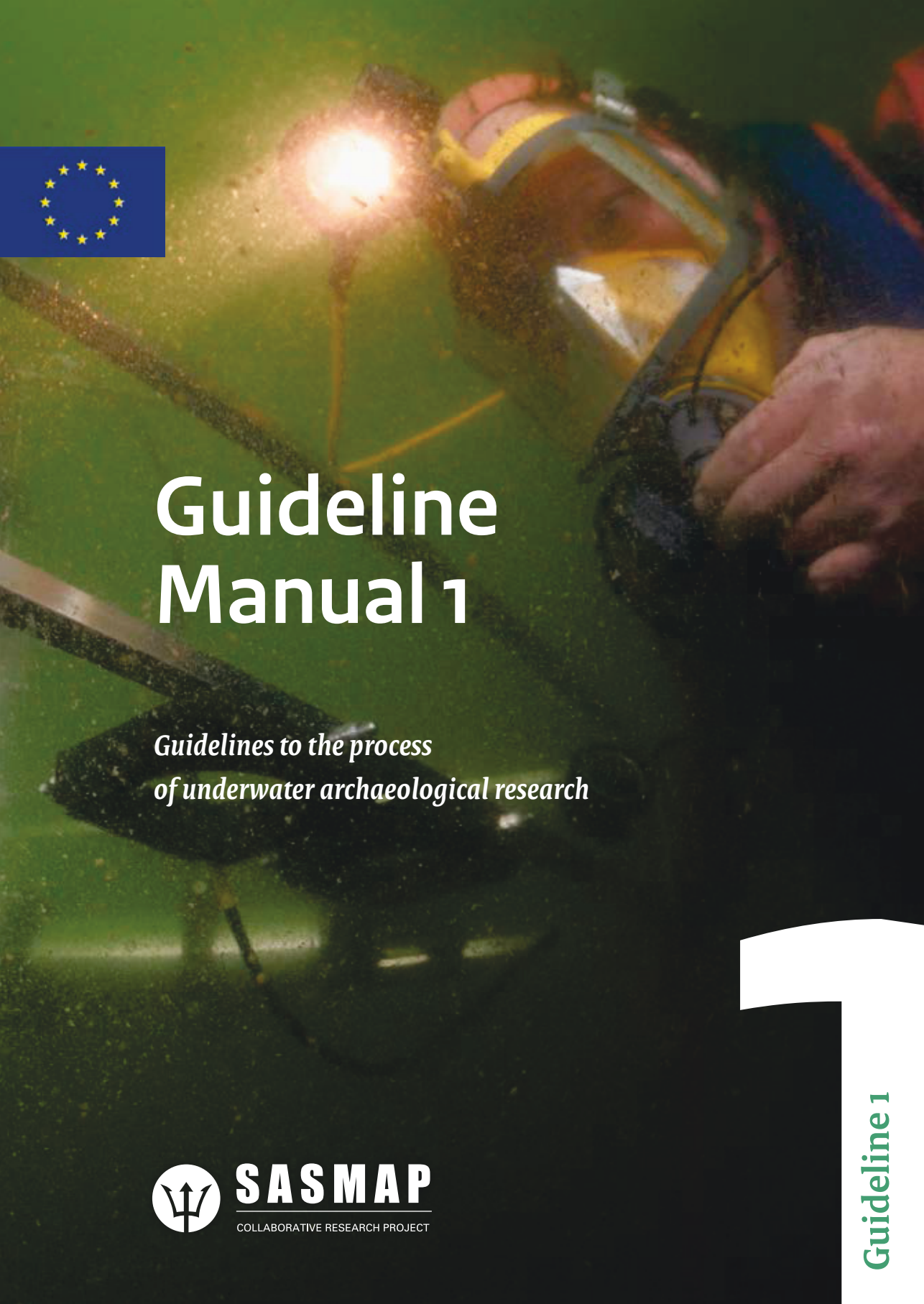

Guideline Manual 1

Guidelines to the process of underwater archaeological research

SASMAP

COLLABORATIVE RESEARCH PROJECT

Guideline 1

Guideline Manual 1

Guidelines to the process of underwater archaeological research

COLOPHON

The SASMAP project, number 308340 [Development of Tools and Techniques to Survey, Assess, Stabilise, Monitor and Preserve Underwater Archaeological Sites], was supported by the EU FP7 thematic research framework theme ENV.2012.6.2-6 for Collaborative Projects

Authors
Z. Al Hamdani, V. de Bruyn, T. Coenen, M. Geraga, D. Gregory, R. de Hoop, M. Manders

Scientific editing
M. Manders, D. Gregory

Technical editing
W. van de Langemheen

Text editing
VU Vertaalbureau

Photography
SASMAP partners, Ron Offermans, Paul Voorthuis/Highzone.nl

Cover photo
Ron Offermans

Graphic design and layout
uNiek-Design.nl

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Content

Explanation of the guidelines

As part of the European Collaborative Research Project, SASMAP (development of tools and techniques to survey, assess, stabilise, monitor and preserve underwater archaeological sites), two sets of best practice guidelines have been established for stakeholders and managers of underwater cultural heritage. Both of these aim at improving the decision-making process in the management of underwater cultural heritage.

Guideline Manual 1 offers a thorough overview of the process of (underwater) cultural heritage management within development-led archaeology (Treaty of Valletta), using a question-based approach. Guideline Manual 2 illustrates, using best practice examples, a practical approach for implementing the different steps in the process. These are divided into accepted methods that have already been applied in multiple projects around the world, and newly developed research processes, such as the methods and techniques developed within the SASMAP project. The two guideline manuals are intrinsically linked.

Both sets of guidelines are tailored for research in relatively shallow inland and coastal waters.

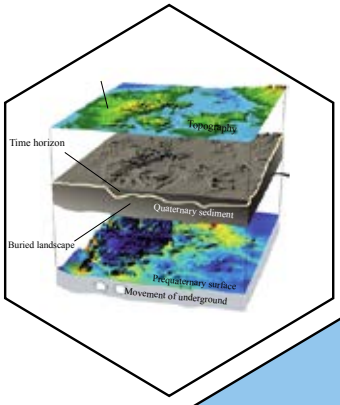
From a long term perspective, both sets of guidelines also seek to fulfil the need to:

- explain more clearly the process of underwater cultural resource management to non-archaeologists, and especially to decision-makers in this area;
- ensure that decision-makers and their advisors understand the process surrounding, and the consequences of, their decisions;
- explain more extensively the structure and the implications of in situ management in underwater cultural heritage management as described in such agreements as the Treaty of Valletta (1992), the UNESCO Convention for the Protection of the Underwater Cultural Heritage (Paris, 2001) and the ICOMOS Charter for the Protection and Management of the Underwater Cultural Heritage (Sofia, 1996).

THE SASMAP PROJECT

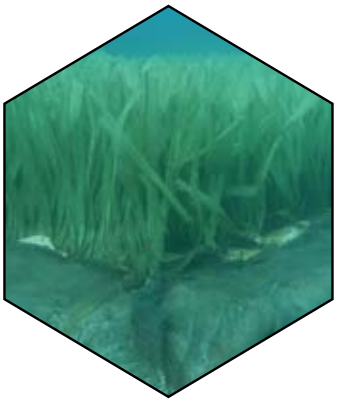
The purpose of the European Collaborative Research Project, SASMAP, which develops "tools and techniques to survey, assess, stabilise, monitor and preserve underwater archaeological sites" (2012-2015), is to forge new technologies and best practices in order to locate, assess and manage Europe's underwater cultural heritage. SASMAP has taken holistic - and process-based – approaches to investigate underwater environments and the archaeological sites contained in them. There is a need to develop cost-effective methods to locate and assess the dimensions of archaeological sites both on and beneath the seabed. The presence and extent of potential threats to archaeology must also be determined in relation to the stability of the site and the state of preservation of the artefacts present. The holistic approach that was taken within SASMAP involved developing and utilising tools and technologies to allow "down-scaling"

from the large-scale regional level to the local site level, and finally, to the individual components of a site - "upscaling." Results obtained from this approach at the case study areas in the project demonstrated its effectiveness in locating and developing detailed mapping of archaeological sites, as well as in assessing their preservation potential. The final results of the methods and techniques developed and applied in SASMAP are included in Guideline Manual 2.
For more information, see: www.sasmap.eu



Reconstruction of the Holocene landscape in Denmark based on geological models. Image: GEUS

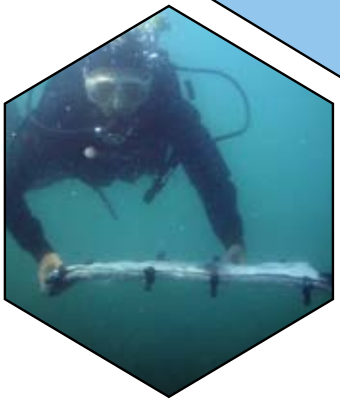
Geological models for regional evaluation of probability of locating arcaeological sites and their preservation (WP1)
Marine geological investigations are essential to develop a model descibing the palaegeographical and depositional environments in the selected study area.



Artificial seagrass used to prevent scour (sediment erosion) around sub sea installations (pipelines, cables). Image: Seabed Scour Controls

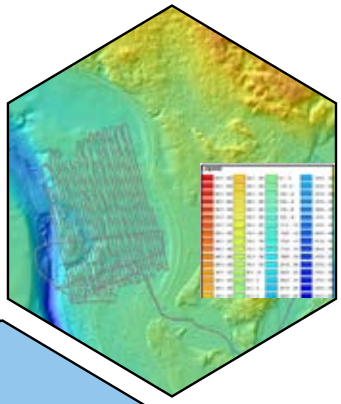
In situ stabilization of underwater archaeological sites (WP6)
Sites which are preserved in situ threatened by the effects of underwater currents which can cause sediment to be removed from sites, leading to their exposure.

Tools and techniques to raise waterlogged organic archaeological artefacts (WP5)
Due to their fragility, organic archaeological materials from underwater sites can be challenging to excavate, support, raise and transport to conservation facilities.



Diver bringing a fragile wooden artfact to the surface after it has been stabilised on the seabed using woven carbon fibre mesh impregnated with polymers which solidify under water. Image: Istituto Superiore for Conservation and Restoration

Fig. 1: The original visual outline of the SASMAP project (2012-2015)



Seamless map of coastline and seabed generated using a combination of Lidar, and remote sensing techniques including mulitbeam sonar. Image: GEUS

Development of tools for surveying and monitoring coastal and underwater archaeological sites (WP2)
Mapping and monitoring of an archaeological site is a prerequisite for determining its location, its extent and for assessment of its physical stability.

Dissemination & Management (WP7&8)

Assessing the burial environment and deterioration of organic archaeological materials (WP3)
Buried waterlogged environments provide unique conditions for organic materials such as wood, bone, antler, textile, skin and plant remains to bepreserved for millennia, partly due to the low oxygen level.

Diver using a micro sensor to measure environmental parameters under water. Image: Unisense

Assessment of the state of preservation of waterlogged archaeological wood (WP4)
Waterlogged wood is one of the most frequently encountered materials on underwater archaeological sites, and knowledge of its state of preservation whilst still in situ determines whether it can be raised and subsequently conserved.

Proof of concept underwater device to non destructively assess the state of preservation of wood in situ. Image: AKUT

Guideline Manual 1: explaining the process in development-led archaeology

As laid down in the Treaty of Valletta, the UNESCO Convention of 2001 and the ICOMOS Charter of 1996, all signatory states have assigned responsibility to a governmental body (referred to as a "competent authority") for cultural heritage management. In some countries, municipalities serve primarily as these competent authorities. However, this responsibility may also be assigned to national, regional or provincial government bodies. These competent authorities are responsible for establishing policies on how to manage cultural heritage on land, as well as under water. Their policies should specify procedures for dealing with situations where cultural heritage is being threatened by development plans. Ultimately, however, the decisions made in such cases are up to the competent authority. Often, these decisions are made by officials with no background in archaeology, history or geology. By and large, officials are forced to rely in these situations on recommendations from an archaeological report, without knowing the background, options and limits of specific methods and techniques. To counter this problem, Guideline Manuals 1 and 2 were written to provide the background information needed to evaluate and validate the archaeological reports that competent authorities work with in making decisions.

Guideline Manual 1 outlines the process steps as generally possible. This was done to ensure their applicability to most European countries and their suitability for development-led and other archaeological research.

Guideline Manual 2 illustrates the optimal management process with information on relevant methods and techniques used in archaeological research. For example, if archaeologists were to propose using only a magnetometer to map possible archaeological remains, the best practice guideline would let the competent authority know that this tool would not generate sufficient information, as it would fail to detect wooden remains. Another example is the relatively new use of satellite imagery to produce bathymetric maps of shallow water environments. Competent authorities may be unfamiliar with this, or other techniques, but can consult the guideline manuals to learn which tools are available and when they can be applied.

All of the research results from SASMAP are included in Guideline Manual 2. Where applicable, this manual also presents results from other EU-supported projects, such as Wreck Protect, MACHU, SPLASHCOS, Arrows, ITACA and other cutting-edge research projects.

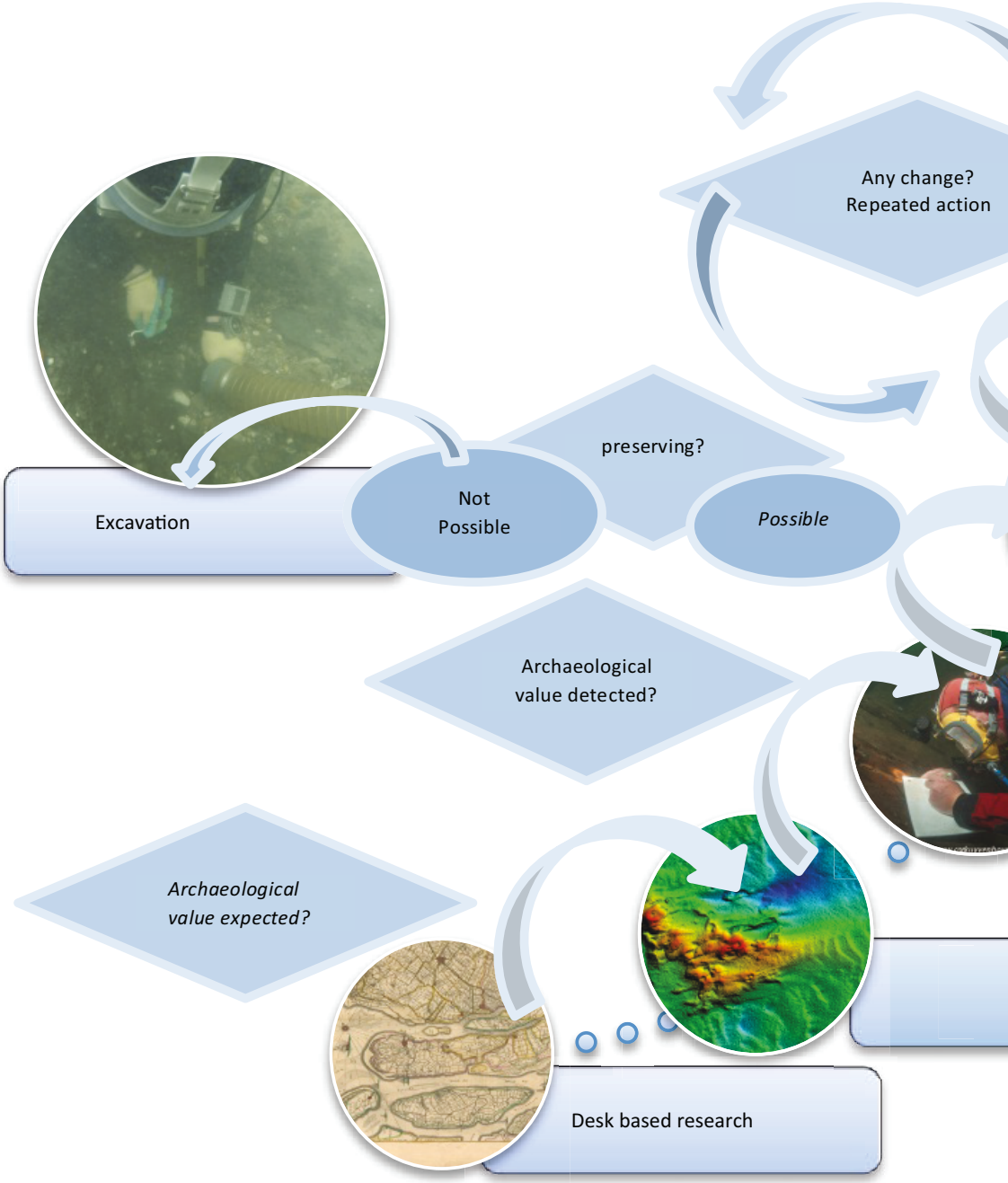
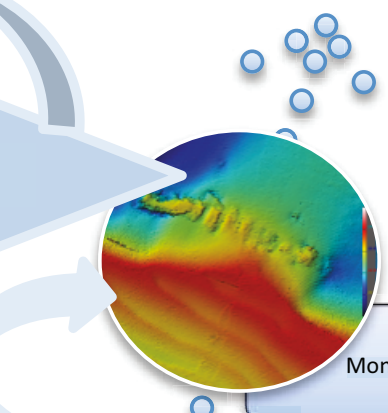


Fig. 2: The different process steps in development-led archaeology. The process and the individual steps are explained in Guideline Manual 1.



Monitoring

deselection

In situ preservation

Archaeological significance assessment

deselection

Prospection
from the water surface/ underwater

deselection

deselection

Fig. 3: Each process step requires different methodologies and techniques in research. These different methods and techniques are explained in detail in Guideline Manual 2.

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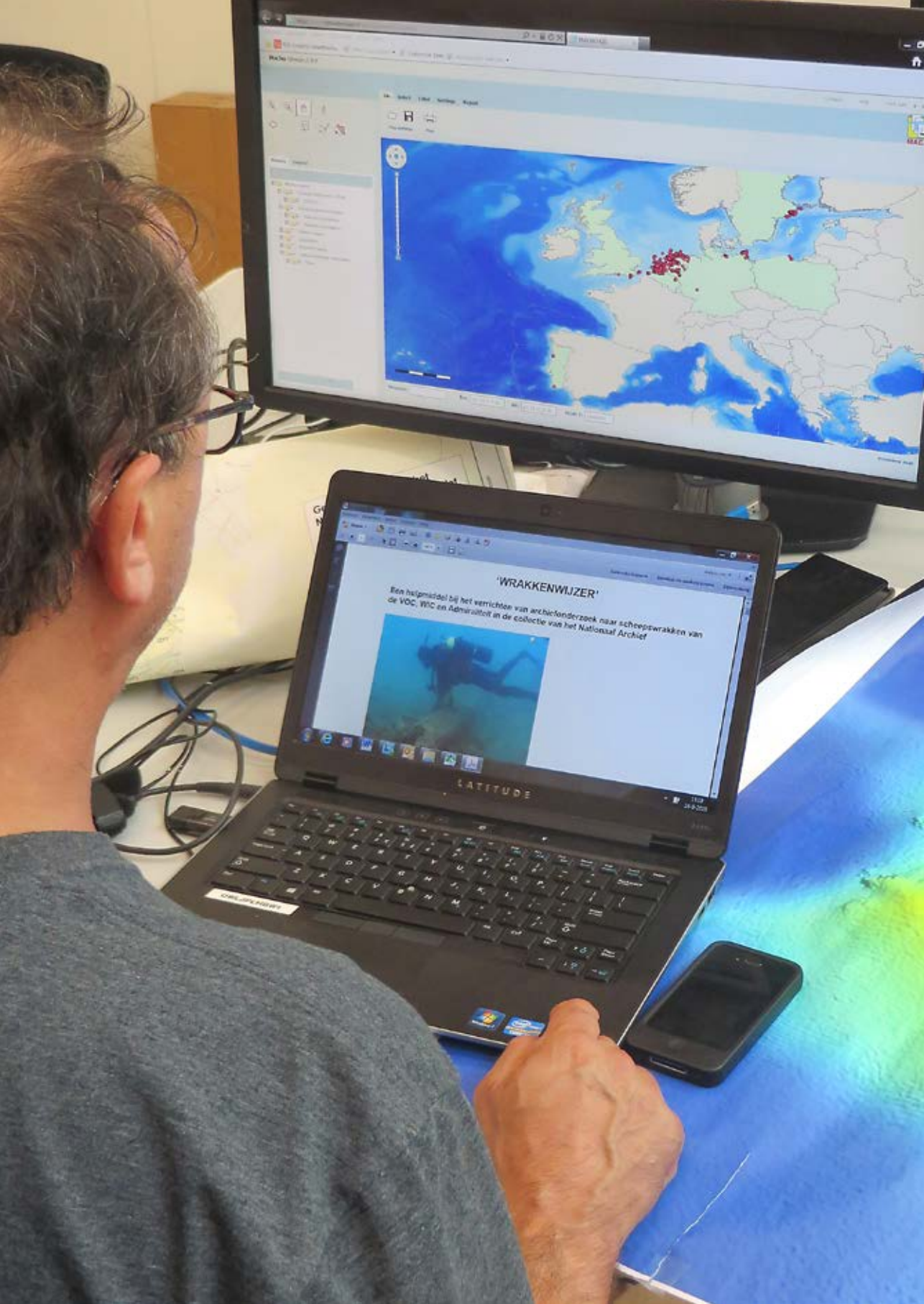

'WRAKKENWIJZER'
Een hulpmiddel bij het verrichten van archiefonderzoek naar scheepswrakken van de VOC, WIC en Admiraliteit in de collectie van het Nationaal Archief
LATITUDE

1. Desk-based Assessment

DEFINITION:

The definition of desk-based assessment is a programme of assessment of the known or potential (or even unknown) archaeological resource within a specified area, or site, on land, in an inter-tidal zone or underwater. It consists of a collation of existing written, graphic, photographic and electronic information in order to identify the likely character, extent, quality and worth of the known or potential archaeological resource in a local, regional, national or international context, as appropriate.[1]

The first step in the process of archaeological research is a desk-based assessment, in which the information available on the history, landscape and archaeology of the location will be collected to create a map with all known and – if possible – even predicted heritage. This information can come from archives, databases, historic maps, literature and previous coring or excavations in the area. This assessment will result in a report, which contains recommendations on the steps that should be taken.

The decision on what should be done after the desk-based assessment is usually up to the competent authority. If the area has high archaeological potential, or sites have been located, then archaeological prospection should be performed. However, if the area shows no signs of archaeological remains and archaeological sites are unlikely, then the proposed development could start without prospection, though sometimes with an archaeologist keeping a watching brief. If a potential archaeological object, or monument, is found during the development, the competent authorities must be notified – within an agreed period of time – and actions must be undertaken to ensure safeguarding of the site or object until proper research has been conducted.

The desk-based assessment process steps help to address questions, such as the following:

1. Who needs to be involved in the desk-based research?
2. What is the history of the proposed area?
3. What is the nature of the development that is being planned, and what are its potential effects on the area's cultural heritage?
4. Has any previous work been done in the proposed area?
5. Are there any known archaeological resources in the proposed area?
6. What potential archaeological resource could be present within the proposed area?
7. What laws and policies are applicable for the protection of the area's cultural heritage?
8. What is the past, present and future use of the proposed area?
9. Who is the competent authority?
10. Is it necessary to conduct any further research in the proposed area?
11. What kind of strategy, methods and techniques should be used for the proposed prospection?
12. Who needs to be notified of the results?

[1] http://www.museumoflondon.org.uk/files/7913/7243/1562/DeskBasedAssess.doc

DESK-BASED ASSESSMENT QUESTIONS

1. Who needs to be involved in the desk-based research?

The research needs to be carried out by qualified professionals with the specific credentials required for the task. In some European countries, these credentials are described in quality norms for research.[2] In some cases, active involvement may be strictly limited to professionals who are listed in an official register.[3] Sometimes, these registers are not mandatory, but function as a voluntary resource for improving quality and maintaining high standards of professional conduct.[4] In addition, the person or enterprise responsible needs to ensure that quality information is collected from the proper people during the course of the research. It may prove necessary to hire additional staff to obtain this information, or to interpret the information accurately for archaeological purposes.

2. What is the history of the proposed area?

Researching the history of an area is a process that creates awareness of its development through time, and provides a framework for any cultural heritage that might be present in the area.

3. What is the nature of the development that is being planned, and what are its potential effects on the area's cultural heritage?

If the work is done within the framework of development-led archaeology, it is important to know and understand what kind of development projects are being planned in the area. Not all activities will have the same effect on the seabed, or cultural heritage sites in it, or on its surface. This also means that (parts of) the work may be executed without any negative effects. For example, the effects on the seabed due to dredging will be different to those resulting from the construction of a wind farm. Moreover, different dredging activities may have different effects, and wind farms or individual windmills are not all alike. Dredging may be done to keep a regularly dredged area at a constant depth. This will not affect any cultural heritage, since the area has been deepened before. However, dredging operations in new areas, or those that further deepen existing areas have an effect. In light of that, it is important to know the depth to which an area will be dredged.

4. Has any previous work been done in the proposed area?

Previous work includes scientific research, as well as other types of operations, such as infrastructural works.
If scientific research has been done, the information it has already yielded may eliminate the need for various other operations. In addition, infrastructural works may exclude certain areas from further research if they have already been disturbed.

[2] See for example: The Dutch Archaeology Quality Standards: http://www.sikb.nl/upload/documents/archeo/knauk.pdf
[3] See for example UK's Chartered Institute for Archaeologists: http://www.archaeologists.net/
[4] See for example: http://rpanet.org/

5. Are there any known archaeological resources in the proposed area?

This can be answered by collecting the information known about the area (see points 2 and 4). However, it is necessary to define the extent to which information is known. For example, in order for a site to qualify as a "known site", it may be necessary to know its nature – at least approximately – and its position. Archaeologically assessed sites can readily be regarded as known sites. Sites registered in databases of the hydrographic offices can also be regarded as known sites, due to their often precisely charted locations. However, while the positions of many sites may be known, their current archaeological value may not yet be. Databases developed by sport divers or amateur archaeologists may also help to identify the known heritage. However, their sources may not always be known, their archaeological value may not be assessed, and their geographic positions may even be inaccurate. In light of this, different databases on known heritage need to be clearly separated and the metadata of their sources should be attached to them. A Geographical Information System (GIS) is the perfect tool for this kind of research.

6. What potential archaeological resource could be present within the proposed area?

Based on known resources, geological models, historical information and even local stories, it is possible to predict where undiscovered cultural heritage might still be found. This is what is called the potential archaeological (or unknown) resources. These areas can be marked in order to enable the contractors (developers) to: avoid the risk of coming across any sites during their operations; take extra measures while working in the area or conduct further archaeological (prospecting) research in the field before any work is done. More thorough information about geological stratigraphy will make it easier to predict the potential existence of prehistoric sites in the area. The presence of shipwrecks may be more difficult to predict. However, analyses of historical sources, already known local archaeological resources and other information sources may make it possible to identify areas with a higher or lower probability of yielding a shipwreck.

7. What laws and policies are applicable for the protection of the area's cultural heritage?

Cultural heritage is often protected by law. These laws may be established at the international, national, regional or local levels. Moreover, heritage policies may also impose limitations in research, or may provide for the protection of known and unknown sites. Aside from the body of legislation and policies on cultural heritage, other laws may also provide a framework for development activities in a local area. These laws may be intended to protect natural heritage, or even to minimise pollution of sites.

8. What is the past, present and future use of the proposed area?

Question 2 may answer part of this question, namely how an area was used in the past.

Nonetheless, it is helpful to examine an area's present and future use, as that analysis may reveal potential threats to the area's underwater cultural heritage, or its options for future development. This information is important for future management solutions.

9. Who is the competent authority?
It is vital to establish clearly which authority is competent to take decisions regarding the management of underwater cultural heritage. This competence may fall under a national, regional or local government body, depending on the waters under investigation (seas, lakes or rivers), and the responsible (national) management organisation.

10. Is it necessary to conduct any further research in the proposed area?
One of the major questions that desk-based assessments address is whether it is necessary to conduct further research in the area before starting intrusive work. If so, then the next process step, i.e. prospection, may need to be organised, based on recommendations on how such further research should be conducted.

11. What kind of strategy, methods and techniques should be used for the proposed prospection (next step)?
The most effective strategy, methods and techniques to use during prospection will depend on the environment. Other questions also need to be examined in order to address this question. What, for instance, needs to be done? What do we need to know? Do we need to "look" into the seabed? Is the water clear enough and is its depth suitable for diving? We can make a distinction between research conducted from the water surface and research that needs to take place underwater. Research from the water surface involves no diving and often makes use of remote sensing with side-scan sonars, multibeam sonars, magnetometers and sub-bottom profiling. See Guideline Manual 2 for best practice examples and the use of other techniques.

12. Who needs to be notified of the results?
Usually, several individuals and organisations need to be aware of the results of the desk-based assessment. Obviously, this group will include the competent authority and the developer(s). In addition, national cultural heritage agencies often play a role in collecting the information compiled. Furthermore, in some cases, it may prove necessary to inform local organisations and/or the owners of the (land) tract concerned, as they may play a future role in the development and management of the area. By sharing the results, the public may also become engaged.

METHODS AND TECHNIQUES USED IN DESK-BASED ASSESSMENT

Desk-based assessment involves collecting information about an area, where development, or other operations that would disturb the area, are being considered. The information required in such cases can differ greatly, and may come from different sources. The level of detail, the scientific standard and the accuracy of the information may also be different. This should not only be acknowledged by the researcher(s), but also by those who interpret the outcome of this step in the process. Historical information may come from books, archives and even stories from the source, or local community. Archaeological information may be acquired through archaeological databases, information from local divers and amateur archaeologists, and (scientific) publications. Geomorphological data may be acquired through previously recorded core data, geological or oceanographic institutes and previously recorded bathymetry from the seabed. There are multiple other, specific data that can be used in the desk-based assessment process. Examples include satellite image processing, carbon-14 dating or grain size databases. By combining data, it will become possible to draw even more conclusions and develop geological models, among other things. The most suitable instrument for this purpose is a Geographic Information System, or GIS. See Guideline Manual 2 for more information.

See guideline 2, p. 11 to 26

Fig 4: Desk-based assessment consists of collecting data that is already existing, including geological, historical, environmental and archaeological data. Analyses and storage can be done, using a Geographical Information System. See Guideline Manual 2 for more information.

MORE INFORMATION

More background information on doing desk-based research can be found in:

1. Maarleveld, Thijs, Ulrike Guérin, Barbara Egger (eds), 2013: *Manual for Activities directed at Underwater Cultural Heritage. Guidelines to the Annex of the UNESCO 2001 Convention*, UNESCO Paris, p. 90 to 100.
2. Manders, M & Gregory, D. (eds), 2015: *SASMAP Guideline Manual 2. Best Practices for locating, surveying, assessing, monitoring and preserving underwater archaeological sites*, p. 11 to 26 contains a description of research methods and best-practice examples.
3. Standard and guidance for archaeological desk-based assessments, accessible at http://www.museumoflondon.org.uk/files/7913/7243/1562/DeskBasedAssess.doc
4. Tilburg, Hans K. Van & Mark Staniforth, 2012: Unit 5: Desk-Based Assessment, Manders & Underwood (eds), *Training Manual for the UNESCO Foundation Course on the Protection and Management of Underwater Cultural Heritage in Asia and the Pacific*, UNESCO Bangkok.

2. Prospection

DEFINITION:

"Archaeological prospection" generally refers to non-destructive identification of features and relics on archaeological sites [on land and underwater].[5]

The next step in the process will be for the competent authority to decide if an archaeological prospection is necessary. In considering this decision, authorities will generally follow the recommendations in the report, which are based on the previous step (desk-based assessment). In this part of the research, the presence of any predicted heritage or "hot spot" areas (areas with high potential) will be checked.

Prospection (or surveying) can – and should – be carried out on two levels: at the landscape level and the site-specific level. The landscape approach focuses on the features of an area that may help to identify areas of interest. The site-level approach aims to locate a specific site on or in the seabed.

Prospection fieldwork can be divided into two parts: prospection by remote sensing from or above the water surface and underwater prospection by divers. In prospection from or above the water surface that is done with non-destructive remote sensing, different non-diving techniques are used to identify the seabed surface and geological layers, or to locate objects on or within the seabed. The line spacing, the frequency of the acoustic signal, the choice of the proper instrument and the interpretation methods are all parts of the evaluation that must be addressed before designing any fieldwork prospection.

In underwater prospection, a diver will check whether any objects located during the work could be of archaeological importance. Generally, underwater prospection follows after prospection from the water surface. However, it can also be performed when potential archaeological sites have been identified in the desk-based assessment of the data already available.

The result of this step (prospection) is usually a report that contains a map with sites of potential archaeological importance, sites designated for further action and sites that have been deselected (not of archaeological importance) based on the information acquired.

This process step helps to answer questions, such as the following:

1. Who needs to be involved in the research?
2. What are the physical conditions at the site?
3. Is it possible to detect any objects or sites on or in the seabed?
4. Is it possible at this point to determine whether the sites are of any archaeological significance?
5. Is it possible to predict, based on the data collected during prospection (and the data available from our desk-based research), the presence of any cultural resources not yet known to us?
6. Are there any sites – of those that were

[5] http://www.nara.accu.or.jp/elearning/2005/archaeoloical.pdf

discovered during prospection – that need further investigation, e.g. an archaeological significance assessment?
7. What kinds of methods and techniques should be used?
8. Who needs to be notified of the results?

PROSPECTION QUESTIONS

1. ***Who needs to be involved in the research?***
Prospection work calls for people with hands-on experience in operating the necessary equipment, such as side-scan sonars, sub-bottom profilers, and other instruments. Prospection also requires special knowledge and experience in interpreting the data collected. In some countries, the requirements for recording and working with specific equipment in archaeological prospection are established in working standards.[6]

2. What are the physical conditions at the site?
Physical conditions determine the use of specific techniques. Depth, current and visibility, for example, are limiting factors for divers. Rock and volcanic rock outcrops have an impact on magnetometer research, and sedimentation build-up may influence what is seen on side-scan sonar and multi-beam sonar images.

3. Is it possible to detect any objects or sites on or in the seabed?
This will depend largely on the dynamics and type of seabed. Sediment erosion processes may change the seabed time and again, covering and uncovering wrecks. This should be taken into consideration when using equipment that scans the surface of the seabed, such as side-scan sonars and multibeam sonars. These techniques do not penetrate the sediment. The type of seabed also influences what can be seen with the different techniques. Rocky sediments give strong reflections, which may make it difficult to identify individual or smaller wreck parts, and soft sediment may be influenced by sediment erosion processes.

Of the more common techniques in prospection, side-scan sonars, multi-beam sonars and single-beam sonars record the surface of the seabed without penetrating into it or through it. A magnetometer can penetrate the sediment, but only records differences in the magnetic field. Although it can detect the presence of metals, it yields no information about the form or purpose of metal objects. Sub-bottom profiling is another method for investigating the seabed. Conventional techniques make slices through the seabed. The frequency determines the detail, as well as the penetration depth. Higher frequencies are usually used for archaeological prospection. Since sub-bottom profilers make slices of the seabed, they can detect different sediment layers and anomalies in the seabed. However, the form and purpose of objects are also difficult to determine with this method. This will be somewhat different with the 3D sub-bottom profilers that are currently being developed. These techniques, which were relatively new when SASMAP was conceived, combine several sub-bottom profiles into one

[6] See for example www.sikb.nl for the Dutch Quality Standards.

image, thus creating a low resolution image of objects in the seabed. Conventional – and 3D – sub-bottom profiling techniques are suitable for reconstructing former landscapes and detecting objects that are known to be in smaller areas (such as those already detected with a magnetometer). However, these techniques are still not viable for larger areas due to the large volume of data recording and processing involved.

4. Can we determine yet if they are of any archaeological significance?

Significance assessment is a relatively expensive procedure. However, pre-selection should always be performed in order to avoid unnecessary significance assessment fieldwork for sites that could have been deselected at an early stage. The high resolution multi-beam and side-scan sonar images, as well as observations from ROVs and divers may provide the information needed for pre-selection (e.g. an indication of the date, condition and integrity of an object). Information acquired during desk-based assessment may also help in this process. For example, the potential presence of historical wrecks can be ruled out in areas that have recently been dredged to a significant depth. In such cases, the zone can be excluded from further research after the desk-based assessment. Areas affected by erosion may contain sites whose conditions have been compromised to the point that the value of any wrecks would be negligible.

5. Is it possible to predict, based on the data collected during the prospection (and the data available from our desk-based research), the presence of any cultural resources not yet known to us?

The condition and history of an area, as well as the work performed there in the past all contribute to a picture of the area of study. Previously discovered sites may also add to this picture. This information will help us to predict, or establish a view on the possibility of discovering new sites, also termed "predicted resources."

6. Are there any sites – of those that were discovered during prospection – that need further investigation?

For all sites that are discovered during the prospection phase, a decision needs to be made regarding further action. At this stage, it may be possible to deselect sites, depending on the information gathered during prospection and what that information indicates about the potential archaeological value. If the information is not conclusive enough to make a decision, an additional survey may be required. Otherwise, the site may be assessed on its significance.

Under the Treaty of Valletta, it is the disturber (often the developer) who is responsible for financing prospection. If, during research, it becomes clear that a proposed construction project will not pose any threat to a site, a decision may be made to leave the site in situ. This may occur, for instance, when the developer changes the area of work, or when a site is detected at 4 metres depth, while the construction work or dredging will only affect the first two metres. In such cases, further research, such as a significance assessment, may be waived.

7. What kinds of methods and techniques should be used for the proposed significance assessment (next step)?

If a site needs to be assessed on its significance, various questions must be answered regarding the aesthetic, historic, scientific and social value of the site and its objects. A significance assessment can be a non-intrusive option; (partial) excavation may also be considered. In addition, threats to the site need to be identified. Many different techniques are suitable for cultural significance assessments. See Guideline Manual 2 for best practice examples and the use of other techniques. However, the approach used should be suited to the questions that need to be answered. Diving operations are often a major part of significance assessments.

8. Who needs to be notified of the results?

Who needs the information regarding the prospection? Usually a number of people and organisations need to be notified of the results of this step in the process. As with the desk-based assessment, the competent authority and the developer are obviously in this group. In addition, national cultural heritage agencies often play a role in collecting the information compiled. Furthermore, in some cases, it may prove necessary to inform local organisations and/or the owners of the (land) tract concerned, as they may play a (future) role in the development and management of the area.

METHODS AND TECHNIQUES USED IN THE PROCESS OF PROSPECTION

Remote sensing in prospection is usually carried out from a ship. Research on and in the seabed is conducted, using side-scan sonars, multibeam sonars and occasionally, single-beam echo sounders for seabed surface mapping, as well as sub-bottom profiling and magnetometers. All of these methods have different ways of operating and provide different details in their recording. In simplified terms, side-scan sonars record the seabed fairly quickly - almost like the negative of a black and white photograph. However, the images are not suited to making detailed measurements of height and depth. Single-beam and multibeam sonars serve to measure the seabed through single or multiple depth measurements in detail (multi-beam) that is sufficient for locating and studying objects. Regular sub-bottom profilers record vertical slices of the seabed, thereby recording the different geological layers. In this process, any other features in that area, such as man-made objects, will also be detected. Newly developed 3D sub-bottom profilers create a more horizontal image instead of only visualising “slices” of the seabed. A magnetometer detects differences in magnetism and is used to locate ferromagnetic objects (i.e. metallic wrecks, pipelines, and even amphorae) in and on the seabed. A relatively new method is airborne remote sensing. This can be done using orthophoto analyses, satellite backscatter imagery and Light Detection and Ranging, or

Laser Imaging Detection and Ranging systems (LiDAR). Remotely operated vehicles (ROV) carrying video and photo cameras can be used, especially in water with good visibility. Video stills can also be used for creating 3D models. These vehicles are operated from the water surface. Sometimes during prospection, a decision is made to deploy divers as well. Divers can gather information through visual observation and collect samples. Diving requires intensive preparation, usually according to strict standards (archaeological standards, as well as those required by dive laws). Prospection may also involve coring and sampling (remotely, or by divers). From a legal prospective, these activities may fall under "excavation," as they entail physical disturbance to the site and/or seabed. More information on the techniques employed and the proposed literature is provided below, as well as in Guideline Manual 2.

MORE INFORMATION

More background information about conducting a prospection can be found in:

1. Bowens, Amanda (ed), 2009: Underwater Archaeology. *The NAS Guide to Principles and Practice* (Second Edition), The Nautical Archaeological Society, p. 103 to 134.
2. Manders, M & Gregory, D. (eds), 2015: *SASMAP Guideline Manual 2. Best Practices for locating, surveying, assessing, monitoring and preserving underwater archaeological sites*, p. 29 to 49 for a description of research methods and best-practice examples.
3. Vos, Peter C., Frans P.M. Bunnik, Kim M. Cohen & Holger Cremer, 5 May 2015: A staged geogenetic approach to underwater archaeological prospection in the Port of Rotterdam (Yangtzehaven, Maasvlakte, The Netherlands): A geological and palaeoenvironmental case study for local mapping of Mesolithic lowland landscapes, *Quaternary International Volume 367*, p. 4 to 31.

See guideline 2, p. 29 to 49

Fig. 5: Prospection can be carried out with geophysical equipment operated from the water surface, as well as with the help of divers. For more information, see Guideline Manual 2.

3. Archaeological Significance Assessment

DEFINITION:

Assessing a site on its aesthetic, historic, scientific and social value for past, present and future generations, as well as assessing the significance of (future) change.

If the prospection indicates that there are indeed (possible) archaeological remains that are in danger of being disturbed, the next step is to assess the archaeological value of the site; this is called a significance assessment. In order to determine the significance of sites, archaeologists need to reflect on the work that has been done before. Is one site more important than another? Does the present study have any significance for our understanding of the past? The assessment of (future) threats will give insight into the measures that need to be taken in upcoming steps in order to maintain the given value of a site.

After the assessment, a decision should be made on whether the site is important or not. Usually, in these cases, the final decisions are up to the competent authority. Their decisions generally follow the recommendations in assessment reports, and any actions they take are based on the research findings. This is one of the most important steps in the process. Since value or significance may be based not only on objective, but also subjective parameters, such as beauty and remembrance, the process used to establish that value must be transparent. It is also important to establish clarity regarding who has the authority to make these decisions. There are different ways to describe value and significance in relation to cultural heritage. Many articles have been published on the philosophy and methods used to assess the significance of maritime archaeological sites[7].

- If a site proves to be of no real importance, the competent authority can decide that no further archaeological research is necessary. In this case, the development can start, possibly under the guidance of an archaeologist. The site may then also be deselected.
- If a site is important, there are two options: either the development will need to be relocated elsewhere, or the site will need to be excavated.

The developer always has the option of relocating the project. For example, a pipeline may be redirected to avoid disturbing a shipwreck. If building plans cannot be moved, the archaeological remains will need to be excavated.

This process step helps to answer questions, such as the following:

1. Who needs to be involved in the research?
2. What is the archaeological significance of the investigated site?
3. What is the site's relationship with the surrounding environment?
4. What is its physical condition?
5. Is the site unique, or does it have a

[7] Manders et al 2012

representative value?
6. Are there any additional values attributed to the site by other stakeholders? (If possible to determine.)
7. What are the threats to the site?
8. Is in situ preservation possible?
9. Who needs to be notified of the findings of the archaeological significance assessment?

ARCHAEOLOGICAL SIGNIFICANCE QUESTIONS

1. Who needs to be involved in the research?
The task of establishing the archaeological significance of a site requires more than just archaeological expertise. Many countries maintain a register of professionals who are authorised to engage in research, such as development-led archaeology projects. Other considerations in examining this question include additional values in the decision-making process. In considering those values, questions need to be addressed, such as what should be done with the site in the (near) future to safeguard its aesthetic value for the future enjoyment of sports divers and others. In light of this, it may be wise to include other stakeholders in an early stage of the decision-making process.

2. What is the archaeological significance of the investigated site?
Whether something is of archaeological significance may be determined by different quality norms in different countries. Typically, these norms include the aesthetic value, remembrance value, condition of the site, integrity, conservation, rareness, information value and representative value. A system for grading the different values by which a site is assessed may be introduced in the future to enable comparison of different sites. To date, however, systems such as this are still uncommon throughout most European countries.

3. What is the site's relationship with the surrounding environment?
Sites may be assessed as unique non-related objects. However, there is usually a link to the area and other objects. This may have an impact on the value of a site. Eventually, the site may be considered to be of high archaeological value on the national, as well as the regional level. Such opinions may be influenced by the role the area has played in the past.

4. What is the physical condition of the site?
Determining the physical condition of a site is an important part of the significance assessment. A site's condition will affect its current – and future – value. Current or future changes may be evaluated and may form the basis for in situ preservation operations, where these effects will be mitigated.

5. Is the site unique, or does it have a representative value?
These two values may conflict to some extent: a unique type of ship will most probably not be a ship that is representative of other shipwrecks. However, in special cases, shipwrecks can be unique and still representative. An extremely

well-preserved shipwreck of a flute, for example, may be representative of the type of flute ships that were commonly used by 17th-century traders in the Baltic. When viewed from a broader perspective, these ships can be regarded as representative of the Baltic grain trade that Dutch merchants engaged in.

6. Are there any additional values attributed to the site by other stakeholders? (If possible to determine.)

A site can have many different values. It may have an archaeological value, but may also be a popular diving site, or symbolise a dramatic event, or serve as a commemorative site. Wrecks can also have a natural value, by serving as a hard substrate and artificial reef for life on the seabed.

7. What are the threats to the site?

Sites may be threatened by physical-mechanical, biological, chemical and anthropogenic processes. These threats need to be identified during a significance assessment, as they may affect the value of the site. Moreover, threats are also important factors to consider in determining future mitigating actions if a decision is made to preserve the site in situ. Physical mechanical processes include the sediment erosion and other processes on the seabed due to currents, waves or tidal movements. Biological threats include attacks by Teredo navalis, fungi, bacterial decay in wooden ship structures or bioturbation in the seabed. The most well-known chemical degradation is corrosion. Iron corrodes - and will eventually disappear - if not treated. In addition, human-instigated degradation processes are myriad. Activities that can have a major impact include trawling, infrastructural works, sports diving, commercial salvaging and souvenir hunting.

8. Is in situ preservation possible?

A decision may be made, based on a site's archaeological value, to nominate the site for preservation in situ. However, the decision to do this will depend, among other things, on the options available. In situ preservation may need to be followed by in situ protection. The question to consider in these cases is: will this be possible considering the depth, sedimentation transport or the specific use of regulations governing the area?

9. Who needs to be notified of the findings?

Who needs to be informed of the findings of the archaeological significance assessment? Usually, a number of people and organisations need to be notified of the results of this step in the process. Obviously, the competent authority and developer belong to this group. In addition, national cultural heritage agencies often play a role in collecting the information compiled. Furthermore, in some cases, it may prove necessary to inform local organisations and/or the owners of the (land) tract concerned, as they may play a (future) role in the development and management of the area.

METHODS AND TECHNIQUES USED IN THE SIGNIFICANCE ASSESSMENT PROCESS

A significance assessment usually requires research by divers. Although the aim is to investigate the site, using non-intrusive methods and techniques, in some cases it may prove necessary to make test trenches, clean the site, or perform coring and sampling. These intrusive techniques may require a special excavation permit. In this process step, a suitable instrument for this purpose may be a GIS to combine and analyse the data acquired previously and during the assessment. Measuring equipment may be required and range from simple tapes and rulers to software for processing measurements, as well as photos and film. The environment may be mapped with remote sensing techniques during this process step. This may, however, already have been done with information acquired in the preceding desk-based assessment and prospection steps. A data logger can be used to measure different parameters in the environment. A relatively new aid in documenting a site is computer vision photogrammetry. For more information on the techniques employed, see the proposed literature below and Guideline Manual 2.

See guideline 2, p. 51 to 63

Fig. 6: Significance assessments often require the use of divers at the site. Other equipment, such as multi-beam sonars and computer vision photogrammetry support the divers' observations. For more information, see Guideline Manual 2.

MORE INFORMATION

More background information about performing a significance assessment can be found in:

1. Babits, Laurence E. & Hans van Tilburg (eds), 1998: Maritime Archaeology: A Reader of Substantive and Theoretical Contributions, *The Plenum Series in Underwater Archaeology*, p. 415 to 451.
2. Manders, Martijn R., Hans K. Van Tilburg and Mark Staniforth, 2012: Unit 6: Significance Assessment, in: Manders, Martijn R. & Christopher J. Underwood (eds.), *Training Manual for the UNESCO Foundation Course on the Protection and Management of Underwater Cultural Heritage in Asia and the Pacific*, UNESCO Bangkok.
3. Manders, M & Gregory, D. (eds), 2015: *SASMAP Guideline Manual 2. Best Practices for locating, surveying, assessing, monitoring and preserving underwater archaeological sites*, p. 51 to 63 for a description of research methods and best-practice examples.

4. *In situ* preservation

DEFINITION:

In situ preservation means the preservation of underwater cultural heritage in its original location. In situ protection refers to active efforts to create a protective environment for a site.

If it is decided that an archaeological site is very important, and the development is moved to a new location, the site still needs to be preserved. The next step is deciding how this should be done and establishing the procedures in an action plan. The protection functions at two levels: spatial (or area) protection and physical (object-related) protection. International legislation, notably the UNESCO Convention for the Protection of the Underwater Cultural Heritage (2001), the Valletta treaty and the ICOMOS Charter (1996), advocate a strategy of preserving this heritage in situ where possible. In part, this is due to the enormous extent of the resource. Furthermore, it is financially prohibitive to excavate, conserve and curate all these finds. Typically, a single wreck, depending on the size, can easily cost anywhere from some 500,000 EUR to 4,000,000 EUR to conserve[8]. That estimate does not even include the cost of the museum facilities needed for exhibition, storage and curation. Excavation, conservation and curation are not realistic options for the abundance of underwater archaeological finds. However, as part of the underwater cultural resource, they should be managed. Another reason to preserve underwater cultural heritage in situ is to keep them in safe underwater storage until new and improved conservation methods are developed.

[8] Manders ed, 2011, p. 42-47

Underwater cultural heritage and the information it yields will be secured over a long period of time with in situ preservation. Important to notice is that in situ preservation means a continuation of responsibilities on site. It is paramount that an in situ preserved site should be monitored, in order to determine whether the site is actually being preserved. Different in situ preservation methods require different monitoring techniques. They should, therefore, always be planned in accordance with each other. Thus, the responsibilities for a heritage manager do not end after this step. For more information about the continuing responsibilities, see the next step: monitoring.

This process step helps to answer questions, such as the following:

1. Who needs to be involved in the work?
2. Are any physical actions needed for in situ management?
3. Who will be responsible for the management on site?
4. Is money available for in situ protection?
5. What kind of in situ protection will be applied?
6. Is there any indication of how long the site needs be protected in situ?
7. What are the possible threats to the in situ protection and how can these threats be mitigated?
8. Is all the baseline data collected for future monitoring?
9. How often does the site need to be monitored?
10. Who needs to be notified of the acquired results?

IN SITU PRESERVATION QUESTIONS

1. Who needs to be involved in the work?

In situ preservation needs to be preceded by a significance assessment: one needs to know why the site is worth protecting and against which threats. The latter is important for the development of the right mitigation methods in the in situ protection. To establish a good in situ preservation strategy, knowledge of different disciplines may be required, such as of the law (for legal protections). In addition, it may prove necessary to deploy degradation specialists and experts on designing and applying in situ preservation methods. Different countries may maintain a register for professionals who are authorised to do this specific research or to apply such mitigation methods. It might also be a good idea to include other stakeholders in the process in order to develop suitable methods to protect the right values of the site. For example: a site might be partly protected to ensure its condition for future research, but also needs to remain accessible for (sports) divers due to its aesthetic value.

2. Are any physical actions needed for in situ management?

A site may be preserved in situ. However, this does not always mean that special protection methods need to be introduced. As long as the site is stable, additional protection may not be necessary. However, in an area where the seabed is dynamic, measures should be taken to rebury the site and to keep the site protected under the sediment as well. Another physical action that is undeniably necessary for all sites is monitoring. (See under monitoring).
A site may thus be preserved in situ without any physical actions taken, or it may be preserved and protected for a short period awaiting further action, such as excavation. Conversely, it may also be protected for a longer period, in which it is treated as an archival part of the seabed, with regular intervals of monitoring.

3. Who will be responsible for the management on site?

When a site is preserved in situ, it needs to be managed. During this step, it must be decided who will do this. The competent authority may be a national government body, a municipality, or some other body. Each of these bodies may, or may not be involved in the decision to preserve the site in situ, depending on the local delegation of authority.

4. Is money available for in situ protection?

Decisions on whether or not to preserve should be based primarily on the significance of the site. Although this may not always be acknowledged, in situ protection can be costly. Often, physical protection for responsible in situ management is needed. The installation, monitoring and maintenance afterwards all cost money. Will the disturber pay for this? Or is the competent authority responsible for the costs? This consideration should be taken into account before undertaking the necessary activities to protect a site.

5. What kind of in situ protection will be applied?

The type of in situ protection depends on the environment, the period of protection, the reason for protection and the decision made on whether the site will be preserved solely to maintain the archaeological value, or will also be used for other reasons. A site may be covered up with a layer of sediment, but only if it has not been affected by erosion. Covering methods to keep the sediment on sites include debris netting and artificial seagrass. Sites may also be covered with geotextile and sandbags to create an anaerobic environment. Cages may be used to protect a site against looting. Different methods of in situ protection will be described in Guideline Manual 2.

6. Is there any indication of how long the site needs be protected in situ?

Will the site only be protected in between two excavation seasons? Or will it be added to the archive of sites that may be excavated or otherwise researched in the distant future? This information will help when developing an in situ management plan for the site. Long-term in situ protection needs to be followed by a long-term monitoring programme, and the system of protection should be longer lasting. Finally, longer lasting protection may require a higher budget for a longer period of time.

7. What are the possible threats to the in situ protection and how can these threats be mitigated?

Is the site under threat of mechanical-physical, biological, chemical or anthropogenic processes? This is important to know in order to apply the right in situ protection. A site that needs to be protected against looting may require different methods of protection than a site that needs protection from deterioration by shipworm.

8. Is all the baseline data collected for future monitoring?

Before and immediately after the application of in situ methods on site, baseline data needs to be acquired for comparison with future monitoring data. If this is not done, no comparisons can be made, which will make it difficult to determine the effectiveness of the in situ method used.

9. How often does the site need to be monitored?

Before the first monitoring is done, an initial monitoring plan will be set up, based on the baseline data, the known threats on site and the protection methods applied. This schedule may be altered at a later date depending on new knowledge. It is common to perform monitoring soon after the in situ protection methods are in place and then shortly after that again. If the site remains stable, the periods in between the monitoring may become longer. If changes are taking place, the site may need to be visited more frequently.

10. Who needs to be notified of the acquired results?

Usually a number of people and organisations need to be notified of the results of this step in the process. Obviously, the competent

authority and the developer belong to this group. In addition, national cultural heritage agencies often play a role in collecting the information compiled. Furthermore, in some cases, it may prove necessary to inform local organisations and/or the owners of the (land) tract concerned, as they may play a (future) role in the development and management of the area. For example, fishermen may want to know where obstacles are located on the seabed. The same is true for hydrographic offices, who may want to include the wreck in their charts.

METHODS AND TECHNIQUES USED IN THE PROCESS OF IN SITU PRESERVATION

In situ protection, the active involvement in the preservation of a site, has a spatial component and a site-specific physical component. Protection by law requires knowledge on the international, national and local laws aimed specifically at cultural heritage and/or those that do not specifically address heritage issues, but that can be applied to or already influence the protection that is required.
The physical protection is often provided by divers, but not always. Usually, it means covering up a site to create an oxygen-free environment and prevent physical-mechanical, biological, chemical and/or anthropogenic degradation. For this protection, barrier methods are used to cover up sites, such as sandbags, scaffolding nets and geotextile, as well as other methods that hold sediment

See guideline 2, p. 65 to 73

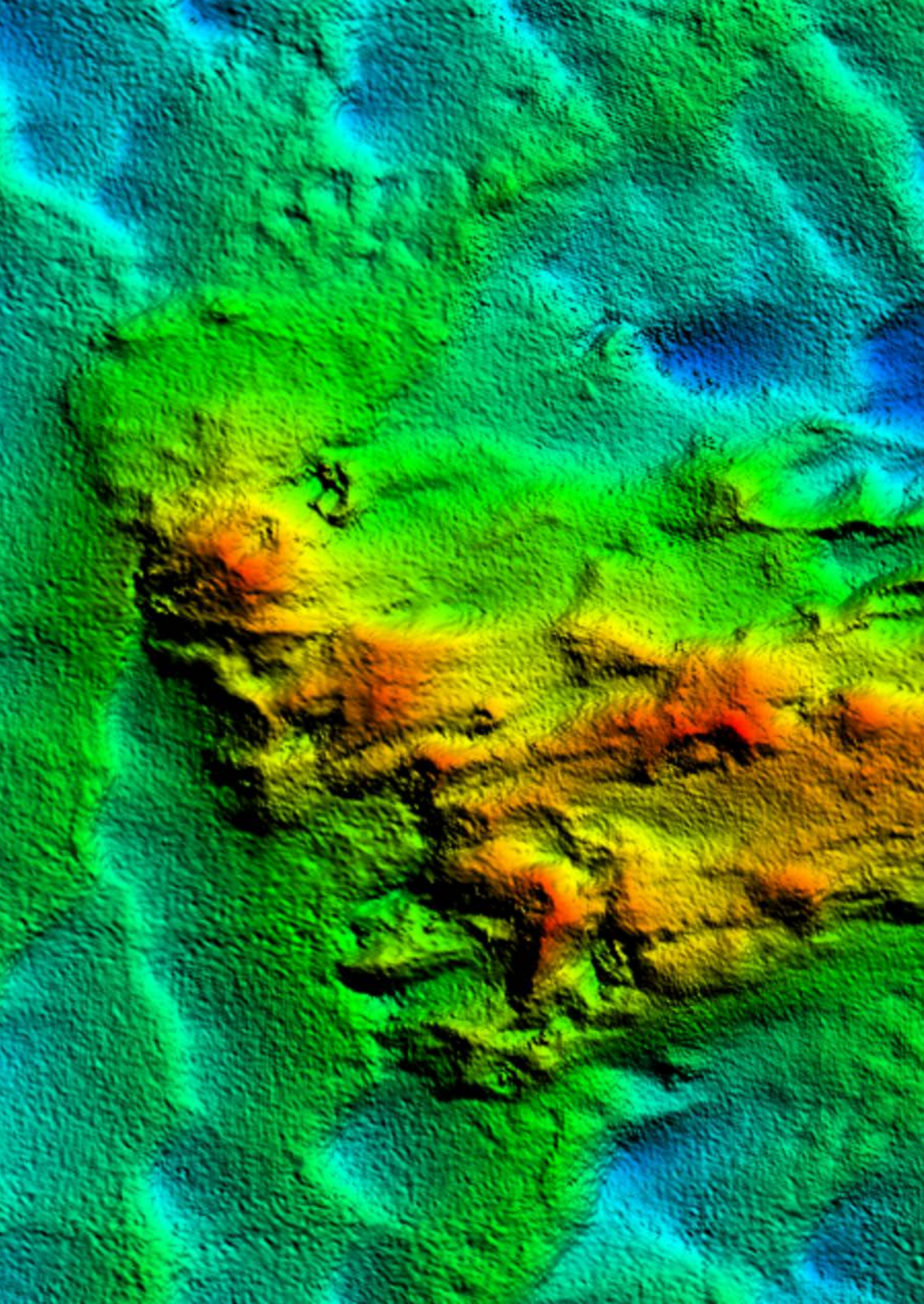
Fig. 7: In situ preservation may require protection by law or physical methods. For more information, see Guideline Manual 2.

in place, like artificial seagrass. For more information about the frequently used techniques refer to the proposed literature below and Guideline Manual 2.

MORE INFORMATION

More background information about in-situ preservation can be found in:

1. Manders, Martijn, David Gregory, Vicki Richards, 2008: The in-situ preservation of archaeological sites underwater: an evaluation of some techniques, in: Eric May, Mark Jones, Julian Mitchel (eds): *Heritage Microbiology and Science. Microbes, Monuments and Maritime Materials*, The Royal Society of Chemistry 2008, p. 179 to 204.
2. Manders, Martijn R., 2012: Unit 9: In Situ Preservation, in: Manders, Martijn R. & Christopher J. Underwood (eds.), *Training Manual for the UNESCO Foundation Course on the Protection and Management of Underwater Cultural Heritage in Asia and the Pacific*, UNESCO Bangkok.
3. M. Manders (ed.), 2011: *Guidelines for Protection of Submerged Wooden Cultural Heritage*, Wreckprotect.
4. Manders, M & Gregory, D. (eds), 2015: *SASMAP Guideline Manual 2. Best Practices for locating, surveying, assessing, monitoring and preserving underwater archaeological sites*, p. 65 to 73 for a description of research methods and best-practice examples.
5. Petriaggi, Roberto, Davidde Petriaggi, Barbara, 2015: *Archeologia sott'acqua. Teoria e pratica Pisa-Roma*, p. 238 to 251.



5. Monitoring

DEFINITION:

A systematic process of observing, tracking, and recording data for the purpose of measuring the condition and state of a site and the effects of implementation of any mitigation measures taken on site. Part of the management of change.

When archaeological sites are preserved in situ, they should be monitored regularly to measure changes, due to natural or human activity. This change might impact the condition of the site or the effectiveness of the chosen protection strategy. Monitoring is also used to prevent threats from damaging the archaeological site (e.g. human actions, such as anchoring, or illicit excavating) and to collect data on erosional activities and marine biological activities. In planning how to preserve a site in situ, account should be taken of how monitoring should be executed.

As a starting point for monitoring a site, baseline data needs to be recorded. This is usually done during the significance assessment and the in situ protection phase. Consequently, the starting conditions of the site must be documented. With this baseline, the conditions of the site can be monitored after the in situ preservation. After days, weeks or months it is possible to detect changes in the conditions of the site, with the baseline as a reference. If the degradation of a site has been stopped, the preservation is effective. If the site keeps degrading, the method applied needs to be reviewed to determine whether it has been properly executed, or whether a different method needs to be implemented. It is, therefore, paramount that monitoring plans also contain information on what actions should be taken when the data requires intervention from the heritage manager. It is important to bear in mind that not all degradation can be stopped. Slow bacterial degradation, for example, may continue even in oxygen-free conditions. In situ protection methods may, however, slow down the process considerably.

This process step helps to answer questions, such as the following:

1. Who needs to be involved in the work?
2. What is the condition of the site? Is it stable, or are there any changes?
3. What is the condition of the applied protection?
4. Are any mitigation measures needed?
5. Who is responsible for executing any mitigation actions?
6. Will the in situ protection be continued?
7. When will the next monitoring be scheduled?
8. Who needs to be notified of the results?

MONITORING QUESTIONS

1. Who needs to be involved in the work?
Monitoring of a site usually follows after in situ preservation and protection activities have taken place on the site. Monitoring data needs to be balanced against earlier recorded baseline

data. This baseline data should be available for the monitoring work.
A monitoring scheme must be in place before the fieldwork, the actual monitoring, is conducted. This requires cooperation between the cultural heritage manager and the archaeologists active in the field.
The monitoring of a site may involve several different kinds of research. The dynamics of the seabed, for example, (physical-mechanical threat) may be monitored with multibeam sonar techniques, while the biological threats on the wooden construction may have to be investigated with the use of sacrificial woodblocks, or by taking samples from the wreck.
Different countries may maintain a register for professionals who are authorised to do this specific research.

2. What is the condition of the site? Is it stable, or are there any changes?

A site preserved in situ has not necessarily been protected with physical methods. In these cases, it may be important to focus primarily on the monitoring of the environment. If something is changing, actions may need to be taken to physically protect the site. Even when a site is physically protected, it is important to monitor the effects of this protection at the site. If the protection is not sufficiently effective, actions to improve it may be required.

3. What is the condition of the applied protection?

The protection methods applied may be vulnerable to deterioration themselves. This should be monitored, as well as their ongoing effectiveness in ensuring protection. Failure to mitigate small changes swiftly, especially in dynamic environments underwater, may have a major impact on the site in the long run. Small holes in debris net protection, for instance, may eventually leave large areas of the site uncovered again.

4. Are any mitigation measures needed?

If changes are being observed during the monitoring, and the site is either degrading or under threat of degrading, mitigation measures should be implemented. Examples of mitigation include repairing damaged protection measures, changing policy, enforcing laws more stringently, or even changing the type of physical in situ protection.

5. Who is responsible for executing any mitigation actions?

It needs to be clear that once a monitoring report is produced, actions may ensue. Clarity also needs to be established regarding who is responsible to take action in order to ensure the effectiveness of the monitoring process on-site.

6. Will the in situ protection be continued?

Based on the monitoring of the site, a decision may be made to continue the in situ protection, or change the protection method(s), or even to discontinue protection efforts altogether. A decision to discontinue protection may result from an inability to ensure the continued effectiveness of preservation measures. In such cases, a decision needs to be made as to

whether to excavate or deselect the site. Plans for an excavation may also result in a decision to discontinue the in situ protection.

7. When will the next monitoring be scheduled?

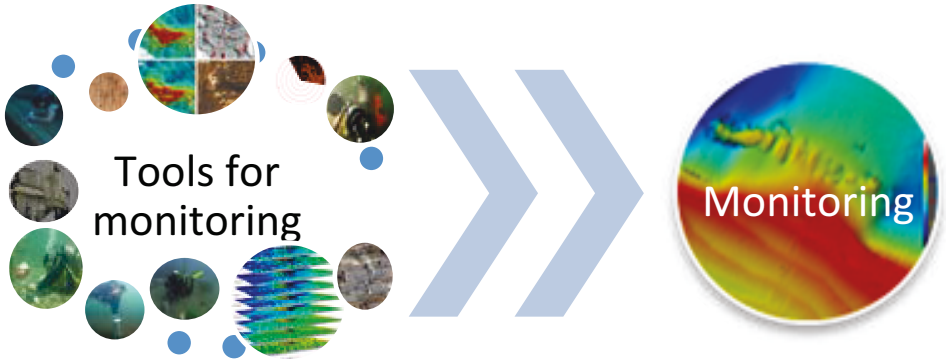
A single monitoring action usually fits into a site's monitoring schedule. It is only through a process of regular check-ups that changes in the area and on site can be detected. As soon as in situ protection measures have been implemented, a monitoring plan should be put in place. The schedule can be altered, depending on the outcome of the previous monitoring action. Instability of the site or area may, for example, be a reason to intensify the visits on site.

8. Who needs to be notified of the results?

Who needs to be informed of monitoring at the site? Usually, a number of people and organisations need to be notified of the results of this step in the process. Obviously, the competent authority and the developer belong to this group. In addition, national cultural heritage agencies often play a role in collecting the information compiled.

METHODS AND TECHNIQUES USED IN THE MONITORING PROCESS

The monitoring process focuses on identified threats and site features that specifically require preservation. Both of these aspects are outcomes of the significance assessment: the value and the significance of change. This focus also determines the approach to monitoring. Sediment erosion processes may be monitored, using regular single- and/or multibeam recording. Changes in environmental



See guideline 2, p. 75 to 83

Fig. 8: Monitoring is an important aspect of managing change at a site. Comparisons and consistent repetition of the methodology are important. In other words, measurements should be performed with exactly the same methods used throughout all the different previous process steps. For more information, see Guideline Manual 2.

conditions may be identified through frequent measuring of different parameters by means of dataloggers or sampling. Detailed photographic (using regular photography or Computer Vision Photogrammetry) and measurement comparisons are also suitable for identifying changes, and thus threats, to a site. Systematic repetitive recording at a site and comparison of the data acquired is important. Analyses of these data can be done with a GIS. More information about the monitoring process can be found in the literature suggested below and in Guideline Manual 2.

MORE INFORMATION

More background information on approaches to monitoring can be found in:

1. Bowens, Amanda (ed), 2009: Underwater Archaeology. *The NAS Guide to Principles and Practice* (Second Edition), The Nautical Archaeological Society, p. 163 to 170.
2. M. Manders (ed.), 2011: *Guidelines for Protection of Submerged Wooden Cultural Heritage*, Wreckprotect.
3. Manders, M & Gregory, D. (eds), 2015: *SASMAP Guideline Manual 2. Best Practices for locating, surveying, assessing, monitoring and preserving underwater archaeological sites*, p. 75 to 83 for a description of research methods and best-practice examples.

6. Excavation

DEFINITION:

The exposure, processing and recording of archaeological remains. An excavation site is a site that is studied. The study is conducted with the use of archaeological techniques, and often involves intrusive methods, removal of protective sediment and the collection of objects. Excavation is destructive: the physical site gets lost, and the information is preserved ex situ.

In cases where it has been determined that an archaeological site is very important, but the development cannot be relocated elsewhere, and the site cannot be preserved in situ, the site should be excavated.

Excavation is an archaeologist's most important method of answering specific research questions. It is only through careful excavation, which includes meticulous documentation and object management, that it is possible to retain all contextual information about the objects and their association with other objects and the site. Documentation can be done by drawing, photographing or using new tools, such as Computer Vision Photogrammetry. Data registration is often standardised by using specially developed forms and databases.

Before an excavation even starts, it is very important to have the required financing in place and sufficient funding reserved to cover the conservation and restoration of finds and unexpected expenses. The following measures must be implemented before an excavation can begin:

- A non-intrusive assessment, where possible
- A project design
- Advance funding for the whole project
- Establishment of a timetable
- Establishment of research objectives, where details of the planned methodology and techniques are defined in the project design
- Establishment of a competent, suitable and qualified investigating team
- Resolution of any political or legal issues, including ownership of the wreck
- Agreement on the body/party that will receive any finds and be responsible for curation.

To ensure the quality of an excavation, it is important to formulate research objectives and questions for different aspects of the excavation, as that makes it possible to guide the research towards answering key questions. An important aspect of excavating shipwrecks, for instance, is the relationship of the ship to its environment, which is unfortunately often forgotten. It is important to have experience in the field of research and to be acquainted with past research. It may be helpful to consult a research agenda – if available - before starting an excavation in order to determine the most important questions. Some countries already have a national research agenda.[9] Another useful reference aid is the Strategic European

[9] See for example the Regional Archaeological Research Frameworks in the UK: http://www.liverpoolmuseums.org.uk/mol/archaeology/arf/what-is-archaeological-research-framework.aspx, a Maritime Archaeological Research Agenda for England (Ransley et al (eds), 2013) or the National Archaeological Research Agenda in the Netherlands: http://culturalheritageagency.nl/en/research/national-archaeological-research-agenda

Research Agenda for Cultural Heritage.[10] Other quality requirements for an excavation can be found in the UNESCO guidelines for underwater cultural heritage.

METHODS AND TECHNIQUES USED IN THE ARCHAEOLOGICAL EXCAVATION PROCESS

An archaeological excavation should always be question based. These questions may be partly straightforward, but should focus primarily on investigating the archaeological significance of the site as determined during the significance assessment process. An archaeological excavation should be organised by knowledgeable, licensed professionals, who use a number of different techniques for documentation, including measuring, hand drawing and Computer Vision Photogrammetry. Excavation efforts should also focus on maintaining proper accuracy. Sediment may be removed with an airlift, or a water dredge. An excavation often also requires the lifting of objects from the seabed to the surface. Several, often hands-on, techniques have been developed for this purpose: boxes, bags and even large frames can be used to support objects. In addition, experiments have also been conducted for block lifting objects with the surrounding sediment, and using super absorbent polymer and other composite materials to support delicate objects while lifting.

[10] http://www.heritageportal.eu/Browse-Topics/

The questions posed prior to the excavation should be answered, and supported by the scientific data acquired through excavation. This is the main objective. All other information is additional. Excavation is destructive. In most cases, the site is lost after an excavation has been conducted, but the information is preserved ex situ. This requires detailed and meticulous data recording and storage. Eventually, this data should be shared. Artefacts (and samples) lifted from the seabed should be recorded and investigated. After registration and research, a decision should be made regarding which artefacts to conserve and which to deselect. For those that need to be kept, a conservation plan should be put in place. More information on excavation methods and techniques can be found in the proposed literature below and Guideline Manual 2.

MORE INFORMATION

More background information about approaches to archaeological excavations can be found in:

1. Bowens, Amanda (ed), 2009: Underwater Archaeology. *The NAS Guide to Principles and Practice* (Second Edition), The Nautical Archaeological Society, p. 135 to 148.
2. Manders, M & Gregory, D. (eds), 2015: *SASMAP Guideline Manual 2. Best Practices for locating, surveying, assessing, monitoring and preserving underwater archaeological sites*, p. 85 to 96 for a description of research methods and best-practice examples.

See guideline 2, p. 85 to 96

Fig. 9: Excavation should always be question based. It requires intrusive techniques. For more information, see Guideline Manual 2.

3. Ransley, Jesse, Fraser Sturt, Justin Dix, Jon Adams & Lucy Blue, 2013: *People and the Sea: A Maritime Archaeological Research Agenda for England*.
4. Viduka, Andrew J., 2012: Unit 10. Intrusive Techniques in Underwater Archaeology, in: Martijn R. Manders & Christopher J. Underwood (eds), *Training Manual for the UNESCO Foundation Course on the Protection and Management of Underwater Cultural Heritage in Asia and the Pacific*, UNESCO Bangkok.

LINKING GUIDELINE MANUAL 1 TO GUIDELINE MANUAL 2

Guideline Manual 1, "Guidelines to the process of underwater archaeological research," as presented above, aims to provide an overview of the different process steps in development-led archaeology that need to be followed in order to organise responsible management of underwater cultural heritage.[11] It is specifically tailored for cultural heritage staff, who are not necessarily underwater archaeologists, cultural historians or aware of the various natural scientific methods that are currently available to assess underwater archaeological sites.

Guideline Manual 2, "Best practices for locating, surveying, assessing, monitoring and preserving underwater archaeological sites," illustrates a practical approach for carrying out these processes of underwater archaeological research. It provides the necessary background on methods and techniques (M&T) that can be used to fulfil the aims of the different process steps. The M&T employed depend on the process step, the questions that need to be answered and the specific environmental conditions in the area of research. Guideline Manual 2 explains different approaches, using examples from actual archaeological research projects. This manual also draws heavily on the down-scaling and up-scaling approach that the SASMAP project has taken to the different phases described in Guideline Manual 1.

These two sets of guidelines are thus strongly connected: the first serves to outline the process, and the second explains how that process can be implemented.

[11] See also page 11

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The purpose of the European Collaborative Research Project SASMAP, which develops 'tools and techniques to survey, assess, stabilise, monitor and preserve underwater archaeological sites' (2012-2015) is to forge new technologies and best practices in order to locate, assess and manage Europe's underwater cultural heritage. This final report offers guidelines to the process of underwater archaeological research, in order to support stakeholders and managers in their assignment to improve the decision-making process in the management of underwater cultural heritage.

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