well as to the underwater archaeology as an important rising issue.

For the exhibitions a kind of idea of transferring the feeling of the underwater is suggested. Visitors should be able to feel the importance of 'being underwater' as a part of the relics and objects which are called as 'underwater cultural heritage'. Entering people through a gate which gives them the feeling of detaching from the land and going to another world-underwater- will be helpful to show a part of the value of being underwater. [Fig.`III-24, 25]

In the case of Buiten Ratel, since some objects have been found within the site, and also the view of the anchor is very dominant in all the studies and photos, constructing the replica of the anchor and displaying it in a virtual underwater space would be of interest. [Fig. III-26]

4-4-6-2- Mid-Term and Long-Term Program:

Short term program should be followed by results of studies in the mid-term program. Following the results, it might be needed to transfer more part on land. Also due to the threatening condition of the sand and seabed, it might be recommended to rebury the remains of the site or even if stabilizing of the site seems impossible, it might be recommended to move the relic to another location, and rebury it in a more stable location. The best and less expensive method for the reburial, for the sandy seabed, would be using the fishing net and covering with the sand bags. In this case the future accessibility to the site is possible, and also more studies could be done in long-term.

If the reburial would be done in a chosen site, where the access is easier, and the condition of the water is more controllable, the in situ visiting might be possible in future.

In a larger dimension, if the project estimated to be valuable-from the point of view of financially, visitation as well as scientifically- the aquarium project could be experienced. The possibility of providing an aquarium for future laboratory tests as well as conservation and presentation of some relics into an aquarium could be one of the options which are of value of discussion in Belgium, owing to Belgium's large numbers of underwater cultural sites, and the biodiversity of the North Sea, but the non-proper condition of diving due to the poor visibility in the North Sea. [Fig. III-27, 28]

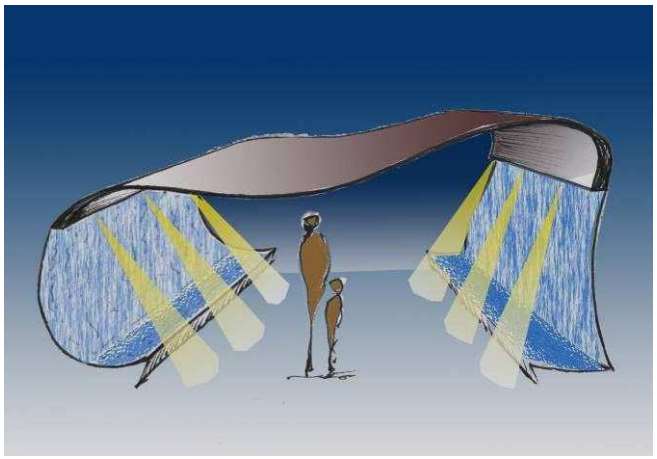

Fig. III-24

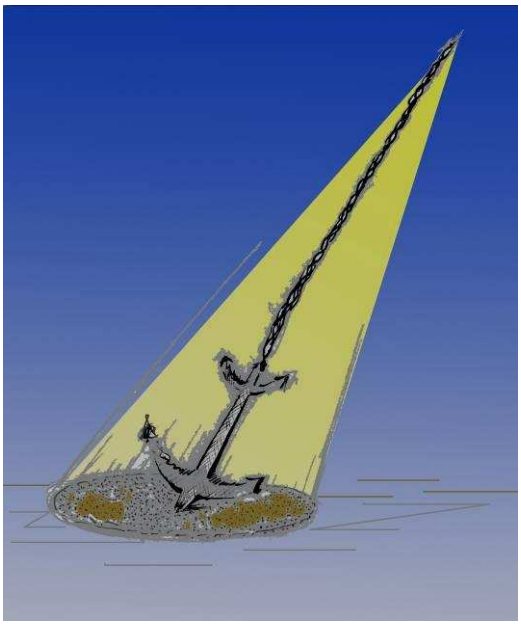

Fig. III-26

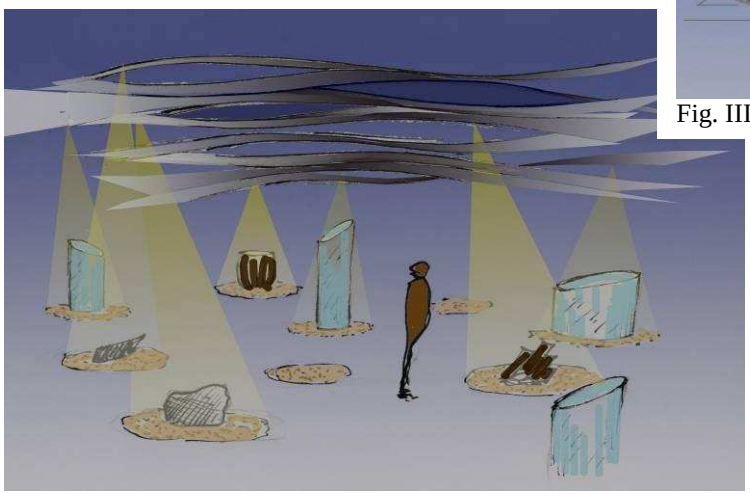

Fig. III-25

Fig. III-28

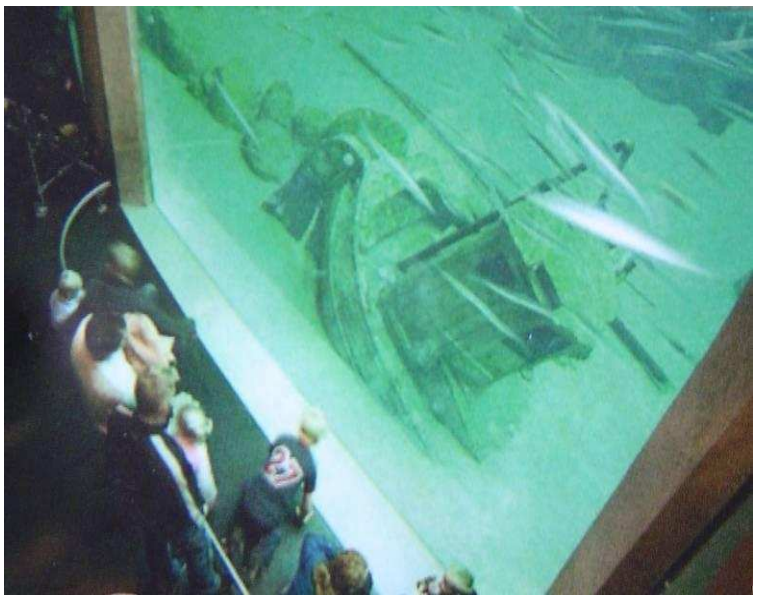

Fig. III-27

Fig. 24: An idea of entering people into an underwater museum or exhibition, using the elements of water and light.
Fig. III-25: A proposal for an underwater museum, where the materials of sand, light and glass try to invent a kind of virtual underwater space.
Fig. III-26: A replica of the anchor could be hanged from the ceiling with applying spot light on it to give the sense of hanging from the ship.
Fig. III-27, 28: An actual aquarium-museum in Sweden

4-5- World War Shipwreck- Bourrasque:

The importance of the World War shipwreck when becomes clear that we notice the importance of the on-land heritages which left due to the World Wars; the bunkers along with the North Sea- so called Atlantic Wall- which attract so many visitors; the intangible values of the war's cemeteries, also other museums and exhibitions and memorials of World Wars shows the values of this cultural heritage. In combine with the facts above, the WW Shipwrecks are of tangible and intangible heritage values; the vessels technical aspects, the naval aspects of a battle wreck, and the excitements of diving and visiting these vessels, are as important as their memorial values- and sometime being considered as underwater graveyard.

There are quite a lot of shipwrecks and submarine-wrecks exist under the water in the Belgium part of the North Sea; from which the ones that have already had some information about could be named as: T-319, LST-80, Bourasque or B115/233, Branlebas, G-96, Wakeful-HMS, UB-20, Prangenhof SS. Some of these have just some description, some have some photos from their lifetime, some have more data about their maps and also some photos from their condition underwater. Out of this list there are two wrecks are of more importance in the eye of VIOE.[153]

Since there were some project on which VIOE and VLIZ, both, worked, preferably as the case study of this research, I have chosen the one about which there are more information available- which is Bourrasque. Also there are some aspects of natural and historical importance about the case which has been chosen for this research which will be explained more in the following study.

As the first and the most studied shipwreck[154], we can mention the Bourrasque; a French military vessel of the frigate/destroyer type. Out of four other shipwrecks, this wreck has also been chosen to be studied by VLIZ- for biological studies- due to its length, good state, position and their date of sinking which is more than 10 years ago, so the colonization by animals already took place.

It was a vessel of 105.77m long, 9.64m wide and 4.30m high.[155]

4-5-1- History:

The vessel was used for the evacuation of Dunkerque (France). It has been built in 1925 as a French Navy Destroyer (Chantiers de France; Dunkerque). Bourrasque, Cdr. C.F. Fouque, was used in May 1940 to evacuate Dunkerque. On May 30th, the Bourrasque was on its way with 600 French soldiers on board when it was hit by a coastal gun-section at Nieuwpoort. Approx. 5 miles from the Nieuwpoortse buoy, the ship was hit and filled with water. The crew of the Branlebas heard a heavy explosion nearby. It appears to be on the stern-section of the Bourrasque, which was sinking fast. Panic made crew and passengers jumping over board and into the live boats. By a number of

[153] In consultation with Ine Demerre, scientific collaborator of the Flemish Heritage Institute (VIOE), unit maritime archaeology and heritage afloat

[154] In consultation with Pieter Marnix, Head of Deapartment of Underwater Archaeology, VIOE

[155] 1.458 tons; 347x33x13.7; 33.000 ihp; 33 knots; turbine engines; four 5 in guns, two 37mm; 6 T.T.

ships were 559 people saved. The last 15 were completely covered with oil. [156] [Fig. III-29, 30]

It has been considered as a war-grave.[157]

4-5-2- Present condition:

The wreck is broken in two halves; currently only a part of the wreck is above the sand, mainly the bow-section and a part of the engine room. The stern-section is completely vanished under the sand. This destroyer was identified only in 1984 after the finding of French ammunition (130mm shells) and finally by her ensign (head of a wild boar).

It is located on the latitude of 51° 14, 964 N, and longitude of 02° 33, 026 E, 8 miles from the Belgium coast. The visible structure is its bow, and its height is about 3.30m. Almost 60% has been covered by sand. Its orientation is 261° W, with an inclination of 26°S and on slopes 21° upwards. Its maximum depth is 16.50m, and the minimum depth at low tide is 11.70m. [158] [Fig. III-31]

Since this shipwreck has been studied by VLIZ and some natural aspects are involved within, it could be of two importance; natural and historical.
Researchers found more than 150 different animal species on the wrecks: 12 fish species, two jelly fish species, and more than 140 sessile or slow moving organisms (bigger than 1mm) like crustaceans, anemones, polyps, worms, sponges, shellfish, starfish and crabs. It is clear that the wrecks have a much higher biodiversity than the surrounding sandy bottom around. Certain polyps or shells have been labeled as rare before, but they are found in big amounts now. There are even species that have not been found in Belgium before; Diadumene cincta (anemone) and Caprella tuberculata (crustacean) are new Belgian species.[159] [Fig. III-32]

With a more detailed focus on the "Bourrasque", the fauna of this shipwreck is dominated by a sea anemone called Metridium senile. This species can cover several square meters by budding from a single individual. The color is white to orange. Another abundant species is a hydroid Tubularia larynx. This last species is attracting and harboring many others while the sea anemone excludes all the others.[160] Aesthetically, it is nice, like all the other shipwrecks. [Fig. III-33, 34] However, as already said, there is no large structure emerging from the sand. [Fig. III-35, 36]

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156 http://www.wrecksite.eu/wreck.aspx?6
157 http://www.wrecksite.eu/wreck.aspx?6
158 http://www.maritieme-archeologie.be
159 http://www.mumm.ac.be/EN/News/item.php?ID=18
160 Vincent Zintzen , Alain Norro, Claude Massin, Jerome Mallefet, Spatial variability of epifaunal communities from artificial habitat: Shipwrecks in the Southern Bight of the North Sea, Estuarine, Coastal and Shelf Science 76 (2008) 327e344

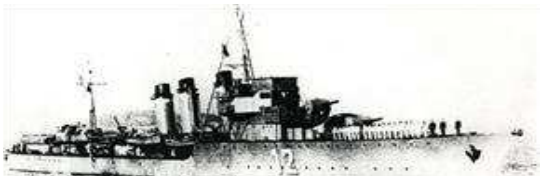

Fig. III-29

Fig. III-30

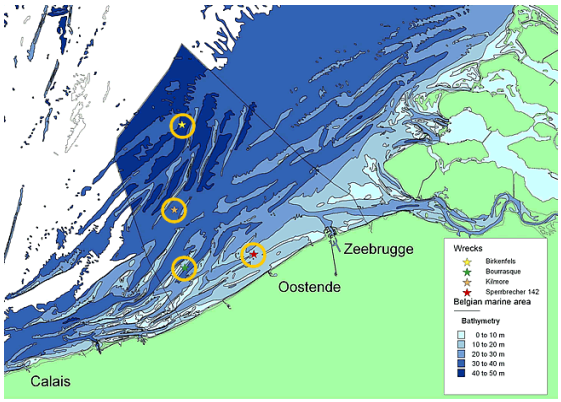

Fig.III-31

Fig. III-32

Fig. III-33

Fig. III-34

Fig. III-35

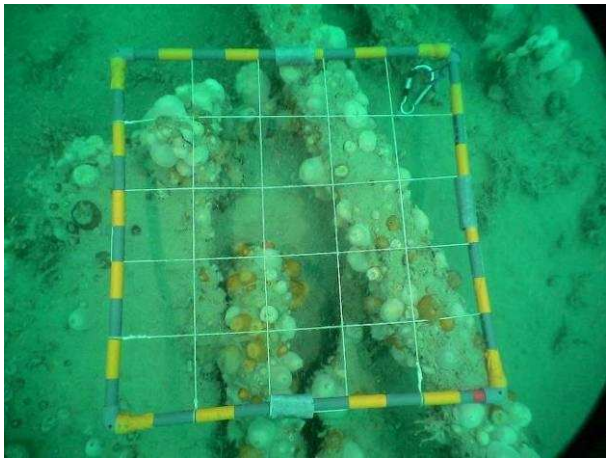

Fig. III-36

Fig. III-29: An image of Buiten Ratel when it was still sailing.
Fig. III-30: The Buiten Ratel ship sinking.
Fig. III-31: The location of the four shipwrecks which have been studied by VLIZ.
Fig. III-32, 33, 34: Some of the species and biological growth which live around and on the Buiten Ratel wreck. They give a aesthetical natural value to the site as well.
Fig. III-35, 36: There is no large structure emerging from the sand. Some parts of the structure is visible, although they have been covered with biofouling and plants.

More data has been generated as well by applying new techniques. Some surveys have been done through multi-beam and side-scan sonar, which can show the amount of the site above the seabed. [Fig.III-37, 38] [161] Visibility around this shipwreck is usually not exceptional because it lies rather close the coast (8 miles). Visibility ranges from 1m to 4-5m. Potentially, diving is possible all year round on this wreck but it usually will not be dived on during late autumn-winter. There are often better visibility conditions during winter and early spring than in late spring or late summer (because of the algae).

There are also some virtual 3D models of the battleship produced, which could be helpful to have a virtual presentation. [Fig. III-39][162]

On almost all known and accessible shipwrecks along the Belgian coast, everything that has an aesthetic or merchantable value has been illegally removed by some divers. Many divers dive only on shipwrecks to come back to the boat with a souvenir. In general the remains of the Bourrasque wreck are in such a bad condition that it is impossible to say how is the condition of the parts of the ship which is still buried in sand. [Fig.III-40][163]

4-5-3- Evaluation of Bourrasque:

As for it has been done for the previous cases, the evaluation of this relic is also has been done by applying the evaluation tables. More information of the condition of the wreck and its characteristics will be presented in the following tables.

[161] http://www.vlaamsehydrografie.be/wrakken/detail.aspx?id=45
[162] http://www.mumm.ac.be/EN/News/item.php?ID=18
[163] According to the interview done with a scientific from VLIZ, Dr. Vincent Zintzen

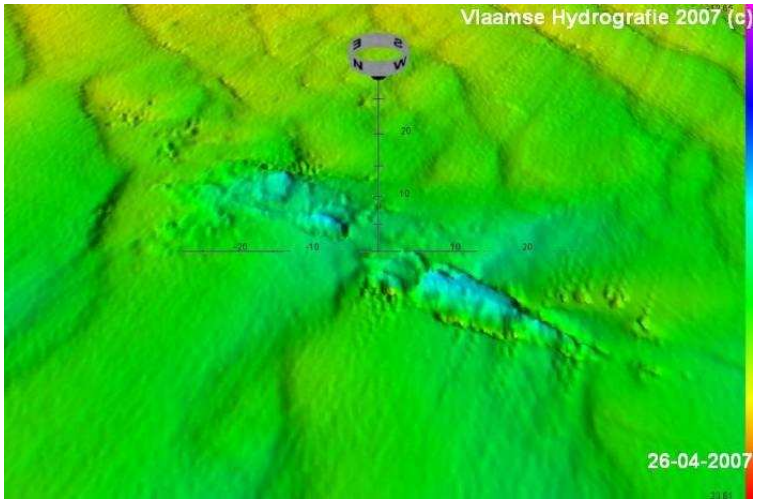

Fig. III-37

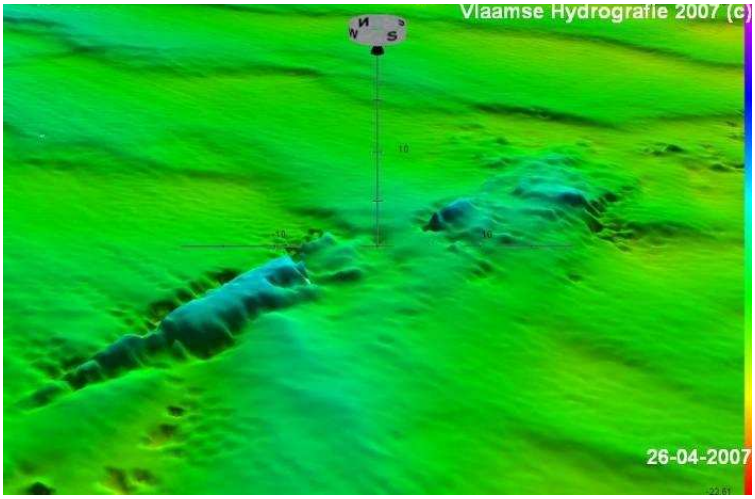

Fig. III-38


Fig. III-39


Fig. III-40

Fig. III-37, 38: Outcomes of the survey done by multi-beam and side-scan sonar.
Fig. III-39: A 3D models of the battleship
Fig. III-40: The shipwreck is barely visible, most f it still buried in the sand.

4-5-3-1- Archaeological Tables: (Bourrasque)

1- Structural remains	**Extensive**		Elements		Fragments	
	Scattered	**United**	Scattered	United	Scattered	United

2- Objects found within the shipwreck site	**Many**		Some		A few		**Not assessed yet- Spected to be under the sediment**
	Scattered	**United**	Scattered	United	Scattered	United	

3- Distribution of the site	Scattered		**Coherent**
	Inorder	Disordered	

4- Geologically of the site	**Sandy and stable**	Rocky	Intermediate (rocky and sandy)	Slop
Almost stable due to its extend of coverage.				

5- Organic growth on the site	**Many**			Some	A few
	Covered completely	Covered Partialy	No cohision	----------	
The biodiversity on this shipwreck is of importance, since it was one of the case studies of VLIZ as well. The floras within the wreck make it of interest of biologists as well as creating an attractive natural/cultural environment for diving.					

4-5-3-2- Conservation table: (Bourrasque)

1- Natural erosion caused by sea and weather	**In the long term**		**Continuous and in process**	Recent, due to the global changing
	Minor	**Major**		
The natural erosion on the parts which are exposed is in a stable condition, and since the relic is mostly covered with sand, it is expected to have less erosion on the parts which have been covered. But more studies needs to be operated.				

2- Objects by the site	All excavated or accessible	**Maybe available but not visible and accessible**	**None**

3- Material-eating (Erosion) organisms	**Organic : More study needed**								**Inorganic**							
	Main structure				Objects				**Main structure**				**Objects**			
	Well - preserved		Endanger ??		Well - preserved		Endanger ??		**Well - preserved**		**Endanger**		**Well – preserved ??**		Endanger	
	On the surface	Under the sediments	Natural threats	Treasure hunting /bad intervention	On the surface	Under the sediments	Natural threats	Treasure hunting / bad intervention	**On the surface**	**Under the sediments**	**Natural threats**	Treasure hunting / bad intervention	**On the surface**	**Under the sediments**	**Natural threats**	Treasure hunting / bad intervention
More studies need to be done within the wreck on its likely existing objects. Since the relic has been dived since almost 10 years ago, and maybe even before that, there have been some salvage occurred through illegal divers.																

4- Environmental conditions Flora, fauna, chemical changes in the sea combination, geological changes, new seabed infrastructure and so on	**Stable**	Various			
		Periodical changes		Recent changes	
		Not harmful	Destructing	Not harmful	Destructing

4-5-3-3- Table of Significances: (Bourrasque)

Aspects / Criteria	Form and design	Material and substances	Use and function	Tradition and techniques	Location and settling	Spirit and feeling	Being underwater
Historical	Traces of historical design	Traces of material used before	Stories of the site function(s) during the history	Result of development or follower by historic tradition or techniques of construction	**Original location**, or moved by the stream, the condition of its location	**people believed it was an Armada-wreck, or a VOC-wreck: known historical facts or companies arouse a lot of interest**	**Historical event, Stories within the events. Etc**
Technical	**Influence of a technique on shaping the site**	**Technical aspects relating to fabricated the materials of the site**	**Techniques which have been developed due to certain use or function**	**Techniques which are correlated to certain traditions**	**Is any technique or craftsmanship involved in the location and settling the site?**	**Any spiritual or traditional attachment to apply a certain kind of construction technique.**	**Any technical issues caused the event of being underwater. shipwreck it could be construction problems, and as for the cities and sites could be related to flowing water, dam construction , etc**
Social	**Forms follow any social value?**	**Any social reason concerning applying certain materials?**	**Function of the site had any social value for the community, or a group of people involved in the site?**	**Tradition and techniques are a result of social progress or social act?**	**Has the location of the site any social value for a community or group of people?**	**Any intangible value related to the site.**	**True history along with the stories and folks correlated to the site and people.**
Interpretive	Highlighting any important issue relating to the form and design of the site.	Extracting date from materials and substances used in the site. **Importance of the cargo-nail and also the remaining of the wine is of importance.**	Implying any information related to the function of a site or in comparison with other sites.	On-site interpretation of techniques and traditions involved in a certain site.	Accessibility which provide wide range of information. **Home-port and destination are of value as well. Any data relating to the home-port and destination might provide more information for display.**	On-site values which are linked with other surrounding sites, cities or places. **Always it was of interest of some groups of people**	Common stories involving with a group of sites and areas, in a way that missing one will cause problem in reading the whole history.

Aesthetic	The forms or designs which are of a unique aesthetic value.	Materials or substances which carry a unique aesthetic value. **The visibility of the anchor, as well as the objects which can be seen**	Function or use of the whole or part of the site which provide a unique scenery.	Any technique which corresponded with producing an object or a site with aesthetic values.	Previous location or current location considering the environmental issues and the influences of the nature which make a site of further aesthetic values. **Existence of flora is expected.**	Intangible aspects, such as craftsmanship, skills, folks and so on which related to the artistic aspects of a site.	The issues involve the over flooding or wreckage which added more attraction and beauty and excitement to the site.
Scientific	Any scientific value related to the design and form of the site.	Science and skills associated with the fabrication of the materials and substances of the sites. **Study on the objects and materials found in the site, such as wine, iron nails and etc**	Development of any function and use in the history of innovation and development.	More detailed data about the development of the construction and production techniques.	Any geological, climatic, constructive information relating to the location and settling of the site.	Any intangible aspects relating to the science of construction function, and so on.	Any scientific reason for the wreckage, broken, and over flooding of the site.

4-5-3-4- Degree of Significance:

Bourrasque was one of the representative battleships of the destroyer kinds. Similar battleships exist but there are some more important issues involved with its present condition as a wreck; historically and naturally this wreck is a typical shipwreck which could be considered as a good source for further studies, as well as containing intangible and memorial values.

4-5-3-5- Size and quantity:

As it is said previously, it was a vessel of 105.77m long, 9.64m wide and 4.30m high**.** Nevertheless more than half of it is covered and which means the majority of the wreck is inaccessible. Therefore there is not an exact estimation of the context of the site available (but this way the wreck remains protected for possible looters or further deterioration).

4-5-3-6- Funding/possibilities/ implications:

The wreck has not been studied in detail by VIOE yet. According to the consultations done with Ine Demerre a scientist from VIOE, "when a prospection on the wreck is planned the first steps will be to register the condition of the wreck, quality of the visible remains, possible damage done, possible threats present. The second step will be getting an idea of the sedimentation-erosion process on the wreck in the third place getting a better view of the shape and location of the existing remains to get a better description of the wreck has been planned."

Therefore, more studies need to be done to evaluate the physical condition of the relic, as well as its presentable cultural values, in order to get to the final proposal for its future.

4-5-4- Conclusions and considerations for Bourrasque:

As it has been said, this wreck at the moment is of importance for two main Belgium organizations-VLIZ and VIOE. For each it has its own points. Therefore it would be considered as naturally important as culturally.

4-5-4-1- Short-Term Program:

Considering the fact that the on site diving is, most of the time, possible, and the aesthetic values of the flora with in the site, at the moment conserving the site where it is, seems the most appropriate decision for the relic.

The issue which is of impotence is the few parts which are visible. More excavation might provide better understanding and better view of the site; since the site considered as graveyard, intervening into the site should be done with the most cautious, in order not to cause any disrespect or harm to the intangible value of the relic.

4-5-4-2- Mid-Term and Long-Term Program:

Following more excavation, and more studies about the history and stories involved within the site, there might be possibility to integrate the site within a bigger project. Not being so far from the coast- 8 miles- gives the possibility of joining the project with some on land WW Heritage projects.

As for some WW wrecks, there are some displacement and transferring on land; such as the case of Prangenhof SS. This case has already been excavated and transferred on land. [Fig. III-41, 42] (Just to depict the possibility of transferring such a relic.) Although, for the Bourrasque's site more issues are involved and transferring the site on land is not recommended.

Gathering more data from other WW wrecks and cultural heritages could provide a base for a possible WW Cultural Heritage Complex, although, the importance of the wreckage, memorial and natural aspects should come into account in any case. In the long term more considerations need to be taken into account, in order to see if a WW heritage should be a part of underwater cultural heritage activities, or it is a part of WW heritage, and in a better way how to integrate all the values of both groups in a vaster domain.

Fig. III-41

Fig. III-42

Fig. III-43

Fig. III-41, 42: Prangenhof SS, a WW shipwreck, which has been transferred out of water.
Fig. III-43: The idea of creating a lagoon, along the seaside, and creating an underwater park, transferring the valuable and worthy visit-able relics into this lagoon.

4-6- Final Conclusion:

As for the final word, accepting that underwater cultural heritage is not just a matter of a shipwreck, or a village deep in the sea or ocean; it is a combination of ships, industries, fisherman lives, infrastructures, dock, and development of cities and so on. On the other hand, apart from all tangible aspects, to have a general master plan and creating similar underwater environment for the visitors, the importance of the visibility of the aspects which are not visible would raise. As Edmund Husserl understood that human perception isn't formed by the invisible, the invisible indicate by the visible aspects of the object. Regarding to this idea, the concept of museology, which I would like to materialize in this project is making invisible, tangible for the visitor. All the aspects of wreckage of a ship, sinking of a city, the history involved with the people and the wreckage, archaeological activities prior to the public presentation and so on, would become of feasible understanding.

On one hand we have the process of study, documentation, damage assessment and so forth, and on the other hand there are the issues involved with the presentation and public displaying. It should be mentioned that the methodology of displaying is the interpretation of visual culture. To make a culture visual an interdisciplinary work is required. And the first step towards an interdisciplinary project is having a comprehensive master plan.

As for the project in Belgium the preliminary step has been taken towards a general understanding of what is going on; still a series of Guidelines to homogenize the whole projects is lacking. Following a Guidelines we could decide exactly what to do with different categories of underwater cultural heritage in Belgium, and furthermore, there will be the possibility to integrate the whole projects which have something in common in land and underwater.

The short-term and mid-term programs could be defined by each individual project, but still a vaster view towards future is needed. The short term decision could be made according to the urgency of the relic condition, with some preliminary study. And the mid-term ones could be considered as a transit between the short-term and long-term. The stage of mid-term is very crucial; at this stage we need a series of guidelines in order to build up the future master plans.

In general with climatic condition in Belgium, the necessity of considering the aquarium as a presentation way is felt. Also for the wrecks which do not have the possibility or priority of any displaying a monitoring system is required to see if they are under threat of any damage or not. For example, before more excavation on Bourrasque, more observation is required to see if the relic is suffering from any erosion or not.

From another aspect, if the importance of the Underwater Heritage in Belgium would be of an international value, there might be options to develop it in other ways as well. In similar situ conservation and presentation can be flourished in a kind of artificial lagoon, near the seaside or inside the sea, where the access to the sea water is possible, the outcome would be a kind of underwater park, which the visibility and the condition of the water would be controllable. [Fig. III- 43]

At this stage, the necessity of having a center for ongoing projects is unavoidable; a center which could boost the underwater cultural activities in a higher level than national. This center would comprise of conservation spaces, laboratories, visiting areas, necessary offices, and so on. The importance of such a center is that the cooperation among different expertise and knowledge could bring a sort of homogeneous and productive factory of data and attraction to visitors. In that case, we will have the possibility to have the conservation process of a relic such as the Doel Cog, along with its display; we could have the laboratory study on the findings of a shipwreck such as Buiten Ratel, and managing the workshops for further expansion, such as possibility of building an aquarium for underwater relics to be displayed in similar situ environment, or the artificial lagoon considering the integration between and impacts of on-land cultural heritages and underwater cultural heritage.

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