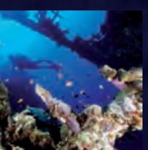
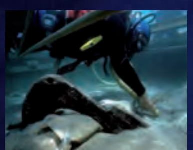
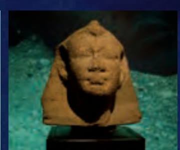
This Manual explains the thirty-six Rules of the Annex to the 2001 Convention entitled «Rules concerning activities directed at underwater cultural heritage». These Rules present a directly applicable operation scheme for underwater interventions. Over the years they have become a reference in the field of underwater archaeology.

In addition to elaborating on the ethical principles, the Manual offers a series of guidelines concerning: project design; preliminary work; the formulation of project objectives, methodologies and techniques; fund raising and management; project scheduling; competence and qualification requirements; conservation and site management; documentation procedures; safety standards; environmental considerations; reporting; curation of project archives; and dissemination.

This Manual is endorsed by the Scientific and Technical Advisory Body of the 2001 Convention on the Protection of Underwater Cultural Heritage.




For more information on
UNESCO's work in the field of underwater archaeology see
www.unesco.org/en/underwater-cultural-heritage

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Cultural Organization

The Protection of the
Underwater Cultural Heritage

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Manual for Activities directed at Underwater Cultural Heritage

UNESCO

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Guidelines to the Annex of the UNESCO 2001 Convention

Edited by Thijs J. Maarleveld, Ulrike Guérin and Barbara Egger

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Since the entry into force of the 2001 Convention for the Protection of the Underwater Cultural Heritage, the international community has at last been empowered with a comprehensive set of legal instruments in the field of culture. UNESCO's core cultural conventions cover key aspects of our shared heritage. They range from built and natural sites to intangible and contemporary expressions and to the protection against illicit trafficking and property threatened by armed conflict. Designed to function in a complementary manner, these conventions constitute a powerful tool for safeguarding cultural diversity, which is now widely recognized as vital to the sustainable development of all societies.

The 2001 Convention focuses on an often overlooked component of the world's cultural heritage: the ancient shipwrecks, sunken cities, flooded caves and other underwater remains that carry cultural or historical significance for humanity. This novel legal instrument aims to provide such underwater treasures with the same universal protection accorded to heritage on land. Another major objective is to facilitate the cooperation among nations that is so indispensable for underwater heritage's proper safeguarding. By promoting and guiding the development of sustainable and responsible underwater archaeology, UNESCO hopes to curb damage from human intrusion and illicit looting with a view to preserving this irreplaceable heritage for future generations.

In the decade since its adoption, the Convention on the Protection of the Underwater Cultural Heritage and its Annex have gained worldwide recognition as the foremost reference for the safeguarding of submerged archaeological sites. This is a source of great satisfaction and encouragement for UNESCO and all those committed to heritage protection.

The present manual is designed to help specialists and decision-makers understand the "Rules Concerning Activities Directed at Underwater Cultural Heritage" contained in the Annex of the Convention and to facilitate their practical day-to-day application. An international team of renowned archaeologists assisted UNESCO in the preparation of this manual. We are most grateful for their dedication and collaboration. It is my sincere hope that this new UNESCO publication will lead to a more efficient and wider implementation of the 2001 Convention.

Irina Bokova
Director-General of UNESCO

This Manual is the result of an effort to establish state-of-the-art management and protection of submerged archaeological sites in light of UNESCO's Convention on the Protection of the Underwater Cultural Heritage of 2001. It is intended for use as a reference tool by site managers, by stakeholders and partners in the protection of underwater cultural heritage, and by persons responsible for training courses in underwater archaeology.

More specifically, its contents expand on and illustrate the thirty-six Rules concerning activities directed at underwater cultural heritage presented in the Annex to the Convention, and fully endorsed by the members of the Convention's Scientific and Technical Advisory Body in May 2011.

UNESCO wishes to thank the Kingdom of Norway for its generous support, Thijs Maarleveld, Professor for Maritime Archaeology and President of the ICOMOS International Committee for Underwater Cultural Heritage, for his guidance, as well as the international team of renowned archaeologists conservation specialists and the editorial staff who contributed to making this project come true.

Francesco Bandarin
Assistant Director-General for Culture

Content

Legal context

▲ © UNESCO. UNESCO's headquarters in Paris, France.

The "**Rules concerning activities directed at underwater cultural heritage**" (hereinafter "the Rules") contain practical standards and ethical directives for archaeological work. They regulate the preparation of an archaeological project, the competences and qualifications of professionals undertaking interventions, the funding and the documentation of the work undertaken.

The 36 rules set out regulations for the responsible management of submerged heritage, be it located in maritime or in inland waters. They present a directly applicable operation scheme and are a major reference document in the field of underwater archaeology.

These *Rules* form an integral part of a broader legal instrument, the *UNESCO Convention on the Protection of the Underwater Cultural Heritage (2001)*. This confers a special legal status on them. Any State that ratifies the Convention[1] also becomes legally bound by the *Rules*. States which are not State Parties to the Convention may, however, also declare to respect them as best practice.

Historic Development of the Rules

Since 1956, UNESCO's "Recommendation on International Principles Applicable to Archaeological Excavations" has applied to underwater sites situated in territorial waters. However, there remained an urgent need for securing the protection of cultural heritage located in international waters

1 The status of ratifications can be verified at www.unesco.org/en/underwater-cultural-heritage.

with a wider-reaching legal instrument. The Council of Europe had examined the issue since 1976, but it was not until 1994 that a draft of the Convention on the Protection of the Underwater Cultural Heritage was adopted by the International Law Association (ILA) in Buenos Aires. Two years later, the International Council of Monuments and Sites (ICOMOS) met in Sofia and adopted the "International Charter on the Protection and Management of the Underwater Cultural Heritage".

Both texts, the ILA draft and the ICOMOS Charter, had no binding nature and only a repercussive effect on national legislations, as ILA and ICOMOS are professional associations, and not intergovernmental entities. Their texts were in consequence not open for adherence by States.

UNESCO

The United Nations Educational, Scientific and Cultural Organization (UNESCO) is a specialized agency of the United Nations. It has 195 Member States and eight Associate Members. The protection of cultural heritage is inscribed in its mandate under its constitution. It achieves its goals, among others, through the elaboration of legal texts, in particular Conventions, for adherence by its Members.

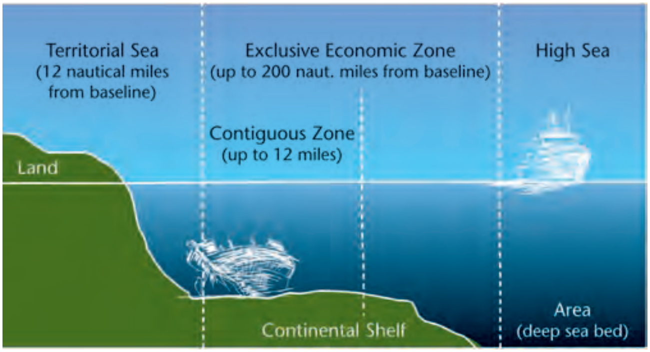
The 2001 Convention

A Convention is an agreement concluded between States in written form and governed by international law. It imposes binding legal obligations on its Parties. The Convention on the Protection of the Underwater Cultural Heritage was elaborated by several intergovernmental expert meetings and then adopted by the General Conference of UNESCO in 2001 at its 31st session. It is open for ratification by all States and even certain territories. It does not regulate the ownership of submerged heritage, but ensures its safeguarding.

Ratification

Ratification means that a State, wishing to become a party, expresses its consent to be bound by the Convention at the international level, thus becoming a State Party. It will harmonize its national legislation in conformity with the Convention and comply with it. When a very large number of States ratifies a Convention, its regulations may become customary law, under certain conditions, and may also bind States which are not party to it, in the event that they do not expressly object.

Understanding the urgency of the situation, UNESCO assumed the responsibility for creating a binding legal instrument based on the consideration of the ILA draft and the ICOMOS Charter. UNESCO's General Conference therefore decided in 1997, at its 29th session, that an international convention should be elaborated and a group of governmental experts was convened. From 1998 until 2001, the UNESCO Convention on the Protection of the Underwater Cultural Heritage was elaborated and finally adopted as one of the UNESCO conventions aimed at safeguarding cultural heritage. The principles of the



▶ © C. Lund / UNESCO. Scheme of the various maritime zones according to UNCLOS.
The United Nations Convention on the Law of the Sea (UNCLOS) regulates the limits of the various maritime zones measured from a baseline, as well as the rights and duties of its States Parties therein. The image shows a sketch of these limitations of maritime zones as regulated in UNCLOS. UNCLOS is one of the most important international treaties regulating the law of the Sea. More than 160 States are party to this Convention. One of its most significant achievements is the regulation of sovereignty rights and jurisdiction at Sea, and the definition of maritime zones.
The 2001 Convention is not intended or designed to amend the regulations of UNCLOS or other international law (Art. 3 of the 2001 Convention), and it does not change the existing maritime zones.

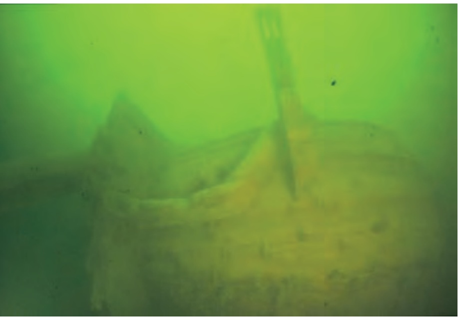
ICOMOS Charter were incorporated in the Annex of the Convention.

The Convention enables States to effectively protect and preserve underwater cultural heritage and provides it the same universal protection in general accorded to cultural heritage on land.

While many issues were subject to complex discussions during the elaboration process (in particular those that dealt with the law of the sea), one part of the Convention draft found quasi immediate and unanimous acceptance by the representatives of governments: the Rules concerning activities directed at underwater cultural heritage placed in the Annex of the Convention. Addressing ethical and professional standards for underwater archaeology, they have become a major reference for this discipline.

▶ © UNESCO. UNESCO Headquarters in Paris, France. Debates of representatives from UNESCO Member States during the General Conference.

I. General Principles



▲ © Jukka Nurminen, Abyss Art Oy. Dutch shipwreck Vrouwe Maria, Nagu, Finland.
In 1999, the wreck of the *Vrouwe Maria*, a Dutch merchant vessel that sank on its way to Russia in 1771, was discovered at 41 m of depth in between the islands off the coast of Finland. The story of its wrecking and it carrying a shipment of artworks destined for the Russian Tsarina Catherine the Great was well-known. The Finnish competent authority was therefore soon faced with pressure to immediately start an operation looking into the cargo. Any such operation would certainly have led to the disturbance of the site's integrity, even before the quality of the hull's conservation had been fully assessed. Despite the pressure, the National Board of Antiquities decided to proceed more cautiously. The site was protected and gradually more and more images, information and environmental data of the wreck were collected. This cautious approach, with *in situ* protection as the first and immediate choice, meant that all other options are still open at the current stage and that well-considered research, visualization and on-site outreach are now still possible.

The 36 Rules of the ANNEX are a set of coherent *rules concerning activities directed at underwater cultural heritage*. Although they address different aspects, they need to be understood as a whole, since not all of them are self-explanatory if taken out of context. Moreover, they need to be considered in the wider context of heritage protection and management, although – even as a set – they only address a specific part of that field, namely the specific activities that are directed at underwater cultural heritage. These Rules align the different purposes, approaches, aims and objectives of such activities in the specific context in which it is deemed acceptable to interfere with heritage, under water as well as on land.

Although management policies have traditionally focused on heritage on land, heritage management is governed by general principles that apply to all heritage, irrespective of its location. Many States have long defined policies and regulations for the protection and management of built and archaeological heritage. Worldwide, these long-standing approaches have led to a widespread consensus on the values of heritage and the prevention of its abuse. The *Rules* conform to that consensus and these widely acknowledged principles govern the *Rules* of the ANNEX.

The manual's structure allows dealing with each *Rule* individually while referring to its wider context. The underlying principles are set out in the first set of *Rules* of the Annex, *Rules 1* to *8*, but obviously these fundamental principles governing heritage management, cooperation between parties, research, planning, and development recur throughout this book. The wider context of heritage protection and management, as well as trends in the development of society will be referred to consistently. It is in this wider context that each *Rule* makes sense.

In situ preservation as the first option

Rule 1. The protection of underwater cultural heritage through in situ preservation shall be considered as the first option. Accordingly, activities directed at underwater cultural heritage shall be authorized in a manner consistent with the protection of that heritage, and subject to that requirement, may be authorized for the purpose of making a significant contribution to protection or knowledge or enhancement of underwater cultural heritage.

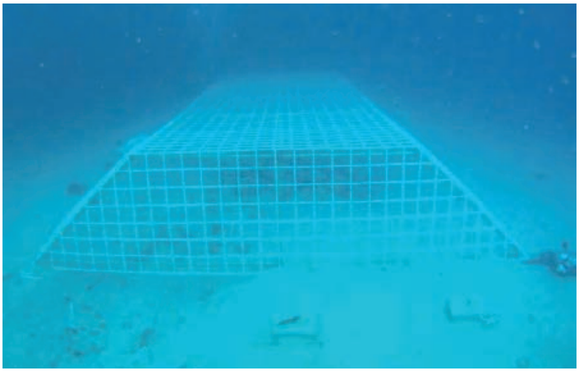
The first sentence of *Rule 1*, *"The protection of underwater cultural heritage through* in situ *preservation shall be considered as the first option"* is the core of this rule. The consideration given to preservation *in situ* by the Convention and its ANNEX is based on the recognition of the importance of the interplay between the site, its story and its context. It is the most telling phrase in the whole ANNEX, while at the same time it is certainly the most debated and the least understood, especially in the context of underwater exploration. Such misunderstanding is nurtured by those who do not want any regulation to curtail their interests. They will claim that archaeology is about finding things and therefore it would be ludicrous to say that things should be left in place. It is certainly true that archaeological research – like any research – is about seeking knowledge and it is even about finding objects in order to do this. This popular image is evidently a simplification of the scientific research process of which archaeological investigation forms a part, but nonetheless the popular image is surely not wrong *per se*. The fact, however, that finding out things 'in the field' is not an isolated endeavour, has fundamental consequences for the organization of archaeological research.

▲ © INAH / SAS. Ancient anchor from *Boris* shipwreck, Chinchorro Bank, Quintana Roo, Mexico.
Located approximately 30 km from the mainland, the atoll of Banco Chinchorro is a continuous reef that covers approx. 800 km².
The remains of at least 18 ships that sank between the 17th and the 19th century have been discovered there.
The Chinchorro Reef was known to sailors, who dreaded it as early as the colonial period. Travelling from Cartagena (Colombia) to Spain by way of Havana (Cuba) required ships to pass close to the bank.
Banco Chinchorro has been declared an Archaeological Marine sanctuary by the Mexican government. The archaeological sites are thus protected and are being conserved *in situ*.

In situ preservation is the first option, because

- The site of a historic event is authentic,
- Context defines significance,
- Heritage is finite.

Authorization of activities



▲ © Fotodocumentation of the Croatian Conservation Institute. Trapezoid protective cage at Rab Rt Sorinj, Cape north of Rab Island, Croatia.
Consideration for the protection of underwater cultural heritage in Croatia began in the 1960s when it became evident that underwater archaeological sites were very much threatened by pillage and devastation, and that it was necessary that legislation be adopted to protect them. Underwater archaeology in Croatia has yielded a great number of results that pertain to the exploration and protection of underwater archaeological sites. To date over 400 sites have been registered from all historical periods. About 80 sites can be visited, some with expert guidance. Particular attention has been dedicated to the preservation of the most threatened sites, protected *in situ.* Some hundred underwater archaeological sites have been registered in the Croatian Registry of Cultural Objects, affording them special legal protection and care. 8 sites are protected by steel cages, which allow visitors to see them, but prevent disturbance.

The second part of Rule 1 states that *"activities directed at underwater cultural heritage shall be authorized..."* and stresses two major points. In the first place, it implies that any authorizing entity should consider the first option as pointedly as any operator. Above all, however, it stresses that any prospective activity should be authorized by the competent authority that exists on the basis of Article 22 of the Convention. This clear reference places any activities directed at submerged archaeological sites within the public domain. Decisions over activities directed at heritage belong to the public domain, as heritage has a unique value for humanity. Competent authorities are entrusted with checking and weighing the considerations involved. Their involvement ensures that any activity is only undertaken for the purpose of making a significant contribution to protection, knowledge or enhancement of underwater cultural heritage, and they impose pertinent quality standards on the envisaged work. The role of the competent authority gains even more importance when the proposed activity involves excavation.

Purpose of activities

Many sites are yet or have long remained unknown because of the simple fact that until discovery they are covered by soil, by water or by both. Evidently it is only through archaeological investigation and research that such newly discovered heritage can be appreciated and investigated. Archaeology has developed through trial and error just like other fields of scientific research. The last part of *Rule 1* claims that activities *"may be authorized for the purpose of making a significant contribution to protection or knowledge or enhancement of underwater cultural heritage."* Today's crucial understanding that excavation should not be undertaken unless for good reason, was not yet manifest when archaeology first developed one or two centuries ago.

◀ © BAR / FPAN. Bronze plaque marking the *Half Moon* Underwater Archaeological Preserve, Miami, Florida, United States of America.
In 1987 Florida began to develop a statewide system of underwater parks featuring shipwrecks and other historic sites. The shipwreck preserves have become popular attractions for skin and scuba diving visitors to witness a part of Florida's history first-hand. They contain not only interesting archaeological features, but also an abundance of marine life that make the parks living museums in the sea. Each site is interpreted by an underwater plaque. A brochure and laminated underwater guides are available from local dive shops. The parks are open to the public all year round, free of charge. There are eleven parks at present, and several others under development. A virtual experience on these sites is offered at www.museumsinthesea.com, where visitors can access underwater video footage of the wreck and the marine life, as well as a video about the history of the vessel.

Excavation is not only the most characteristic activity of an archaeologist in the popular image, but it is also the most drastic activity directed at cultural heritage that an archaeologist can undertake. If given careful consideration, and if embedded in the context of wider research and research questions, excavation can be a very creative process, producing new knowledge on past societies, or shedding new light on specific aspects of the past. At the same time, however, it is also destructive. While carefully documenting and combining evidence as recognized, it also destroys the coherence and context of a site. Although excavation can make the heritage more accessible, it also compromises to a greater or lesser extent the site's authenticity, the quality that is most respected in experiencing and enjoying a place, in identifying with it, or in terms of commemoration. Excavation cannot do without research. And yet, even a research excavation misses the evidence that fails to be recognized for its significance by the excavator. Consequently, excavation must be embedded in a wider context of research questions with which the team is fully familiar. An ill-considered excavation can neither be undone nor can its results be amended once the original evidence is destroyed.

Scope of intervention

Moreover, heritage sites are not an inexhaustible resource. Archaeological remains are limited, and as research develops, it is important to carefully consider

▲ © National Museum of Underwater Archaeology. ARQUA. Phoenician shipwreck *Mazarrón II* near Cartagena, Spain. In the waters of the Mediterranean off Spain the timbers of two 7th century BC Phoenician shipwrecks were discovered in the Bay of Mazarrón near Cartagena. They are providing important information about how the Phoenicians constructed their ships. The remains of the *Mazarrón I* wreck are presented at the ARQUA museum in Cartagena, whereas the *Mazarrón II* is preserved *in situ*.
These ships are the key to Phoenician colonizing, explaining the way the Phoenicians travelled the Mediterranean. But they also reveal that the Phoenicians used mortise-and-tenon joints, giving their boats more strength than earlier boats, which were made of planks sewn together. The research team discovered a wooden anchor that had been filled with lead, apparently a novel invention of the Phoenicians. Researchers also found intact Phoenician knots, amphoras the crew used to store trade goods, and mills they used to grind wheat. The hulls of the boats were lined with brush, the Phoenician version of bubble wrap, to keep their cargo of lead ingots from shifting and damaging the hulls.

what would be the most desirable and strategic approach: to research a particular site now or to preserve it for future research and scrutiny. The future holds unimaginable advances in technology, which may lead to far more innovative methods of trace analysis that could profitably be used in archaeology. Even more importantly, research questions develop step-by-step, building on prior knowledge and understanding. In order to address research questions that will arise in the future as a result of this creative scientific process, it is essential that at least a selection of sites remains untouched and researchable. As they are the only repository of primary archaeological information in context, research planning calls for very deliberate and well-considered choices in view of limited heritage resources. Ideally, a selection of each and every conceivable type of archaeological deposit should remain available for future study. These considerations need to be given serious attention for the realistic deployment of research capacity and for the most favourable allotment of research funds. Since, in addition, countless opportunities arise for archaeological field research in the context of planning, development and urbanization, under circumstances where excavation is the best option, it has become the norm to try and keep whatever archaeological evidence can be kept for future scrutiny and enjoyment, rather than to exploit and disturb it as soon as occasion arises. These reasons have led to a wide acceptance of the cautionary approach that first considers *in situ* preservation, *in preference to* the recovery of artefacts *and in preference to* partial *or* complete excavation of the site.

Authenticity and context

The consideration given to preservation *in situ* by the Convention and its ANNEX is based on the importance of the interplay between the site, its story and its context. Authenticity and context are therefore the principal arguments that heritage is best preserved *in situ*. For research and understanding, it goes without saying that context and surroundings provide important clues and indispensable information. Authenticity and context are paramount, both to heritage experience and heritage research.

◀ © Deep Sea Productions. Sculptures from a 17th century shipwreck located in the Baltic Sea and preserved *in situ*. The wreck of this Dutch cargo vessel lying at a depth of about 130 m was discovered by chance in 2003. This unique Dutch fluyt of great historic significance stands upright, with the masts still standing, and offers a unique opportunity to examine a typical ship engaged in the largest and most profitable trade in Europe in this period. Consideration of *in situ* preservation and the cost of investigation required a clear definition of the scope of intervention, the careful formulation and prioritization of relevant research questions, so that the product of expensive bottom time could yield relevant and significant historic information.
The archaeological investigation of this essentially intact ship at 130 m depth required both new technical solutions and advanced underwater methodology as the wreck could not be raised or excavated easily. Therefore, the documentation and sampling was carried out remotely by ROV mounted multibeam echosounders and high definition cameras. Wood and sediment samples also had to be recovered from the site, along with one artifact (a man-size wooden sculpture), with minimal damage to the recovered material or surrounding context. While the ship remains conserved *in situ*, it is due to non-intrusive detailed mapping of the wreck site and a 3-D model that the scientists can reconstruct the site as well as both the exterior and interior of the ship. Some 100,000 well-preserved shipwrecks and maritime related constructions are supposed to be found on the seabed of the Baltic. They have so far been protected from aggressive shipworms due to the low salinity in the water, but it seems that the shipworms are now spreading as a result of climatic changes.

Heritage management takes care of heritage so that the community at large can identify with authentic remains. The context and setting of these remains are an integral part of their authenticity. This is true for underwater cultural heritage as for any other category. Though the site of a shipwreck might be considered completely fortuitous, it nevertheless provides the context of that find and determines its significance. Large-scale destructive displacements of heritage to encyclopaedic museums, from the 18th century onwards, have made it all the more clear to what extent the original context and authentic qualities suffer from intervention. Authenticity and context are therefore important arguments for heritage being best preserved where it is found.

Practical lessons

- Promote *in situ* preservation where, and whenever possible
- Promote research related to development-led archaeology

Lessons of the past are highly relevant. The recoveries of extensive underwater heritage, for instance those of the *Vasa* and the *Mary Rose* wrecks, have promoted the appreciation of underwater cultural heritage enormously. They have also suggested that ultimately such recovery would be the appropriate practice in underwater archaeology, while at the same time calling attention to the issue of limited capacities. The

▲ © J. Carpenter / Western Australian Museum. Diver mapping the *HMS Bounty*, Pitcairn Islands, British Overseas Territory, United Kingdom.
The *HMS Bounty* is famously associated with one of the most notorious mutinies of British history. The mutineers deliberately burned and sank the ship in the waters off Pitcairn. The Pitcairn Island was first settled by the mutineers and their Tahitian companions in 1790. Even today the current island population traces back its roots to them. It is therefore important that the community can identify with authentic remains preserved in the original context.
The *Bounty* and mutineer village sites on land are significant for a number of other reasons as well. The wreck, although often exposed to extreme ocean swell and scavenged by later generations, has yielded valuable information about what the mutineers took from the ship, providing a baseline of what was available at the inception of the settlement. For Pitcairn's population the *Bounty* was for many years an irreplaceable resource of European materials such as fastenings, copper sheathing, rope, canvas, and planks. Structurally, the vessel is an example of an 18th century ship modified for the transport of botanical specimens.

in-vestments engaged in these projects would be difficult to afford repeatedly. However, this is not the sole reason for which full recovery projects are not necessarily the best option. Appropriate practice varies significantly, depending on the specific circumstances of each site. Accordingly, wide acceptance of the cautionary approach prevails, promoting *in situ* preservation, *in preference to* the recovery of artefacts *and in preference to* partial *or* complete excavation of the site.

It will never be possible to preserve all sites in their status quo. This is not just a matter of insufficient funds, limited capacities of heritage agencies, or the limited number of qualified archaeologists. There is a range of processes on site and impacting developments on the immediate surroundings that cannot be stopped. Since not all sites can be protected and managed, a pragmatic choice needs to be made, based upon the assessment of all heritage sites and their archaeological, historical and artistic or aesthetic value. In making a reasonable choice, with regard to the finiteness of heritage resources, as well as the importance of authenticity and context, many sites are being preserved for future generations, including future generations of researchers. In this respect, the importance of inventory cannot be overestimated.

Other options

Rule 1 indicates that *in situ* preservation shall be considered as the first option and that in authorizing any activity, this possibility should be considered first as well. However, 'first option' is not the same as 'only option', or 'preferred option'. Partial or total excavation may be necessary under certain circumstances and preferable for a number of reasons. Reasons may be external, such as development projects for which many sites need to make way. If their character is fully understood, some sites will be considered sufficiently significant to warrant their preservation *in situ* in spatial planning processes. This is very unlikely, however, to be the case for sites whose existence or significance is unknown or only vaguely indicated until development is well underway.

Nevertheless, just as on land, developmentled archaeology in maritime and offshore projects presents challenges and enormous opportunities for archaeological research. Fundamental research questions can be addressed without interfering with sites that indeed can be preserved *in situ*. Time constraints imposed by development-led archaeology on research call for tight and focused research planning. The cost of mitigation, including such research, can often be considered as integral to the project's development. In many countries [including those who are party to the European Convention on the Protection of the Archaeological Heritage adopted by the Council of Europe on 16 January 1992 in Valetta], this is regulated by law. However, even if it is not, these collateral costs for society are integral to the project and should be accounted for in the project's development. Maritime and offshore projects are often of such a scale that they call for explicit political decisions that should take the public interest in heritage into account.

▲ © Swedish Maritime Museum. The Vasa Museum. Stockholm, Sweden.
After the raising of the *Vasa* the public could visit the wreck in a temporary museum. The new Vasa museum was then opened in 1990 and attracts between 730,000 and 1.2 million visitors every year. Only 25% of them are Swedish. The Vasa museum is therefore one of most visited museums and an enormous economic asset for the Stockholm region and Sweden in general. This success as a national icon is partly due to strong narratives, an excellent visitor service and a successful long-term marketing strategy.
Despite the high numbers of visitors, the Vasa museum has though never been, and will never be, a financial success.
The recovery of a shipwreck as complex as the *Vasa* could not possibly happen today in Sweden. It would probably be regarded too costly in relation to the scientific and cultural benefits and too big a risk when it comes to conservation and developing a successful museum.

Another external reason for excavation is the need to secure a site's continued existence, due to instability of the environment, or due to the fact that stabilizing it would be so exorbitant in cost that *in situ* preservation would not be the preferred option at all.

However, none of these reasons should prevent considering *in situ* preservation first. This applies to

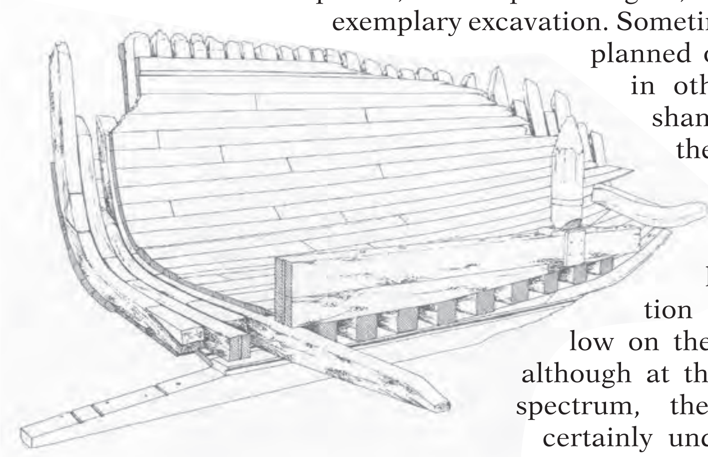
The first option is not necessarily the preferred option. Reasons to decide against *in situ* preservation:

1) There are external factors that are prohibitive, and
2) There are substantive reasons to excavate partially or completely.
   These substantive reasons are the intention to make:

   - *a significant contribution to protection,*
   - *a significant contribution to knowledge, and*
   - *a significant contribution to enhancement.*

The argument for excavation should be convincing and will mostly include a combination of reasons. In exceptional cases a contribution to knowledge can be enough.

▼ © Thijs Maarleveld / Jon Adams. The removal of a 19th century collier within the frame of the Slufter dredging project, Rotterdam, Netherlands. In the Slufter dredging project in the North Sea off Rotterdam, archaeological mitigation was integrated in the planning, although with a limited budget of no more than around 0.05% of the project realization costs. In all, 6 historical wrecks were discovered, dating from the Middle Ages to the 19th century. All needed to be removed. The protocol for excavation was differentiated beforehand. An 18th century ship was extensively surveyed and dismantled at depth. The 19th century collier on the image below was removed in as big a portion as possible. In contrast to the rough method of lifting, the recovered material was carefully studied on land, producing considerable new information on shipbuilding on the English east coast in the beginning of the 19th century.



both the initiator and the authority who considers authorization. Understandably, initiators of projects will defend their interest in excavation. They tend to be very creative in finding and formulating reasons for excavation by amplifying the magnitude of vigorous threats to a site. According to their arguments, it is almost invariably better to have the sites excavated. External reasons for excavation should therefore always be complemented by substantive reasons as referred to in *Rule 1*. Depending on the situation, these grounds can certainly be strong and urgent enough to decide on partial or complete excavation in preference to *in situ* preservation in the end.

Rule 1 explicitly mentions three overall purposes for which activities directed at underwater cultural heritage can be authorized:

- a significant contribution to protection; or
- a significant contribution to knowledge; or
- a significant contribution to enhancement of underwater cultural heritage.

These three purposes are mostly intertwined, but independently each can, under certain circumstances, be reason enough for undertaking an activity directed at heritage.

The history of underwater archaeology has seen quite a few examples in which interest for the underwater cultural heritage of a certain type or period, or in a specific region, first arose through an exemplary excavation. Sometimes these were well-planned operations whereas in other instances, they shamefully remind us of the pioneering years in archaeology. Their common characteristic is that long-term preservation *in situ* was very low on the initiator's agenda, although at the better end of the spectrum, the operations were certainly undertaken with long-term preservation in mind, *'in a manner consistent with the protection of that heritage'*, to use the phrase as used by *Rule 1*. It is ironic that our present concern for the underwater cultural heritage might not have arisen if these pioneering – and sometimes exemplary – excavations had not stimulated our consciousness. In less explored areas and for other types of heritage it can well be argued that exemplary intrusive research or a model excavation will do much to enhance the consciousness necessary for the development of well-considered policies, although with present technology, enhancement of understanding can very often be attained by other than intrusive means.

In exceptional cases, a very good research design, addressing pertinent research questions, can be reason enough to sacrifice a stable site through excavation. However, it is certainly not the first option, and needs to meet the maximum requirements of state-of-the-art archaeological projects.

▼ © Landesamt für Denkmalpflege im Regierungspräsidium Stuttgart. Use of geotextile techniques to protect a prehistoric site, lake Konstanz, Germany.
In order to counter erosion on and consolidate the archaeological remains of prehistoric lakeshore settlements that are preserved *in situ* on lake Konstanz, techniques have improved greatly in the past few years. After installing rigid reinforcements and coverings with sand bags, sand deposits and similar methods, new methods are now being carried out.
For the past number of years, geotextiles covered with gravel deposits have proven successful.

Commercial exploitation

▼ © Dirección General de Bellas Artes, Secretaría de Cultura del Gobierno de España. Restitution of the stolen cargo of the *Nuestra Señora de las Mercedes*.
On 31 January 2011, Odyssey Marine Exploration Inc, an American company claiming to be 'the world leader in deep-ocean shipwreck exploration' lost its appeal against the decision of a US federal court to return to Spanish authorities 17 tons of gold and silver coins salvaged under the code name 'Black Swan' from the Spanish war frigate of the *Nuestra Señora de las Mercedes*, sunk by the English fleet during the battle of Cape St. Mary in 1804. After an intense five-year legal battle, Odyssey Marine Exploration had to comply with the court ruling ordering it to restitute the *Mercedes*' cargo to Spanish authorities.
That the company was thus penalized was hailed as a landmark victory in the defence of underwater heritage. The UNESCO Convention on the Protection of the Underwater Cultural Heritage prohibits pillaging and commercial exploitation of submerged archaeological sites.

Rule 2. ***The commercial exploitation of underwater cultural heritage for trade or speculation or its irretrievable dispersal is fundamentally incompatible with the protection and proper management of underwater cultural heritage. Underwater cultural heritage shall not be traded, sold, bought or bartered as commercial goods.***

This Rule cannot be interpreted as preventing:

(a) the provision of professional archaeological services or necessary services incidental thereto whose nature and purpose are in full conformity with this Convention and are subject to the authorization of the competent authorities;

(b) the deposition of underwater cultural heritage, recovered in the course of a research project in conformity with this Convention, provided such deposition does not prejudice the scientific or cultural interest or integrity of the recovered material or result in its irretrievable dispersal; is in accordance with the provisions of Rules 33 and 34; and is subject to the authorization of the competent authorities.

Rule 2 embodies respect for the public interest in the proper management of cultural heritage for everyone. Our heritage should not be seen as an economic resource available to be used in trade or speculation. Upon recovery, it should be treated so as to preserve those characteristics - scientific and/or cultural - that give it its unique value for humanity. Heritage should remain in the public domain, though the Convention does not address issues of ownership rights.

Rule 2 also implies that heritage derives its value from its context and association. The whole assemblage as included and concealed in an archaeological site is far more significant than the separate individual items would be. It is essential to keep together artefacts, samples, and information relating to a site. Dispersal should clearly be avoided.

- Heritage is a public interest.
- Heritage has a unique value for humanity.

The Antiquities Market

Trade in heritage items is a major threat to the integrity of collections and to the principle that archaeological heritage is a public interest and not a private one. Trade in antiquities has a long and animated history that went hand in hand with the early development of antiquarianism and archaeology. There was a time when it was the accepted norm, rather than the exception, that heritage was exploited for the benefit of private collections. Public institutions, such as archaeological museums, operated accordingly, acquiring single objects of dubious provenance. As a result, collections originating from one and the same site became dispersed between many different countries and many pieces lost their provenance record.

The major flows of artefacts originated in colonised, occupied and underdeveloped regions and were directed towards the rich in prosperous areas, towards occupying and colonising powers.

Even today, it is sometimes argued that this helped to raise the understanding of the cultural variety of the world and that it thus helped to enhance mutual respect and diminish self-centred chauvinism. The debate over whether or not there is truth in that, does not change the fact that enormous fortunes were made in the process of depriving archaeologically rich areas from everything that stands for their identity. Moreover, in building or rebuilding societies after war, and the many other calamities of the 20th century, the hardest hit areas found themselves with their most iconic cultural heritage held in private

Fighting illicit trafficking and pillage

UNESCO has been an important platform for fighting illicit trafficking. The first of the UNESCO Conventions, the Convention for the Protection of Cultural Property in the Event of Armed Conflict, the so-called Hague Convention of 1954 addresses the prevention of looting and destruction in times of war. It does so in recognition of the fact that protection of heritage is not just a national interest, but that *damage to cultural property belonging to any people whatsoever means damage to the cultural heritage of all mankind since each people makes its contribution to the culture of the world* (Preamble). Unfortunately, there have been many armed conflicts since, during which the Convention needed to be applied, with less or greater success. But it is evident that sites and collections are particularly vulnerable to looting or destruction during or after conflict, when government is weakened or non-existent. War booty continues to surface on the antiquities market. And eager collectors that stimulate this market keep justifying their investment as safeguarding the heritage of humankind.

The next major development was the conclusion of the UNESCO Convention on Prohibiting and Preventing the Illicit Import, Export and Transfer of Cultural Property in 1970. Although the ratification process had a slow start, it gathered speed in the 1990s. The 1970 Convention has now been ratified by more than 120 countries, including both source-countries and the traditionally more liberal facilitators of the transfer and acquisition of ‘illegal antiquities’. The 1970 Convention goes hand in hand with the 1995 UNIDROIT Convention that complements it in dealing with private law aspects related to the undesirable trade.

As a consequence of the implementation of these Conventions and the public reflection and debate that accompanied it, buyers, collectors and sellers in the antiquities markets have become more and more conscious of having acceptable pedigrees for each object of trade. Objects that are clearly of an archaeological nature and whose history is unclear or displays major gaps, are suspected to be stolen or looted. The trade in such ‘tainted objects’ has become less attractive for operators in the market who covet a reliable and responsible image, do not want to be looked upon as smuggling and stealing crooks, and are obliged to keep records of each transaction. People do not want to be blamed for keeping stolen, looted or blood-tainted objects in their houses.

The 2001 Convention is complemented by these Conventions fighting illicit trafficking, and foresees regulations concerning the control of trafficked heritage entering the territory of a State, its dealing and possession, the non-use of areas under the jurisdiction of States Parties for activities not in conformity with the Convention, and sanctions.

collections on the other side of the world, unable to inspire new efforts.

On a national level, many countries had started to protect their heritage with archaeological legislation long before the end of colonial times. Internationally, however, it was not unless decolonisation was well underway that action and measures were finally taken to terminate the looting of archaeological sites, to curtail trade in antiquities acquired through looting and to organize hesitant restitution efforts to countries of origin of some of the most flagrantly stolen and smuggled items.

▲ © Christie's. The cargo of porcelain from the *Geldermalsen* sold at an auction at Christies, Amsterdam, Netherlands in 1986. The *Geldermalsen* was a Dutch East India Company (VOC) ship that held an ordinary cargo of *Chine de Commande* porcelain destined for the European market, when it sank in the Riau Archipelago (Indonesia) in 1752. The auction of 1986 marks an important turning point in the way underwater cultural heritage is perceived and was an important catalyst for the debate on its protection.

UNESCO has been an important platform in fighting the commercialisation and unequal trade in heritage. The organization facilitated the development of recommendations and conventions and promoted other forms of international cooperation. The laws and conventions that were developed for this purpose (see sidebar on UNESCO Conventions and illicit traffic) ensured that exploitation of sites on land was made illegal. Since then, there is a distinction between the legal antiquities market and the trade with illicitly recovered antiquities.

Commercial exploitation for trade or speculation is not acceptable, because:

- Heritage shall not be traded, sold, bought or bartered as commercial goods;
- Heritage shall not be object of art theft or illicit traffic;
- Heritage shall not be commercially exploited for trade or speculation;
- Heritage shall not be irretrievably dispersed; and
- Heritage shall be kept as close to the site where it is found as possible.

▶ © Commonwealth of Australia. Campaign to raise awareness of the looting of shipwrecks initiated by the Heritage and Wildlife Division of Sustainability, Environment, Water, Population and Communities, Australia.
The heritage values of historic shipwrecks are very susceptible to damage from looting. Australia protects its historic shipwrecks and their relics that are older than 75 years or shipwrecks that have been specifically declared as historic through the Australian Government's *Historic Shipwrecks* Act (1976). Approximately 8,000 shipwreck sites are protected by the legislation.
To compliment the legislative protection the department undertakes a program of works aimed at researching, documenting, conserving and compliance activity to enforce the protection of Australia's historic shipwreck heritage.
The department also works to educate and inform the public about protecting Australia's historic shipwrecks.
On a national level, many countries have actively protected shipwrecks for many years and put in place measures to stop the looting of archaeological sites and to curtail trade in antiquities acquired through looting. Although legislation has been directed toward combating the looting of underwater cultural heritage sites, certainly one of the most important measures is to change public opinion through effective education.

In the absence of the 2001 Convention, looting and commercial exploitation of underwater sites was stimulated rather than discouraged. In taking advantage of the freedom of the high seas and the deficiency of legal protection of submerged heritage, commercial operators and their auction houses have claimed that exploiting underwater sites was perfectly legal and ethical. *Rule 2* is therefore very clear that *underwater cultural heritage shall not be traded, sold, bought or bartered as commercial goods*. It addresses both the seller and the buyer, and, for good reason, it explicitly mentions barter. Operators using archaeological sites to collect objects have a tendency to approach museums, officials and politicians with gifts and other bribes in order to ease their operation. Any such barter is definitely prohibited by *Rule 2*.

Professional services, and authorized deposition

Rule 2 is clear on the fundamental principle that commercial exploitation for trade or speculation is incompatible with protection and proper management of heritage. This is not to say that heritage management and activities that are deployed in the context of protection and proper management cannot be subject to business principles, nor does it mean that all transfer of ownership would be unacceptable. *Paragraph a)* affirms that interventions can be paid for, without being considered commercial exploitation under the Convention or its ANNEX, and *Paragraph b)* bears out that artefacts can be transferred without being bartered.

Professional archaeology

Paragraph a) addresses professional archaeological services and other services that are incidental to

◀ © U. Guérin / UNESCO. Sale of artefacts from a Vietnamese wreck in Portsmouth, UK.

▼ © Australian National Maritime Museum. Part of the cargo of the *Dunbar* wreck, Sydney Heads, New South Wales, Australia.
Artefacts recovered from the wreck of the *Dunbar* in the early 1960s are now being analyzed to add to our knowledge on international trade to New South Wales in the 1850s. The Australian National Maritime Museum has been entrusted with care of and research on the collection of artefacts recovered from the *Dunbar*, thus ensuring that the transfer to an appropriate repository is in the best scientific and cultural interest.

archaeological interventions and by doing so, it specifies which services are exempt from the ban on commercial exploitation. Although it is possible in a money-driven economy to express all benefits, activities and services in commercial terms, and to manage them accordingly, *paragraph a)* clarifies that the provision of professional archaeological services is not what is banned. All archaeological activity can be governed by commercial principles, as long as the activities are authorized in conformity with the Convention, and as long as the finds that belong to the site are not part of the commercial equation.

The ways of organizing heritage management and of authorizing activities directed at underwater cultural heritage may vary in detail from country to country, although in each case a competent authority is involved in overseeing the public aspects. In many cases, professional archaeological services, or the provision of necessary equipment, are outsourced or contracted. Everywhere, both private and public management is subject to business principles: budgets, planning, salaries, and balance sheets of costs and benefits. Using the terminology and logic of the market in defining professional relationships has its advantages,

▶ © U. Guérin / UNESCO. Damaged Chinese ceramics removed by a salvage company from a wreck near Cirebon, Indonesia. More than 270,000 artefacts (Chinese ceramics, religious objects, jewellery, gold coins, pottery, etc.) were salvaged in a commercially motivated intervention from an ancient wreck. Located by a private exploration company in 2004 off the coast of Cirebon in northern Java, the ship is thought to have foundered in the 10th century as it sailed to Java from Sumatra, giving the discovery exceptional historical value. In 2007, a mission of experts from UNESCO visited the site where the findings were stored. The experts underlined the historical importance of the artefacts and the need to conserve them in suitable conditions. The artefacts were subsequently considerably damaged by the lack of conservation and were ultimately put in majority on sale.

as is further discussed in particular in *Chapter V* on funding. This should not be confounded with undue commercial exploitation. Also, *Paragraph a)* of *Rule 2* further reiterates that nothing prevents the commercial renting and exploitation of equipment, expertise and services in the context of heritage management.

Curation and the issue of dispersal

The second disclaimer under *Rule 2 b)* addresses the transfer of a collection to an appropriate repository. Such transfer should not be interpreted as an undesirable transaction. Obviously, it should be subject to authorization by the competent authority and it should meet several conditions. The transfer should not *'prejudice the scientific or cultural interest'*; on the contrary, the transfer should be in the best of those interests. Also, the *integrity* of the collection should be guaranteed. Artefacts, samples and information relating to a site should be kept together. However, in practice, there can be multiple reasons relating to storage, preservation and display that plead against physically keeping everything together in the same place or building. Sharing responsibilities between different institutions, such as museums, repositories and archives can therefore sometimes be the preferable solution. There is no reason to fundamentally oppose this, as long as it does not result in irretrievable dispersal and as long as the competent authority agrees. Transfer between public institutions is not included in what the *Rule* tries to avoid; neither is deaccessioning, as long as it does not imply feeding the antiquities market with finds. All such transfers should be in accordance with the provisions of *Rules 33 and 34*, which address the sustainable curation

The ban on commercial exploitation does not preclude the organization of professional services, or of access to heritage on the basis of commercial principles.
The ban addresses

- trading,
- selling,
- buying, and
- bartering.

It does not preclude the change of ownership in the context of curative deposition.

of archives and collections. It should be added that in view of authenticity and context, it is preferable that the institution where the archive of finds and information is to be kept should be as close to the archaeological site of origin as practicable. As a matter of course, it should be under the same political control as the site itself.

▲ © Underwater Archaeological Division of Thailand. Confiscated ceramics that have been illegally retrieved from an Asian wreck in Thailand waters.
As early as the Han dynasty, a lucrative maritime trade developed in south Asia. The numerous exchanges of spices, aromatics and exotic products, silk, ceramics, etc. were a source of wealth but also the cause of a great number of human tragedies, caused by storms, piracy or treacherous reefs. Over more than 2,000 years of maritime trade, the ocean floor of the South China Sea has become the graveyard of numerous shipwrecks.
In view of the high commercial values, numerous salvage operations both legal and illegal were made to recover the artefacts.

Counting the benefits

In banning the commercial exploitation of underwater cultural heritage for trade or speculation, *Rule 2* defines what is meant by the term commercial exploitation in the context of the Convention. It fully accepts that management can be organized in commercial terms. This applies to *'the provision of professional archaeological services or necessary services incidental thereto'* and by extension it also applies to visitor centres, museums and museum shops. Neither the Convention nor the Annex aim to prevent economic benefits of the heritage accruing from visitors and sustainable tourism from being realized and shared in an area or among a community. Certainly these arrangements need to be in their nature and purpose in full conformity with the Convention and the authorization of the competent authorities must be obtained. Examples of compatible exploitation of underwater cultural heritage are commercial arrangements that organize access to and supervision of heritage sites, either by dive operators or visitor centres, or entrance fees to museums exhibiting underwater cultural heritage.

While *Rule 2* does not explicitly mention such arrangements for access that are compatible with a site's protection and management, this interpretation is fully supported by other rulings of the Convention. As will be discussed below in relationship to *Rule 7* and *Rule 8*, sharing of knowledge, appreciation and access are important ethical principles.

▶ © H. E. Edgerton / MIT Museum. Electrical engineer Martin Klein, Cambridge MA, United States of America.
In the 1960s, building on previous experiments, the electrical engineer Martin Klein invented innovative techniques for survey without impact. He improved signal processing and developed the sonar instrument that is still the workhorse of underwater archaeological surveying. In this picture Martin Klein (in boat) and Willard Litchfield are testing it in the Charles River in Cambridge in the 1970s, loading a *Klein* side scan sonar towfish fish into the boat, at the MIT Sailing Pavilion.

Limiting impact

Activities directed at underwater cultural heritage fall within the wider context of heritage protection and its management. Within this context, there can be plenty of reasons to undertake, fully endorse and authorize activities. While the ANNEX regulates activities *directed at* underwater cultural heritage, it is important to stress that there are reasons for not disturbing a heritage site at all, including the principle to not disturb sites for the purpose of retrieving finds and selling them.

Unavoidably, any activities directed at a site have an impact. *Rules 3, 4, 5* and *6* specify the general principles in view of qualifying impact and regulating activities accordingly.

No more impact than necessary

Rule 3. ***Activities directed at underwater cultural heritage shall not adversely affect the underwater cultural heritage more than is necessary for the objectives of the project.***

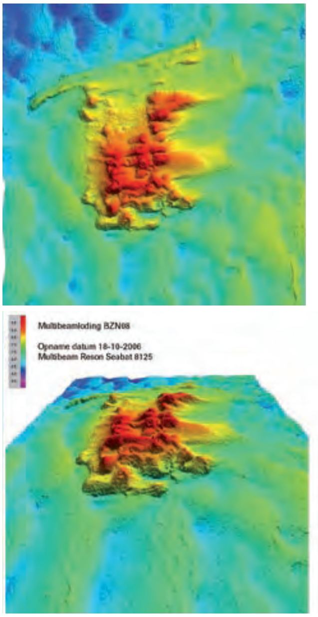
Rule 3 is a specific reiteration of the principle addressed under *Rule 1*. *In situ* preservation is the first option. Heritage should not be disturbed in the absence of good reason. In addition, *Rule 3* emphasizes the relative impact of activities and specifies that a site should not be disturbed beyond what is strictly necessary to attain the objectives of a project. *Rule 3* thus calls for proportionality, both in terms of how much research, archaeological observation and intervention is needed in order to gain the expected knowledge or protection, and how much impact inflicted by these activities the site can bear. The determination of what impact is proportionate lies with the competent authority, but will be informed by the proposals of the initiator of the project, if that is not the authority itself. The quality and comprehensiveness of the project plan will obviously be an important factor in negotiating urgency and limits.

The reasons for disturbing a site can be diverse. There can be external factors that determine that *in situ* preservation is not an option, implying that the site presents itself as an opportunity for the pursuit of knowledge through archaeological excavation. The project design for such an activity needs to be embedded in the wider context of research questions and expertise, as is discussed in Chapters II and VII. This wider context is equally important if it is not external factors, but the pursuit of knowledge, protection or enhancement that provoke the planning of such activity. Whether it is protection, consolidation, contribution to knowledge, enhancement or improved site accessibility that are cause to action, *Rule 3* will apply, as no activity shall adversely affect the site more than necessary.

In activities directed at underwater cultural heritage with the objective of contributing to protection, knowledge or enhancement:

- impact shall be proportional to the objective,
- impact shall not be greater than necessary, and
- impact and observations shall be documented.

◀ © Wessex Archeology.
Sidescan sonar.
The methods and techniques applied for scientific studies must be as non-destructive as possible and contribute to the preservation of the remains. Surveys with non-destructive techniques can address large areas.
Side scan sonar is still the most practical solution for this. It can be deployed from large and small vessels alike, either towing the fish or mounting it in front in order to avoid interference from propeller wash.



▲ © Cultural Heritage Agency of the Netherlands /RWS/ Periplus. Multibeam sonar image of wreck-site BZN 8. Detailed survey showed the site to contain a wreck sunk in the second half of the 17th century. Important finds at this site include a church bell cast by Hemony and a rich assemblage of navigational instruments. The methods and techniques for scientific studies must be as non-destructive as possible. Surveys with non-destructive techniques can address large areas. With multibeam sonars a more detailed and scale-corrected image can be obtained. It can also be used to monitor gradual change through repeated survey of the same area, as happened in this instance. The site was provisionally protected after its significance had been established. It has been monitored ever since. On-going erosion may be a reason to decide for intrusive excavation after all.

Protective measures and measures facilitating access will by their nature tend to remain as limited as possible. Different technical alternatives may exist. In deciding between them, relative pricing will be a factor, as well as the expected durability.

With regard to activities that are motivated by research, *Rule 3* calls for a clear focus on the research objectives, in function of research priorities. Some research questions can be answered by limited interventions, while others cannot be isolated without compromising the whole site. This calls for careful consideration of the following questions:

How does the proposed research fit, not just in the management of the site in question, but in a wider context of research and heritage management? Is this the right site for these objectives? Or, can equally valuable scientific information better be gathered elsewhere; perhaps on a site with little potential significance other than for and through research, or little potential for long-term preservation? This issue is taken up again in *Chapter III*, where the assessment of significance is discussed.

On the basis of the site's characteristics and conditions, it needs to be determined which research questions need addressing first and which research questions are proportionate to their impact, given the present knowledge of the site. A cautious step-by-step approach and phased decision-making may be the best way to avoid disproportional impact. Due to the constraints of proportionality of impact, archaeological research is continually caught between sampling strategies and total excavation. In order for science to progress, a combination of both strategies is needed. Sampling and excavation are complementary. One is not necessarily less radical than the other. Sampling the construction of a ship's hull for example, is extremely radical. It is perhaps more radical than a total excavation in which a hull is left intact, because that is deemed more '*consistent with protection*'. Such sampling is not necessarily less proportionate or responsible, however, as it also yields other information. In order to facilitate decisions on what is urgent, responsible and proportionate, it is helpful to formulate a research agenda for a region or for a certain type of site. Scrupulous preparation and scrupulous competent authorization can then indeed ensure that the impact of activities that are primarily undertaken for research is proportionate to their objectives.

Preference for non-destructive techniques

Rule 4. ***Activities directed at underwater cultural heritage must use non-destructive techniques and survey methods in preference to recovery of objects. If excavation or recovery is necessary for the purpose of scientific studies or for the ultimate protection of the underwater cultural heritage, the methods and techniques used must be as non-destructive as possible and contribute to the preservation of the remains.***

Rule 4 further reiterates the principle of *Rule 1*. Just like *Rule 3* it stresses that activities should not affect a site more than necessary, and that the overarching aim is to preserve and protect a site as much and as best as possible. In *Rule 4* the emphasis is on the methodology and on the techniques to be deployed. Every initiator of an activity directed at a site is encouraged to consider whether the objectives defined cannot be achieved with the deployment of non-destructive techniques and survey methods rather than by traditional digging and the recovery of objects and samples.

Many non-destructive techniques exist and many others are likely to be created or to be adapted to the specific needs of archaeological research. Hydrographical and geophysical survey methods can be applied to underwater cultural heritage and in the interpretation of submerged landscapes or sea-bottom conditions. The development of such methods and the techniques involved went hand in hand with the development of underwater archaeology. Archaeological sites have often been the showcase for what new devices are capable of. In *Chapter III*

▶ © E.Trainito. Site assessment of a wreck from the 3th century AD discovered in the Baia Salinedda, Sardinia, Italy.
Heritage should not be disturbed in the absence of good reasons. Unavoidably, any research directed at a site has an impact. Rules 3, 4, 5 and 6 specify the general principles in view of qualifying impact and regulating activities accordingly. It is the relative impact of activities that should be limited. A site should thus not be disturbed beyond what is strictly necessary to attain the objectives of a project. Non-destructive techniques are to be preferred to intrusive methods, whenever intrusion can be avoided.

on preliminary work, the most relevant present-day techniques, such as sonar and swath-bathymetry, are discussed in a sidebar on the process of inventory. These techniques are used to visualise the bottom surface of a body of water.

In relation to underwater cultural heritage, such survey methods, as well as magnetometers were at first solely applied to find, retrace and position individual sites. The integration of data generated by geophysical techniques, with accurate positioning data generated by global or local positioning systems (such as GPS), allowed for the application of these tools to precisely map large or smaller areas at great resolution. That in itself is of great help both in research and management. Developments continue, however, and the integration of various techniques of surface mapping and sub-bottom imaging means that non-destructive techniques can now provide an understanding of thus far unknown and invisible structures. Certainly there is no end to development. In many fields, probing by means of sound, light, magnetism and radiation find application, leading to the development of ever more sensitive devices, and using ever more different ranges of the various physical spectra. Equally important, software to process, filter and distil two- and three- dimensional scale images from data is being developed for a wide range of applications. The development of techniques that may be useful in archaeology is thus

- All research and management depends on data.
- Data gathering by non-destructive techniques is essential.
- In all activities non-destructive techniques come first.
- Non-destructive techniques are to be preferred to intrusive methods, whenever intrusion can be avoided.

definitely not isolated from innovation in astronomy, engineering or the medical sciences.

It is unlikely that all these non-destructive techniques will ever completely replace coring and excavation in archaeological research under water or on land. Intrusive approaches will continue to be important, but they will be much more effectively deployed if they are informed by preliminary non-destructive work. Acquaintance with the possibilities of such techniques is therefore fundamental. In recommending the consideration of non-destructive techniques, *Rule 4* has considerable meaning for the management of individual sites, for management questions relating to spatial planning and development, for fundamental archaeological research and for the planning of intrusive research interventions. As *Rule 4* suggests, one should always consider whether non-destructive techniques are sufficient to achieve specific objectives that traditionally would have been dependent on intrusive approaches.

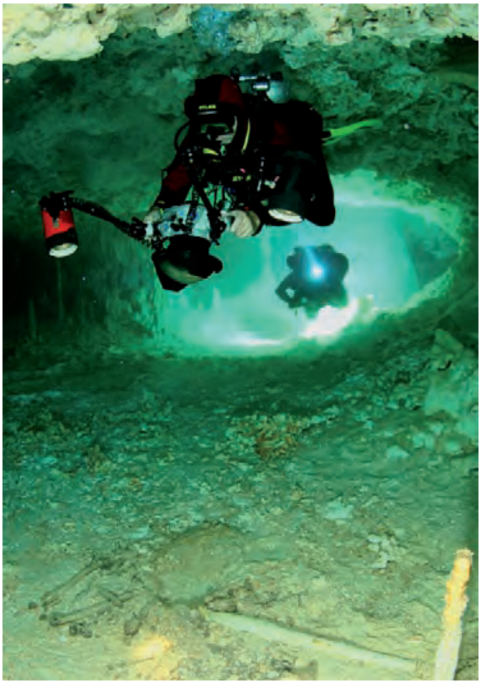
Human remains and venerated sites

Rule 5. ***Activities directed at underwater cultural heritage shall avoid the unnecessary disturbance of human remains or venerated sites.***

Rule 5 calls for carefully considering unnecessary impact, in calling for due respect of human remains and venerated sites. In claiming respect for other people's feelings, it touches upon one of the fundamental dilemmas and areas of contention in archaeology and heritage management.

Significance of heritage, including underwater cultural heritage, can be assessed by objectifying approaches. However, it is also quite evident that

▼ © INAH / SAS. Diver in the Chanhol cave discovering a human skeleton, Tulum area, Quintana Roo, Mexico.
A cenote is a natural karst cave first tunnelled into the limestone by groundwater and than exposed to the surface by the collapse of its ceiling. Mexico's flooded cenotes hide numerous submerged archaeological sites, ranging from mysterious sacrificial places of the Mayas to pre-historic campsites. For instance, in the Cenote Calaveras (cave of skulls), located at the archaeological site of Tulum, State of Quintana Roo, 118 Mayan skulls and other bones scattered on the bottom were discovered at a depth of 15 m. Underwater cultural heritage may contain human remains as part and parcel of the deposit. Although human remains may be of considerable scientific interest, research activities shall avoid the unnecessary disturbance of human remains and always handle them with the due respect.



Human remains

- Underwater cultural heritage may contain human remains as part and parcel of the deposit.
- Human remains may be of considerable scientific interest.
- Human remains shall be handled with respect.
- Human remains shall not be disturbed unnecessarily.

Venerated sites

- Some underwater cultural heritage sites are venerated sites.
- No activities at venerated sites shall be planned or authorized without prior involvement of interested parties.
- Venerated sites shall not be disturbed unnecessarily.

▼ © INAH / SAS. Underwater archaeologist records a Mayan skeleton at the bottom of cenote Calaveras in yucatan, Mexico. A human skeleton from about 11,000 BC (late Pleistocene age) was found 487 m inside the cave Chan Hol (meaning 'small hole' in Mayan).
Underwater cultural heritage may contain human remains as part and parcel of the deposit. Although human remains may be of considerable scientific interest, research activities shall avoid the unnecessary disturbance of human remains and always handle them with due respect.

significance is perceived differently by different people, by different interested parties, and by different 'stakeholder' groups. This is particularly true for heritage that includes human remains and venerated sites and relates to varying ways that cultures associate with this heritage, depending on their relationship with the deceased, religious convictions or historical associations. Moreover, there is great cultural diversity in what the dead or their remains mean for the living.

Human remains solicit great scientific interest as exemplified by the fierce scientific debates on early human evolution. The present opportunities to isolate human DNA or to reconstruct food patterns on the basis of dental degradation or the relative presence of various stable isotopes, are examples that indicate how new research can build onto what has been done before, both in relation to the distant past and to more recent periods. This applies in particular to human remains that have been preserved in the submerged environment,

where preservation has generally been much better than on land. Feedback from the medical sciences in palaeopathology has been considerable. Customs and cultures of prehistory and later periods have been deduced from funerary practices. In the process of studying funerary practices and burial sites, cremation remains and bones are often collected. Although these remains are handled with the care appropriate for scientific specimens, this care is not necessarily identical with the care that according to a variety of cultures is due to the remains of deceased humans or human ancestors. As a result, such bones have in a number of cases become bones of contention, connected with fierce disputes. The number of disputes that have sparked from the archaeological study of human remains stresses the sensitivity of the issue.

▲ © Friends of the Hunley. The *H.L. Hunley*, a submarine of the Confederate States of America that played a small part in the American Civil War before sinking in 1864, was discovered in the 1970s. The hull was first kept underwater for research but in 2000, as a national project referring to the American Civil War, the submarine was raised. At the time of its initial discovery the hull still contained the remains of its crew. In that context it was decided to proceed with utmost care and to investigate the remains forensically in as much detail as possible. The remains of the crew were eventually laid to rest at Magnolia Cemetery in Charleston, South Carolina.

Rule 5 demands due respect for human remains and equally requests due respect for venerated sites. These two issues are clearly interlinked as grave sites and monuments are often places of veneration. In addition to submerged tombs, inundated caves, sacrificial resting places or sunken burial ships, there are, however, also other submerged venerated sites, as for instance sacred cenotes (carst caves or sinkholes), prehistoric or historic offering places, sunken temples and the abodes of sacred animals. In many instances, veneration changed or disappeared over time. In others, it persisted or has been given new substance under new circumstances, serving new purposes. Both human remains and venerated

◀ © A. Balbiano / PROAS-INAPL. Official burial of a private marine whose remains were found in the wreck of a 18th century British war ship, the *HMS Swift,* Buenos Aires, Argentina.
The body of a private marine was found at the wrecksite of the 18th century british sloop of war *HMS Swift,* located in Puerto Deseado, Santa Cruz province, Argentina. After consultation between the two countries' government authorities it was decided to inter the body in a cemetery in Buenos Aires after the completion of the related archaeological studies. In the photograph the UK Naval Attaché in Argentina, Chris Hyldon, walks behind the casket, and a group of private marines from the Argentinean Navy stands at the entrance of the chapel. Under certain circumstances such enterment is considered appropriate.

sites call for attention and care in respect of other people's feelings. More than other cultural heritage, these categories embody interpersonal human relations, in the present as much as in the past. The intrinsic quality of such respect also has a fundamentally political dimension.

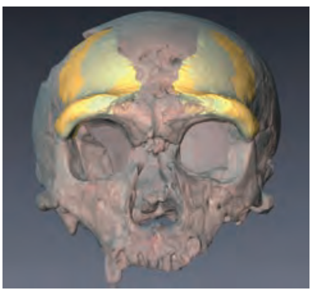
Besides the submergence of landscapes in which people have been buried, there are other customs to be taken into account where the underwater cultural heritage is concerned. Some cultures have deliberately chosen the sea or rivers as repositories for their dead, while others have done so out of necessity.

Burial or sacrifice in moors has led to the discovery of ranges of bog bodies, preserved in the turf, whereas other ancient graves remain the subject of legend, like the grave of the Gothic king Alaric in the Busento river. The inclusion of entire ships in prestigious graves on land reflects other rites where the dead were sent out to sea in an otherwise unmanned ship.

On long voyages, before the invention of cold storage, there was little alternative but to surrender the deceased to the surrounding waves. Specific funerary rituals developed relating to these watery graves, as is described in the seamen's lore and literature of those cultures for which a written record exists. One may suppose that the other, yet similar customs arose in the context of prehistoric and illiterate navigation. It is likely that evidence of it might one day turn up as underwater cultural heritage.

No less dramatic than intentional burial are sinking ships that incur a great loss of lives. Yet again, it is a recurrent theme in sea-related literature. Those who stayed behind and who are thus bereaved of their kith and kin are likely to have an awkward mourning process marked by uncertainty. Stay-behind partners are not only hard hit by uncertainty, but face taboos in their cultures, unless death can be ascertained. Feelings about what happened may survive for several generations, inspiring coastal and maritime populations with awe. *Rule 5* calls for considering these feelings in any activity directed at underwater cultural heritage resulting from shipwreck.

▼© Max Planck Institut, Leipzig111. Part of a Neanderthal man's skull dredged up from the North Sea and found in a containment of shellfish landed in the port of Yerseke, Netherlands. The find of a Neanderthal skull cap on the bottom of the North Sea in 2009 illustrates the wide variety of human traces and cultural heritage that can be encountered under water, but also the high scientific significance that human remains sometimes have. Such remains must however be treated with the due respect. In the image the specimen is mirrored and superimposed on the La Chapelle-aux-Saints Neandertal skull with a maximum geometrical match.



On archaeological shipwreck sites, corpses are found comparatively rarely, since in the event of distress there is a tendency to abandon ship. It is only when sailors get caught under heavy equipment, in tackle or netting, or in closed compartments that their remains are encapsulated in the wreck deposit. This is more likely to be the case for modern or technically advanced ships. Iron or steel ships with watertight bulkheads and watertight doors are obvious traps. Depending on the character of the calamity, they may indeed still contain the bodies of all hands. Deliberate foundering in war has frequently had this effect.

The traumatic nature of the effects of war needs no comment. Populations have suffered, whether passively or actively involved. Cherishing victories and commemorating losses have been coped with in different ways by different cultures. Many present nation States have originated from the ravages of war, or continued their existence despite of it. In all such instances, these States had armies and servicemen to fight and die for their cause. To preserve the memory, unknown soldiers are commemorated at venerated sites. Major battle grounds have their dedicated cemeteries, and mutual respect for such memorials, cemeteries and war graves have been subject to negotiations between States in peace settlements and has thus been part of mutual and multilateral agreements between States. Besides formal graves on land, these agreements include respect for the location of military ships that foundered with great loss of life. Rightfully, the States concerned wish for others to respect these places.

During the negotiation of the 2001 Convention at UNESCO, the deliberating delegations consciously gave specific weight to the protection of those war graves that have previously figured in international law. Such war graves should be respected and command the protection of the 2001 Convention if they have been under water for more than 100 years (*Article 1*). In codifying this, the delegations have sought a general wording that accommodates for other sites that similarly relate to traumatic death. As a consequence, *Article 2.9* of the Convention does not specifically set aside war graves, although obviously they are implied.

▲ © Igor Miholjek, Fotodocumentation of the Croatian Conservation Institute.
Wreck of the SMS Szent Istvan, an Austro-Hungarian warship, found near Premuda, Croatia.
World War I and II shipwrecks have come under the protection of the Ministry of Culture of Croatia over the past fifteen years. While they do not fall into the category of underwater archaeology in the classic sense, these shipwrecks have been protected as cultural objects because of their historical significance and the opportunities for their promotion in tourism and culture. Besides being blue graves, they are monuments of technical heritage and the technological development of their time.
Interventions at protected sites must be authorized by the national authorities. →

→ This authorisation process is indispensable for all actions that are necessary to further protection, knowledge and enhancement. In authorising activities directed at underwater cultural heritage, the competent authority sets the standards for archaeological interventions, demands for competent and qualified staff, and regulates the standards of documentation.
The Szent Istvan is interesting as a subject of study to researchers from all of countries that emerged from the fall of the Austro-Hungarian Empire and has been the subject of several international research campaigns.
With its length of 153 m, the battleship Szent Istvan, of the Tegethof class, is numbered among the largest warships sunk in the Adriatic Sea. It was built in Rijeka in 1914 and was, along with two other vessels of the same class, the Tegethof and the Viribus Unitis, the pride of the Austro-Hungarian Navy in World War I. Equally impressive are its twelve 305 mm cannons. It was sunk on 10 June 1918, by Italian torpedo boats. Indicative of the measure of this military success is the fact that the day was declared Italian Navy Day. The ship turned 180 degrees while sinking and lies now at a depth of 68 m with its keel pointing to the surface.

- Documentation is the cornerstone of heritage management.
- Documentation is the cornerstone of archaeological research.
- Insufficient documentation is destruction without compensation.

In conformity with this, the simple wording of *Rule 5* stresses that one should respect other people's feelings. It extends this respect to all human remains and to all venerated sites. These sites may be venerated for any kind of reason, by any kind of group. In planning or authorizing activities directed at underwater cultural heritage where such feelings may be at stake, they should be taken into consideration. Interested parties should not only be informed but involved. It is a topic that is dealt with in more general terms in Chapter XIV. Unnecessary disturbance should be avoided. If possible, these sites should not be meddled with at all. The preference for *in situ* preservation as the first option presents itself strongly in such cases.

The need for regulation

Rule 6. ***Activities directed at underwater cultural heritage shall be strictly regulated to ensure proper recording of cultural, historical and archaeological information.***

Rule 6 requires that any activity impacting underwater cultural heritage be properly recorded. Conditions and observations that are left unrecorded will never be part of the activity documentation, let alone part of the wider record of archaeological observations that can inform other research. Also, if left unrecorded there will be no account of the impact and damage caused to the site, however well-intentioned the activity. Unless recorded, what has been destroyed will not be available for future study. To this end, activities directed at underwater cultural heritage must be subject to strict regulation.

As such, *Rule 6* reiterates what much national legislation states concerning the authorization of interventions at archaeological sites. Authorization is indispensable for all actions that are necessary to further protection, knowledge and enhancement; moreover, it is limited to organizations with qualified and competent staff, who are fully familiar with the wider context of research questions, in which the significance of the site and the proposed intervention are embedded. Only such staff is geared to guarantee the best possible standards of recording and documentation.

Competence and qualification, and the details of recording, reporting and documentation are dealt with in *Chapters VII*, IX and *XII* respectively. *Rule 6* emphasizes that all these aspects must be regulated and thereby formulates an obligation for the competent authority, defined by *Article 22* of the Convention. The competent authority is requested to verify that strict regulations apply in view of ensuring the quality of archaeological work and in view of documentation and preservation of the results obtained throughout the activity.

Archaeology is a cumulative discipline. This means that results from very different endeavours build up to form a consistent body of information. Conventions that facilitate comparison of data gathered under different circumstances have developed for the description, illustration and drawing of phenomena. Such conventions have developed into professional standards. The competent authority is responsible for ensuring that strict and equal standards are adhered to. In many instances, the standards evolve from combinations of government directives and professional guidelines, which are referred to in permits and authorizations.

Detailed regulations and comprehensive systems of quality control have been developed in different contexts. International comparison shows, however, that much consensus exists. The most detailed regulations do perhaps apply in those instances where archaeological interventions are tendered out to service providers, especially in systems where in the context of development-led archaeology, the developer acts as client. Very detailed regulations do then apply in order to check competition and balance the market. In other systems, internal directives may suffice. Nevertheless, it is striking how much conformity there actually is in guidelines that govern fieldwork execution. *Rule 6* simply indicates that *proper recording of cultural, historical*

In authorizing activities directed at underwater cultural heritage, the Competent Authority:

- sets the standards,
- demands competent and qualified staff, and
- regulates the standards of documentation.

and archaeological information can only be ensured if it is regulated.

Sharing as a principle

Rule 7 and *Rule 8* postulate sharing as a general principle. Exclusiveness in matters relating to cultural heritage is just not acceptable in the present time, even if perhaps at one time in history it was. Heritage is protected for its general and public interest, and not in order to please its discoverer, its owner or one exclusive stakeholder. The consequences of this principle are far-reaching, implying that rulings that attend to maritime salvage are not appropriate for shipwrecks to which the 2001 Convention applies. Salvage rulings deal with private interests exclusively, resulting in secrecy and exclusive access to information. This stands in contrast to the principle of sharing and public interest that dominates heritage protection and management. Thereby private interests are not necessarily curtailed, but they are made subsidiary to the significance of the heritage in question. The 2001 Convention does not interfere with private property rights. The *Rules* that govern activities directed at underwater cultural heritage do, however, imply that any activities directed at underwater cultural

▶ © National Museum of Underwater Archaeology. ARQUA. The ARQUA Museum is the main institution responsible for the study, evaluation, research, conservation, promotion and protection of Spain's underwater cultural heritage.

heritage are subject to careful consideration and authorization by competent authorities. Moreover, these activities should be undertaken for the public benefit, in pursuance of a significant contribution to protection, to knowledge and enhancement. Benefits accruing from activities should be shared, as should be the heritage.

The principle of sharing assumed a fundamental importance in regulating the protection of underwater cultural heritage from the beginning. The 2001 Convention, including the *Rules* of its Annex was elaborated in the belief that *"cooperation among States, international organizations, scientific institutions, professional organizations, archaeologists, divers, other interested parties and the public at large is essential for the protection of underwater cultural heritage"* (Preamble). The principle of sharing is made operational through the directives on public access (*Rule 7)* and international cooperation (*Rule 8)*.

Public access

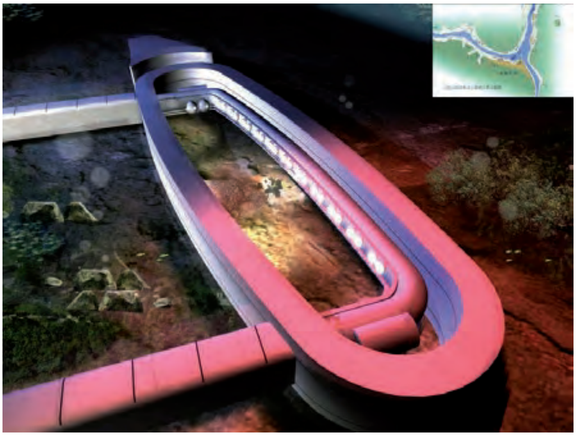
Rule 7. ***Public access to in situ underwater cultural heritage shall be promoted, except where such access is incompatible with protection and management.***

Heritage is protected for its public interest and its unique value for humanity. It should be enjoyed by as many people as possible. For this reason, *Rule*

▼ © PROAS - INAPL. Interpretive sign close to the shipwreck of the cargo vessel *Colomba*, Puerto Madryn, Chubut, Argentina. Although the site is neither covered by the UNESCO Convention nor the Argentinean legislation, it was decided to erect the sign with the purpose of creating awareness on the maritime history of the area. This was an initiative of the Underwater Archaeology Program of the National Institute of Anthropology and the Municipality of Puerto Madryn, Chubut Province, Argentina.

It is preferable to allow for public access because:

- Heritage has a unique value for humanity;
- Access contributes to appreciation and awareness;
- Indirectly, access contributes to:
  - o Better understanding and knowledge,
  - o Better protection.



▲ © Baiheliang Museum. Right: Architectural model of the Baiheliang. Museum, Fuling, Chongqing, China.
Left: Baiheliang Museum, Fuling, Chongqing, China.
Baiheliang is an archaeological site in Fuling, China, now submerged under the waters of the Yangtze River, raised by the newly built Three Gorges Dam. It displays some of the world's oldest hydrological inscriptions, recording 1,200 years of changes in the water level of the Yangtze River. Among the world's oldest hydrological inscriptions, the Baiheliang engravings record 1,200 years of changes in the water level of the Yangtze River in the north of the Fuling District of the Chongqing Municipality. The stone ridge is 1,600 m long and 15 m wide. It reaches 138 m at its peak height and is submerged under 43 m of water with the completion of the Three Gorges Dam. The Baiheliang museum offers access to those inscriptions under water. The museum construction is a fabulous first-world-wide example of the presentation of underwater cultural heritage *in situ* reachable by the non-diving visitor.

7 stresses that *"public access to in situ underwater cultural heritage shall be promoted"*. However, heritage is also an economic asset, adding to the quality of a region and its environment if it is known and accessible. In fact, there are many reasons for promoting public access and enjoyment.

Fundamental dilemmas

Nevertheless, public access to archaeological sites poses some dilemmas. This is particularly true for vulnerable or fragile sites, including those that have never been disturbed, and sites that are subject to careful but non-continuous investigation. The much debated dilemma arises on whether these sites should be the exclusive domain of archaeological researchers.

Public access calls for the resolving of dilemmas because:

- *Heritage is fragile;*
- *Access may not be compatible with protection; and*
- *Access may not be compatible with management.*

In resolving these dilemmas:

- *Think of limitations as temporary;*
- *Avoid solutions of convenience;*
- *Develop guidance and strategies; and*
- *Make the best of heritage assets.*

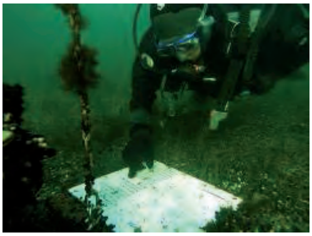
Archaeological research is an important reason for the protection of archaeological sites. Nonetheless, restricting access to archaeologists only is not advisable. The validity of protective policies depends on the extent to which the heritage can be experienced by the public and therefore on access. Restricting admission results in a lack of growth in public awareness, appreciation and knowledge. This is contrary to the objective of research, which is the creation of understanding and knowledge. Allowing access and permitting authentic experiences makes protection valuable, less exclusive and better understood. Access, in other words, is not only an important aim in itself; it also contributes to awareness and to joint support for protective approaches. This is as true for underwater cultural heritage as it is true for heritage sites on land.

There are, however, reasons for restricting public access. Heritage is fragile. Moreover, it is susceptible to natural decay and erosion, but it may also be damaged through abuse, looting and unrestricted access. Restricting access and protective measures, often including a protective cover, may be necessary to ensure its continued existence.

▼ © T. Maarleveld. A class of schoolchildren listening to an archaeologist, Perow, Germany. Archaeologist Jens Auer explains to a class of schoolchildren in Prerow (Germany) a strange piece of wreckage that was found on their beach, and what a group of archaeologists and archaeology students are doing to document it. The wreckage is a ship's side dating from the 18th century. It was clinker-built at first, but rebuilt with a extra layer of flush planking.

Pending such measures or while awaiting research, it may be useful to temporarily restrict access to the site. During the course of archaeological work, strict control and supervision may be preferable to unlimited access. Once adequate measures for protection have been taken there is no further reason to restrict access permanently. To cater for these necessary measures is a challenging assignment for management.

To resolve the dilemma of access, it is useful to compare underwater cultural heritage with heritage sites on land, but this should be on the basis of a correct analogy. On land, different regimes apply to visible parts of heritage, such as erected monuments and buildings



▲ © Metsähallitus. A diver checking an information plate at the Stora Hästö underwater trail, Finland.
Heritage trails, including heritage trails underwater, have become part of the tourism infrastructure in many countries. Information plates are often installed on the trails for tourists' use. The information relates to the natural environment, the cultural landscape and cultural remains.

on the one hand, and to buried deposits of archaeological remains on the other. To the former access is usually permitted, for the latter access is hardly an issue. Protection prevails since intrusion and excavation are subject to authorization.

Underwater heritage is not visible in everyday life. It would therefore be easy to deny access by a comparison with invisible heritage on land. However, diving is not excavating, and access and intrusion are not the same. Underwater cultural heritage may not be visible in everyday life, but it nevertheless includes both exposed and buried remains. Some sites can hardly be experienced or accessed other than through specialized scientific excavation, but for others this is different. Like on land, there are sites for which access is not problematic and sites for which it is.

Economy, tourism and leisure diving

It has been said that the past is a foreign country and the same can be argued for the underwater world that captivates and enthralls. Experiencing the past under water is rapidly becoming an enormous asset in the leisure industry and the 'experience economy'.

▶ © Seger van den Brenk. A group of recreational divers using different seasons to document a site discovered near Hoorn, Netherlands. The site is close to the city of Hoorn. The divers of this group work under the control of the competent authorities. In close cooperation with a range of historians and archaeologists they produced a book on their find. The site is preserved *in situ*.

This development has risks and opportunities for protection. Travellers have the tendency to take souvenirs back home. Time-travellers in the underwater world are no exception. Many divers have in fact been reported thoughtlessly removing from the sea souvenirs. Occasionally, operators of diving schools and diving centres recommend visits to attractive souvenir-hunting locations. The self-defeating nature of such an approach is evident. If every diver takes a bit, a site will quickly be depleted. Protection and continued *status quo* is in an operator's long-term business interest. The leisure diving industry stands to profit enormously from protection, on the condition, of course, that it is combined with access. Accordingly, organizations of divers and diving instructors support sustainable approaches.

▲ © Kyrenia Shipwreck Project. Experimental replica *Kyrenia II* sailing in the Aegean Sea. This replica was built in the original ancient *shell-first* technique by the Hellenic Institute for the Preservation of Nautical Tradition (HIPNT). It now resides in the Thalassa Museum, Ayia Napa, Cyprus. Precise replicas can bring archaeological artefacts back to life and thus very directly promote understanding among the general public.

Access can be provided directly or through intermediary techniques. Diving allows for direct presence and experience on site, without necessarily being intrusive. Diving visitors can act responsibly and should be encouraged to do so. Moreover, simple preventive measures can be taken. Transparent fences enable first-hand experience, preventing intrusion without preventing access and enjoyment, when they are cleaned regularly. A site can be made accessible through closed circuit television, webcams, Remotely Operated Vehicles, 3-dimensional reproductions or other means of visualisation. Such techniques allow for indirect access and have a long history. Some such solutions are maintenance intensive, certainly, but not

Guiding considerations for the permission of public access can include the following:

1. Distinguish between access and intrusion;
2. Ban unauthorized intrusion;
3. Visitors (divers) can act responsibly, encourage them to do so;
4. Consider:
    a. Not limiting access, but channelling it;
    b. the development of heritage trails;
    c. allowing access under guidance of a 'custodian';
    d. involving the leisure diving industry in protection and management;
    e. making access conditional on responsible behaviour.
5. Limit access limitations to what is absolutely necessary.

necessarily expensive. Indirect access has the added advantage of engaging the non-diving part of the public, a (very large) group that should not be forgotten.

Compatibility with protection and management

Not every site is equally suitable for public access. *Rule 7* provides for an exception to the general rule. The exception is very broadly formulated: *"except where such access is incompatible with protection and management"*. Such exception should not become the rule. Admission should not be denied for the wrong reasons or for bureaucratic convenience. Limitations on access should be an exception, decided upon after due consideration. The specific reasons for such a decision must be made transparent for public benefit.

With some form of supervision and control, access is hardly ever incompatible with protection. Divers do not change the environment and need not touch and abrade. The challenge is therefore for management. Organizing an appropriate level of supervision and control is what matters. If that is in place, access is not incompatible with management either.

Involving diving operators

Providing leisure diving operators with a measure of responsibility and custodianship is an attractive option to solve the issue of supervision and control. Promoting preferential access may help to channel it without compromising site protection. To cope with the demand and encourage economic development,

▶ © Florida Bureau of Archaeological Research. An information plate on the *SS Copenhagen*, Pompano Beach, Florida, United States.
Heritage trails, including heritage trails underwater, have become part of the tourism infrastructure in many countries.
The *SS Copenhagen* Underwater Archaeological Preserve near Pompano Beach in Florida became a State Preserve and Florida Heritage Site in 1994.

▲ © L. Faucompré / FMC.
Exploration of *La Seine* sunken in the Passe de Puébo on 4 September 1846, New Caledonia. Tourism is one of the world's fastest-growing industries, and for many countries, especially those in the developing world, it holds impressive economic potential. International tourism receipts have amounted to over US$ 919 billion in 2010. Not only does tourism create jobs and possibilities for economic growth, but it can also do so in regions having few other economic resources. However, tourism development can also have significant problems attached to it, recent years having demonstrated the negative environmental effects of increasing tourist numbers and tourism can also distort the local economy by injecting poorly managed or highly seasonal demand. Tourism can act to commercialize the expression of local cultures, leading to the phenomenon of staged authenticity at tourism destinations, and the economic benefits of tourism can be passed on unequally, exacerbating existing inequalities.
Heritage tourism is tourism's most rapidly growing international sector. With millions of tourists visiting for instance UNESCO's World Heritage sites each year, sustainable tourism has become an important cross-cutting →

many countries have had positive experiences with devising heritage trails; providing information, guidance and monitoring at low cost, and actively contributing to awareness as well as providing unique experiences for tourists and leisure divers. Guidance leaflets on waterproof paper may be part of the endeavour.

Not every site is suitable for such an approach. As an alternative, traditional publications and media may be supplemented with more and more virtual techniques, simulating experience or allowing for visualisation at a distance, through internet or other means. However, allowing for access and the authentic experience is what makes protection more valuable, less exclusive and better understood. It contributes to awareness and to joint support for protective approaches.

International cooperation

Rule 8. International cooperation in the conduct of activities directed at underwater cultural heritage shall be encouraged in order to further the effective exchange or use of archaeologists and other relevant professionals.

As a general principle, international cooperation should be promoted. Underwater cultural heritage is an international section of heritage if ever there was one. Nevertheless, protection and management, including the management of activities directed at this heritage is in the hands of individual States, each having its competent authority to deal with the matter. However, States that ratify the 2001 Convention do so on the understanding that they act responsibly not only on behalf of themselves, but on behalf of all other States Parties. That is actually the condition based on which they can act as a coordinating State in maritime zones such as the Exclusive Economic

→ issue and management concern at culturally significant sites. Especially in Oceania, tourism is the main industry of many islands and the leading element of their economies. Understandably, given the picturesque locations and the clear waters, a large part of this tourism is dive-tourism. This is also due to the fact that scuba diving is a rapidly increasing leisure activity with estimates of global growth of 14% per annum in newly certified divers (PADI statistics).
Over the years, many underwater cultural heritage sites in Oceania have become accessible to divers. On certain properly stabilized and protected places, these visits can be encouraged as long as it is ensured that their integrity is respected. Heritage is an asset that should be enjoyed by all and the magnificence and impression of the authentic locations teaches history much better then any classroom stay could do.
However, souvenir collecting, metal recovery and sensation hunting have done great harm to submerged heritage and the awareness of this threat and the consequent loss have only dawned in recent years. The UNESCO 2001 Convention encourages responsible public access, as well as opening up promising tourism opportunities. It shows that underwater cultural heritage is a very important tool for economic development and also stresses that it is very important for the reconstruction of memory and the creation of intercultural dialogue.
Nevertheless, it additionally calls for the effective protection of sites and establishes strict rules for interventions. Access is encouraged, when protection needs are respected.

Zone, the Continental Shelf or the Area (*Article 10 & 12* of the Convention).

Even apart from the understanding that each State contributes to a wider goal, sharing through international cooperation is the way forward. The significance of heritage is not limited to one group or one specific country, even though that specific group or country may have a great interest or stake. Verifiable links exist everywhere, as heritage is the result of the complicated and thoroughly intertwined history of humankind.

Cooperation is beneficial, especially in research and in sharing expertise. Of all the levels of international cooperation that exist, it is therefore in particular the exchange of archaeologists and other relevant professionals that is targeted by *Rule 8*.

A means of improving international cooperation is the participation in the Meeting of States Parties of the 2001 Convention, in its Scientific Advisory Body and in UNESCO regional meetings and training programmes. Another is the engagement of professionals in groups like ICOMOS and its international scientific Committee, ICOMOS – ICUCH, or other organizations that further concern for underwater cultural heritage and help setting standards, like the Advisory Council on Underwater Archaeology (ACUA), the Society for Historical Archaeology (SHA), the Australasian Institute for Maritime Archaeology (AIMA), the German Society of Underwater Archaeology (DEGUWA), the Joint Nautical Archaeology Policy Committee (JNAPC) in England, or the Nautical Archaeology Society (NAS), depending on the region.

In the domain of underwater archaeology, where the number of well-qualified professionals is still limited and many sites need to be treated and researched in an international comparison, it is advisable to draw up regional or multinational research agendas, setting the priorities for joint-research projects. Such research agendas could for instance address the comparison of prehistoric settlement and use of the submerged continental shelves of different regions.

▲ © Danijel Frka. An Apoxyomenos statue *in situ*, Croatia. Roman period life-sized bronze statues are very rare, some 20 have been recovered, and there are only a few original works. Copies are much more frequently made of stone. The statue is likely a copy dating from the 4th century BC. No traces of a shipwreck from which it may originate have been found, although it is presumed that it does come from a shipwreck that sank between the 1st century BC and the 1st century AD. The statue depicts an athlete scraping himself clean of oil, a conventional subject of Ancient Greek votive sculpture called Apoxymenos. The Apoxyomenos statue was found by chance in 1997 in the waters off the islet of Vela Orjula near the island of Veli Lošinj. The task of bringing it to the surface was taken up by the staff of the Department for Archaeological Heritage of the Ministry of Culture's Directorate for Cultural Heritage Protection, assisted by divers from the Special Police and in collaboration with GRASP (Groupe de Recherche Archéologique Sous-Marine Post-Médiévale) and OML (Oxford Maritime Ltd.). →

They could address the evidence of early seafaring that provided for the population of the Earth. They could target the shipping that provided contacts between different regions, across one or different seas in a specific period of Antiquity. Or, they could focus on the development of a specific class of ships. Whether these be Pacific multihulls, whaling vessels, Maccassan praus, Arabian dhows, Chinese junks, VOC ships, Spanish galleons, American teaclippers, troopships, slaveships, or transports for pilgrims, conscript labour and immigration, one-man submarines, dreadnoughts or any other class of vessel. Drawing up such an inclusive research agenda will need to include collaboration with researchers from the States of departure, of passage, of destination and from those on whose coasts they came to grief. These research projects would be a good basis for further research and international cooperation.

→ The extraction of the statue from a depth of almost 45 m was further complicated when damage was discovered on the statute: the head was practically separated from the body, and a number of fractures were discovered under the right knee and on the right shoulder, but the statue was successfully extracted without new damage. The statue has been preserved intact, missing only the small finger of its left hand. The entire statue was covered with a thick layer of incrustation, and was half filled with sand and sea sediment.
Conservation and restoration work was carried out at the Croatian Conservation Institute in Zagreb. The first phase involved desalination, followed by the mechanical removal of the incrustation, a 3-year undertaking, and the consolidation of the fractures and breaks. A support construction was built into the statue to allow it to stand upright. The Croatian Apoxyomenos is certainly among the most spectacular archaeological finds extracted from the Adriatic Sea. The best-known Apoxyomenos was that made by Lysippos in the late 4th century BC. The manufacture of statues of athletes is most often associated with victory at the Olympic games, and they were a votive gift to a god, and an expression of the pride and glory the winner brought to his city. Besides as a statue, Apoxyomenos has also been depicted on grave stele, reliefs, gemmas and statuettes. The Croatian Apoxyomenos is very similar to the one kept in Vienna, which was found in 1896 and is believed to be an original.

The Convention builds upon international cooperation. It stimulates cooperation at all levels between:

- States Parties,
- their competent authorities,
- their experts,
- professionals,
- divers and other interested parties, and
- international researchers.

Particular fields of cooperation are:

- The Convention itself and its Operational Guidelines,
- The management of sites with multiple verifiable links,
- The management of sites in international waters,
- Exchange of expertise,
- Training,
- Setting up cooperative research agendas and projects.

Professional and non-governmental organizations inform cooperation at the State level and provide a platform for cooperation at other levels. They include:

- ICOMOS – ICUCH with its global membership and remit to advise on policy matters worldwide;
- ACUA and SHA with its firm basis in historical archaeology of the New World and remit to advise on policy matters worldwide;
- Universities cooperating in international training programs;
- NAS with its remit to inform and raise awareness in the diving community;
- AIMA which concentrates on the Australasian region;
- Groups organizing relevant international archaeological conferences such as IKUWA and ISBSA;
- many other regional and topical organizations.

II. Project design

▲ ©T. Maarleveld. Research operations at Nørre Bjert, Denmark.
At Nørre Bjert the presence of mesolithic culture layers in the coastal was to be established through coring and a small trial trench by a team of the Viking Ship Museum and the National Museum of Denmark in January 2006.

The first set of rules addresses the general principles that apply to all activities directed at underwater cultural heritage. They therefore place such activities in the wider context of heritage management and protection. The second set, consisting of Rules 9 - 13, deals with the actual planning of activities. These Rules address the Project Design for such activities and all the aspects that it should include. Many of these aspects are further elaborated in the subsequent rules and chapters.

Function, submission and availability of the project design

Rule 9. Prior to any activity directed at underwater cultural heritage, a project design for the activity shall be developed and submitted to the competent authorities for authorization and appropriate peer review.

Project management should be the result of a planning phase during which the objectives of the project, methodology, strategies and resources are defined. Any intervention on underwater cultural heritage should be preceded by the draft of a Project Design. Ideally, the project design should be integrated into the long-term site management plan.

A project design is a plan of all activities of a project, within a defined time frame for implementing these activities by identifying all relevant information about a proposal that may impact on a site. It is produced to guide the team, the decisions of the project director and the competent authorities. It does so by identifying all relevant information about a proposal that may impact on a site.

A good project design helps to prevent or successfully manage negative impacts that could arise from an activity directed at a site of underwater cultural heritage. This is important as the information contained in an underwater site is extremely fragile. Activities ranging from archaeological excavations to conservation operations can have unexpected and destructive outcomes. If disturbed, sediments deposited over many years can become unstable. Waves, currents, and sometimes ice can then remove protecting covers of sand or silt, allowing marine organisms to become more active. The result is that cultural remains and their archaeological information can be damaged or even destroyed.

All sites represent a human enterprise that can only be understood if this historical record is studied in its entirety. This means it is important to avoid hiatuses in the study process or that are caused by poor planning that do not take due account of the time, resources or financing available to the working team.

Rule 9 states that the project design should be submitted to the competent authorities. It is important for the information to be kept with all other information regarding the site.

Archaeology and the understanding of a site are based on facts and interpretation. It is a cumulative process. With new information becoming available, interpretation needs to be reviewed. This can occur many years later. It will then again be important to know what the considerations were for an intervention and on what information and considerations the earlier interpretation was based. Another reason for submitting the project design to the competent authorities is that decisions are based on it, decisions on whether or not to grant permits, arrange funding, or allot capacity. The way these decisions are organized varies from country to country. Sometimes it is the competent authority itself that reviews, approves or rejects, and directs or executes all archaeological projects, other times it is not. However, in any case, the project design will guide project related decisions and will make them transparent for others. Accordingly, *Rule 9* mentions that the project should be submitted for authorization and appropriate peer review. This may mean a formal process of peer review preceding the authorization.

▲ © NAS. Mapping project, Portland Harbour, Dorset, United Kingdom.
The Portland Bay Wreckmap mapping project was undertaken on a stricly volunteer basis in 2003 and 2004 by the NAS, the Nautical Archaeology Society. This public archaeology project aimed at gathering as many observations and as much information as possible on the sites, recorded in the monuments record of which actually very little was known.

▶ © H. Mostafa. Dr. Emad Khalil and Dr. Sameh Ramses engaged in preparatory work, such as the elaboration of a project design for research projects in the Alexandria Centre for Maritime Archaeology and Underwater Cultural Heritage, Alexandria University, Egypt.

The elaboration of a project design is an integral part of the syllabus of the Diploma and Master programme in Maritime Archaeology and Underwater Cultural Heritage taught at the Alexandria Centre and put into practise in a number of research projects (Lake Mareotis, Red Sea, etc).

In 2009 the Alexandria Centre was established as a European Union project under the EU-Tempus III Programme. The project succeeded in creating a specialized centre for postgraduate studies, which provides education and training at different levels in aspects of maritime and underwater archaeology (postgraduate Diploma and Master programmes in Maritime Archaeology and Underwater Cultural Heritage) in accordance with EU standards. The centre was created through collaboration between 8 consortium institutions from the EU and Egypt (Alexandria University, University of Southampton, NAS, AAST, Supreme Council of Antiquities, Centre d'études Alexandrines, University of Ulster and Université de Provence) who among others provided the necessary academic, technical and administrative expertise required for the establishment of the centre.

▲ © D. Nutley. Anchors of the *Edward Lombe*, sunk in 1864, Syndey Harbour, New South Wales, Australia.

The *Edward Lombe*, a vessel of significant size, was the first known shipwreck inside Sydney Harbour which resulted in loss of life. Its sinking had a strong impact on the colony as suggested by the number of contemporary paintings dedicated to this catastrophe.

The site of the *Edward Lombe* is a good example to illustrate that the project design should include an assessment of what site features will be left *in situ* as interpretive features. The loss of an anchor from a site may severely reduce its attraction as a recreational dive site. If an anchor is to be removed the methodology for its recovery and the technological and funding requirements for its conservation must be included for consideration by the competent authority.

It certainly means, however, that the project design should be made available to the wider archaeological community. As in all sciences, discussion and debate are the basis for developing new knowledge and understanding. Since a project design should outline scientific and practical objectives, as well as the methodology to achieve these, discussion on these issues should not be avoided. On the contrary, it is important that these be available for peer scrutiny, now and in the future.

Developing and assessing a project

Rule 10. The project design shall include:

(a) an evaluation of previous or preliminary studies;
(b) the project statement and objectives;
(c) the methodology to be used and the techniques to be employed;
(d) the anticipated funding;
(e) an expected timetable for completion of the project;
(f) the composition of the team and the qualifications, responsibilities and experience of each team member;
(g) plans for post-fieldwork analysis and other activities;
(h) a conservation programme for artefacts and the site, in close cooperation with the competent authorities;
(i) a site management and maintenance policy for the whole duration of the project;
(j) a documentation programme;
(k) a safety policy;
(l) an environmental policy;
(m) arrangements for collaboration with museums and other institutions, in particular scientific institutions;
(n) report preparation;
(o) deposition of archives, including underwater cultural heritage that is removed; and
(p) a programme for publication.

▲ © M. Harpster. An archaeologist setting a reflector on an archaeological site at the Cilaes Island during the Karpaz Maritime Heritage Programme near Karpaz Peninsula, Cyprus.
The scientific and practical objectives of the project design for the programme were to assess, document, and catalogue underwater sites along the coastline of northern Cyprus in order to advance their protection.
In view of achieving these objectives the outline of the methodology provided that the team should use a total station on land to survey and map sites in shallow water.
In line with the project design, the team member has set the reflector pole next to an amphora fragment on the seabed, distinguished by the painted and numbered stone label placed there during the survey earlier in the day. Both her head and the reflector head are above the water.

The list of issues to be addressed in a project design, according to Rule 10, is relatively comprehensive. They should all be included and are equally important for larger and for smaller projects. There is, for instance, no justification for work that is unsafe or environmentally unfriendly, or for not writing a report just because an activity is of a lesser scale. All listed items are more fully explained in the further Rules of the Annex.

Previous or preliminary studies

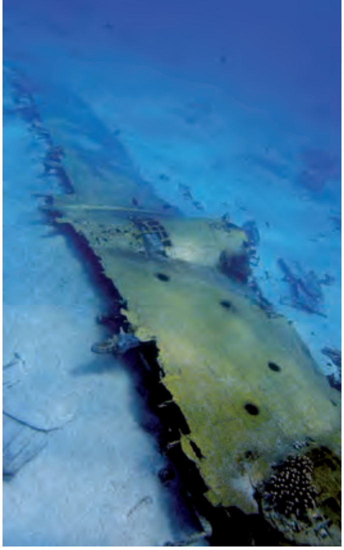
▲ © J. Gribble. Desktop work. All preliminary studies should start with a so-called desk-top phase, bringing together all information from archives, maps and surveys for other purposes that can be relevant for the project. One of the obvious starting points for desktop studies is the inventory of previous archaeological observations which is kept by the competent authority, but information from hydrographic offices, geological surveys and other sources should equally be included.

A project design should begin with a description of the concerned site and then identify any previous research that has been undertaken on it, or any related themes, and should similarly include a literature review. This allows the new project to benefit from the findings of other researchers. It can also save time and costs by avoiding duplication of work that has already been done. The evaluation of previous studies also helps to identify gaps in the knowledge, that is, topics which have not been dealt with or require further research. Areas of research that may need to be considered include archaeological studies, historical studies, biological studies or geophysical studies. The project design should also identify any known modification to the site from natural causes (storms, sea level changes, currents) or by human intervention (engineering, diving), in order to assess any damage to the integrity of the site. ***See Rules 14 - 15***

Project statement and objectives

A 'project statement' is a brief sentence or paragraph that enables the reader to quickly understand the overall nature and scope of the project. It also defines the logic of the intervention. This could be as simple as, "This project is an archaeological excavation of [the site] to uncover new information about the history of [a given country, a given culture, a given aspect of past society]".

The 'objectives' describe the purpose of the project or the major research questions that it will address. These could include questions about technical developments, the history of a civilisation, or a historical event. The objective of a project can also be to facilitate site access, to test a method or to train a team, or to set an example that fits into an overall management strategy. Whether such objectives are commensurate with the importance and fragility of the site in question is for the competent authority to decide. It is important that the objectives and the project statement are formulated in a realistic and attainable fashion. ***See Rule 16***



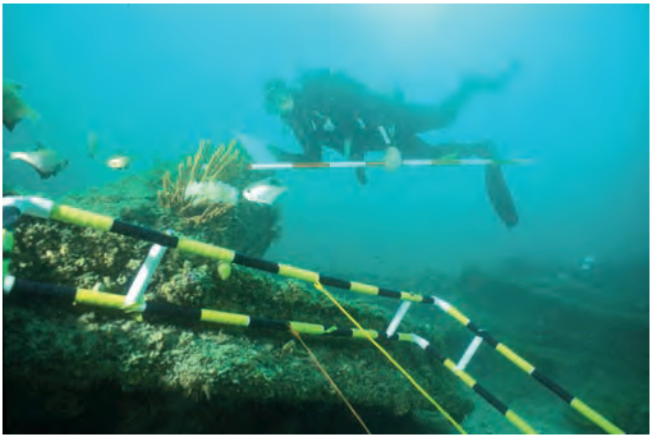
◀ © Ships of Discovery. Wing of a Japanese bomber plane on the World War II Heritage Trail, Saipan Lagoon, Commonwealth of the Northern Mariana Islands.
The project statement should be concise and appealing in the same way that a single picture can convey a more encompassing message. The establishment of a World War II Heritage Trail in the Saipan Lagoon, is for instance conveyed in this image of the wing of a Japanese H8K Kawanishi "Emily" bomber plane.
Students and faculty from Flinders University (Australia) have led archaeological and historical investigations into submerged World War II heritage (planes, tanks, landing craft, ships) in Saipan Lagoon with the purpose of creating a World War II maritime heritage trail for both local people and diving tourists. This project aims at educating citizens and visitors about the importance of our submerged cultural heritage and to provide a sustainable heritage tourism product which will stimulate the economy of the island of Saipan. Working with local heritage and marine agencies, archaeologists have been surveying and mapping these sites for public interpretation and inclusion on the trail. Project personnel also have been conducting training courses in underwater archaeology to enable local divers to participate in the recording of the island's history.

Methodology and techniques

'Methodology' refers to how the project is going to be undertaken. Which approach will be taken? Which techniques will be employed? It defines how the identified research questions will be answered. For example, if the question is about the age of the site, the methodology will be to establish that age through dendrochronology or radiocarbon dating, stratigraphy, studying the presence or absence of certain classes of objects at the site or the identification of specific marks or serial numbers on specific objects. ***See Rule 16***

Funding

Funding plans need to consider all anticipated project costs before work begins on a site and equally comprise a contingency plan for funding losses. This ensures that the project can be completed successfully and that the site and the artefacts it contains are not randomly and unnecessarily disturbed. Anticipated costs can include work vessels, dive



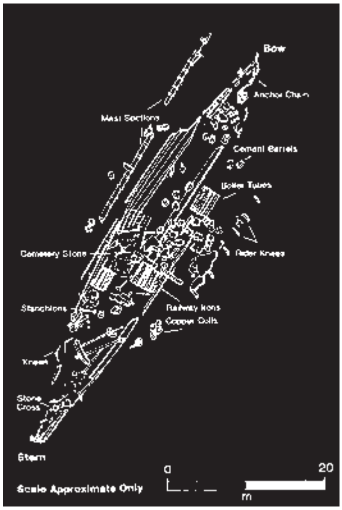
▶ © National Parks Service Tasmania. Site of the *Centurion* sunk in 1887 in Sydney Harbour, New South Wales, Australia.
The project design should include the full range of survey techniques that will be employed, including non-disturbance survey such as cameras and scales in the instance of this project on the site of the *Centurion*.

facilities, personnel, and travel/transportation costs. If a project is intrusive, it should also include conservation facilities, site stabilization and long-term storage of recovered artefacts. Materials that have been under water for a long time can deteriorate rapidly when they are placed in a dry environment. Therefore, adequate funding should be sourced to ensure that the collection of artefacts can be properly conserved and stored and that the site can be stabilized as appropriate. ***See Rules 17 - 19***

Timetable

▶ © T. Maarleveld. Gradiometric magnometer survey, IJssel delta, Netherlands.
A timetable is an essential part of a project design as it assures that activities are planned in a logical sequence without delay while allowing for optimal use of necessary weather windows, equipment and staff. Moreover, a timetable allows commissioning and funding bodies to know when to expect results in the form of a report or clearance for accession of the site. Timetables are particularly strict when activities are undertaken in advance of construction or dredging work. This image illustrates such a case on the example of a gradiometric magnetometer survey before contaminated sludge is to be removed in the IJssel delta.

A timetable for each individual section of the project and the completion of the entire project ensures that there is a commitment to deliver results within a reasonable period. Depending on the scale of the project, this may range from 6 months to two years for limited projects, and a lengthier period for large ones. The timetable should establish the duration of field work, the anticipated duration of conservation work, the delivery of any interim reports and the completion date of the final project report. It should moreover set clear deadlines for the conclusion of project sections and the project as a whole, taking account of risks that can cause delays. Completion dates should be agreed upon by the competent authority as part of the project approval process. ***See Rules 20 -21***



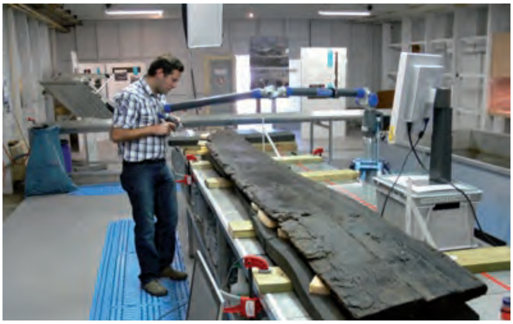
▲ © T. Smith. Site plan of the *Queen of Nations* sunk in 1881, Corrimal Beach, New South Wales, Australia.
Funding estimates must include consideration of the time and cost of developing detailed site plans before, during and after the intervention.

Composition of the team

Project teams need to be matched with the type of project being conducted. They should be composed with a view to the qualifications, responsibilities and experience of each team member and cover all aspects of the project that in return require very diverse profiles. It is appropriate for the competent authority to require proponents to provide details of the qualifications of the archaeological director and other key personnel before project approval is given. ***See Rules 22 - 23***

Post-fieldwork analysis and other activities

At the completion of fieldwork, an analysis and interpretation of results is undertaken and report writing begins. Further research may be necessary in light of information that has been uncovered. Each week in the field may mean at least 2-3 weeks or more analysing the results and report writing, depending on the complexity of the project. Sharing and providing access to information gained from underwater cultural heritage investigations through appropriate archives is a key principle of the 2001 Convention. Therefore, other post-fieldwork activities may include media coverage, lectures and preparation of publications for popular or academic purposes. ***See Rules 30 - 31***



▲ © K.Vandevors / Onroerend Erfgoed. Post-fieldwork analysis on the Doel Cog, Flemish Cultural Institute, Antwerp, Belgium. 3D measuring of timbers with a 3D recording arm and a real-time control in a Computer-Aided Design or Drawing program (CAD) is developing into a standard for ship-archaeological research. A more or less informal network the Faro-arm / Rhino Archaeology User Group (FRAUG) connects nautical archaeologists applying this technique and provides for mutual assistance. This picture shows a team documenting and analyzing planks from the Doel Cog.

Conservation programme for artefacts and site

Any recovery of artefacts or other intervention on a site will have implications for site and artefact conservation. Sites and artefacts that have been under water for a long time can deteriorate quickly once they are interfered with. Any equilibrium with the environment that ensures stability will be disturbed. This is true for the site as a whole, but is particularly evident when artefacts are recovered and exposed to dry air. Conservation requires specialized expertise from qualified material conservators.

Therefore, this section of the project design must clearly identify arrangements for conservation treatment of artefacts and site stabilization. For sites with a large and complex collection of artefacts, a field conservation laboratory is advisable. Packaging and safe transportation of the artefacts have to be accounted for and planned. Storage plans should be concerned with practical accessibility of the material for researchers involved in the preparation of the report. Redundancy in the recording process should be ensured from the field work operation to the laboratory. This may involve the use of parallel data logging systems and parallel data storage systems to provide insurance against system failures and information loss. It should also be accompanied by compatibility and clear relational cohesion between all the different types of records, whether field notes, site plans, photographs, drawings, videos etc.

The competent authority has a role in ensuring that planning for the conservation process begins well before any artefact is recovered. The inclusion of a conservation programme in a project design is therefore best done in close cooperation with such competent authorities. Moreover, archaeologists should work closely with materials conservators in the planning process and development of the project design. Where possible, a materials conservator should visit a site prior to excavation and, if possible, be present to assist with the excavation. This will enable them to assess the condition of artefacts that may be recovered and guide the development of appropriate conservation facilities and procedures. ***See Rule 24***

Site management and maintenance

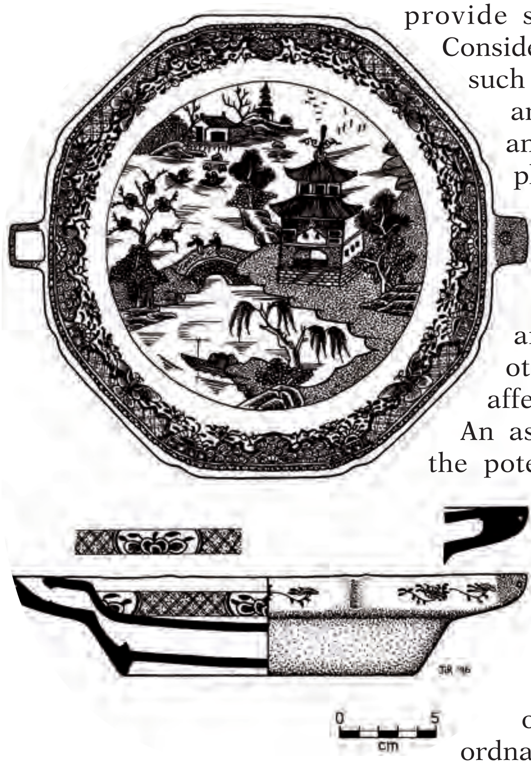
A site management plan identifies a site's stakeholders and authorities with a view to engaging them in the curation and guaranteeing sustainable use of the site. It regulates access and research, includes provisions for public education and information, tourism, sustainable use, and should include a vision for the future. Moreover, it identifies risks for site stability and conservation, proposing a policy framework of adequate measures. Once a site of underwater cultural heritage has been disturbed, it is vulnerable to the effects of waves, tides, currents and storm activity. Changes in the stability of a site can occur quickly and with little warning. Site management and maintenance policies are a part of risk management and should provide mechanisms to deal with such contingencies promptly and effectively during the whole duration of the project. Moreover, these policies will inform the management of the site after the termination of the project. ***See Rule 25***

▼ © Syddansk Universitet. Documention work on a shipwreck site.
Although archaeology goes largely beyond documentation, it is nevertheless one of its cornerstones. Each activity, each observation should be documented. During fieldwork archaeologists establish plans, take photographs, make accurate drawings and record the circumstances of the project in observation reports. The project design needs to assure for correct documentation. A fieldwork day is not finished before all logs and reports have been written.

Documentation programme

Once a site has been disturbed, it cannot be restored to its original condition. It is therefore essential that a comprehensive site record be established and that all aspects of the project work are methodically documented as a permanent archive. This documentation needs to be stored in a stable environment and on stable and secure storage mediums. It is also important that documentation is to a standard that enables comparisons with data from other sites and other cultural heritage jurisdictions, so that it can become part of an increasingly valuable body of research. ***See Rules 26 - 27***

▼ © Tasmanian Parks and Wildlife Service. Drawings of artefact from a shipwreck.
Drawings of some artefacts can reveal more detail and information than photographs. It is skilled work and the Research Design needs to include planning for the people and resources needed to produce these drawings.



Safety

Work in an underwater environment requires high standards of safety to ensure the well-being of all participants. Risk management should identify all possible dangers associated with a project and provide strategies that mitigate dangers. Consideration should be given to issues such as: dive training, fitness to dive, and the availability of safety equipment and medical aid, injury management plans, decompression chambers, emergency evacuation plans and communication plans. The environment of each site should also be assessed in view of depth of water, currents, and exposure to heat, cold or any other extreme weather that could affect the safety of the project team. An assessment should also be made of the potential for any toxic substances to be present in the water or in the sediment as these could result in long-term health problems. These substances are particularly common in rivers, harbours and near industrial facilities. But toxic substances can also be part of the deposit, just like unexploded ordnance or dangerous cargo. ***See Rule 28***

Environment

Any activity directed at underwater cultural heritage intrudes in an alien environment. Excavation entails the disturbance of sediments and of site content. As with a dredging programme this may affect the surrounding ecology or produce physical instability. Excavation can increase silt within the water column or release toxins from a wreck or the sediment. An environmental management plan should be required as a matter of policy by the competent authority to ensure that these matters are fully addressed. ***See Rule 29***

▲ © Syddansk Universitet.
Standby diver.
Safety should be addressed in every project design. Each part of equipment and each activity have their particular safety issues. All projects that include diving operations will require a standby diver. The standby diver need not be equipped with the same equipment as the primary diver but shall have equivalent depth and operational capabilities.

Collaboration with museums and other institutions

Sites of underwater cultural heritage are typically highly complex and include many aspects of public and academic interest. Collaboration is the key to maximising both the expertise and the information that can be gained from these sites. Museums specialise in making artefacts and scientific information accessible to the public. Universities and other institutions focus on scientific research and training. Cultural heritage agencies develop policies and procedures that provide cohesive, coordinated and consistent site management for overall public benefit. The project design should indicate how effective collaboration with existing institutions will be achieved. ***See Rules 32 - 34***

Report preparation

Well-structured project reports need to provide a thorough record of the project and address all aspects of the authorized Project Design. The project report will be an important source of information for any future decisions concerning the site, as well as for future scientific analysis and synthesis. It is therefore important that the report be as factual as

▶ © T. Maarleveld. A team of the South African Heritage Resource Agency, South Africa. Collaboration with all possible stakeholders is essential for assuring the best results of a project and the dissemination of knowledge. An example for this is for instance the National Survey of Underwater Heritage in South Africa that is sponsored by the national lottery and is implemented by a team of the South African Heritage Resource Agency in close cooperation with national and local museums, as well as diving schools and recreational clubs.

possible and that observations and interpretations can clearly be distinguished. ***See Rules 30 - 31***

Deposition of archives

The Rules define the project archives as including both the documentation and the underwater cultural heritage removed from a site. Ideally, both will be stored together. In practice, this is not always possible, as different materials have different requirements. The project design should indicate how these issues will be addressed in accordance with guidance from the competent authorities. Two equally important considerations apply. One is the integrity of the site, documentation and collection. The other is appropriate access for researchers and the general public. All documentation regarding underwater cultural heritage – including heritage removed from a site – should be stored in an archival environment to ensure it is retained and available for future generations. Appropriate storage should be established for records such as photographs, drawings, field notes, reports and any other electronic data. Museums, cultural heritage management agencies, government libraries and other dedicated archive facilities may all be suitable repositories. ***See Rules 32 - 34***

Programme for publication

The information gained from investigation of sites of underwater cultural heritage is essentially public information. It is therefore important that any project directed at underwater cultural heritage includes a commitment to publish the findings of that work. This should include popular media, such as newspapers, magazines, videos, television, internet sites, web blogs, as well as academic publications, so that the results can be examined and tested by peers and other scientists. ***See Rules 35 - 36***

Following and adapting the project design

Rule 11. ***Activities directed at underwater cultural heritage shall be carried out in accordance with the project design approved by the competent authorities.***

Once approved by the competent authority, a project design becomes a contract between the proponent and that authority. It is a commitment to conduct the project according to all aspects of the project design. Failure to comply with the project design should be regarded as a breach of contract. It is the role of the competent authority to establish a system of penalties appropriate to the nature and extent of such a breach. It is for this reason, among others, that the project design should contain contingency plans that identify alternative courses of action when facing certain unexpected situations.

▲ © M. Manders. A briefing on-board a research vessel. Research projects that are conducted from a research vessel use the mess (where the whole team gathers for meals) for briefing and debriefing. Whiteboards help in the planning of the activities and interventions.

Rule 12. ***Where unexpected discoveries are made or circumstances change, the project design shall be reviewed and amended with the approval of the competent authorities.***

Thorough research and planning during the development of the project design will minimize the occurrence of unanticipated circumstances and unexpected discoveries. This is true for interventions of limited scope, but it is likewise true for research projects where there are many unknown factors. It is part of the nature of archaeological research that the specific contents of archaeological deposits are not known before they are uncovered. However,

▲ © Centre for International Heritage Activities / MUCH. Briefing on the deck of a ship during the MUCH training that took place in 2010 in Zanzibar, Tanzania.
In a project including field survey, every discovery – expected or not – will influence the project's progress and proceedings. A good project design should accommodate for unexpected discoveries, without being open-ended. Some discoveries may lead to the reconsideration of the next steps of a project. Following unexpected discoveries, the project design needs to be adapted in order to comprehensively deal with the newly discovered finds, or alternatively to explicitely exclude them from the project in order to retain the focus on the project's original aims.

that does not prevent good overall planning.

There may be circumstances or unexpected discoveries that suggest a need to depart from the original project design. Where such circumstances or discoveries do occur, it is the obligation of the project director to develop options for amending the project design, advise the competent authority, and to obtain approval for an amendment. In extreme cases, an option could be to cancel or postpone the project until conditions can be met to face the challenges determined by the unexpected discoveries.

Project design in cases of urgency

Rule 13. ***In cases of urgency or chance discoveries, activities directed at the underwater cultural heritage, including conservation measures or activities for a period of short duration, in particular site stabilization, may be authorized in the absence of a project design in order to protect the underwater cultural heritage.***

Natural disasters, illegal activities or chance discoveries during authorized activities that are not directed at underwater cultural heritage can expose sites and make them suddenly vulnerable to decay or destruction. *Rule 13* provides for flexibility in relationship to procedures and paperwork that is otherwise necessary.

It is no excuse for inconsiderate action. "*Think first, act second*" is still wise. All the aspects listed as part of the Project Design in *Rule 10*, still need to be addressed. Safety is still an issue and so is the choice of an adequate methodology.

In case of emergencies:

- Rule 13 provides for flexibility
- It specifically addresses
    - site stabilization
    - conservation measures
    - activities of short duration
- Think first, act second
- Check the aspects listed in *Rule 10*

When emergencies recur:

- Develop a strategy for emergencies, including
    - action plans
    - model project designs
- Develop a strategy for discovery in planning and development
- Target sites under development in research strategies

The recurrent nature of '*cases of urgency or chance discoveries*' is a good reason to develop general strategies including action plans for specific kinds of contingencies. With such a strategy, one can have 'action' or 'project' designs in place even before the occurrence. The same is true in relationship to discoveries in the context of planning and development. If anticipated, such discoveries are an asset rather than an impediment. Research strategies can target such heritage under stress in preference to sites that can be preserved *'in situ'*.

Responses to cases of urgency can vary. Two examples of emergencies and associated response options may be given:

- *Storm damage*: most underwater sites are relatively immune to storm damage. In many cases this is part of the normal process by which sites are formed. However, in cases where unusual damage is suspected, immediate responses may include:
    - An immediate visual inspection by divers, cameras or remote sensing equipment to accurately record and assess the existence or extent of damage. This documentation may be all that is necessary but should be followed up with a written report and archival storage of the documentation;

- If there has been damage to a site, an assessment needs to be made about how the site can be stabilized. Mitigation through a covering of sand bags or of sand over artificial grass, netting or wire mesh may help to re-stabilize the site.

- *Scouring damage* can result from a change in the direction of currents, dredging or illegal artefact recovery. If scouring is the result of:
    - a natural event, the exposure can be of short duration. It may be an opportunity to record the current condition of the site. No further action may be necessary. It may also be a recurrent phenomenon, or expose the site permanently.
    - dredging or illegal activities. It is very likely to permanently expose the site. An initial assessment should identify the nature of the material exposed and whether there is archaeological material that needs to be rescued. A qualified materials conservator should then be a part of the team. Any recovered material should be kept in a moist environment. A project plan should be developed immediately to identify and establish arrangements for subsequent conservation and storage.

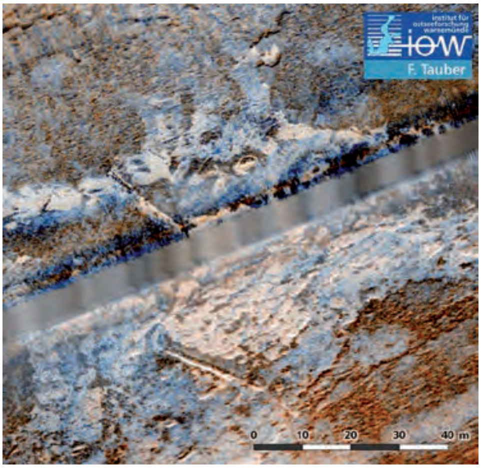
These are just two examples of recurring events that may occasion urgent intervention. Competent authorities may identify other circumstances that call for sudden action.

It is for instance not unusual for highly informative pieces of wreckage or other cultural heritage to wash ashore on dynamic beaches. This is the result of the processes described above, but these pieces usually originate from previously unknown sites. Having a strategy in place on how to deal with such pieces and how to decide what can be disposed of and what should be documented and kept, will assist in decision-making. Action may, however, have to be engaged in a fully unprepared manner.

It should nonetheless be remembered that these cases of non-compliance with the prerogative of project design should be limited to periods of short duration, in particular emergencies with regards to site stabilization and safeguarding of information. Moreover, such activities need to be approved and authorized by the appropriate authorities.

◀ © T. Maarleveld. Remains of a 15th century barge destroyed in a construction project, Nijmegen, Netherlands.
Unfortunately cases of urgent intervention for the protection of heritage arise, which are often caused by a lack of awareness. This was the case for a 15th century river barge that was almost completely destroyed in a construction project near Nijmegen in the Netherlands. The destruction was noticed by a local diver alerting the authorities. In such instances, it is most helpful to have a standard project design at hand for quick evaluation and coordination. The readiness of such a plan will help in the deployment of capacity and funds. Further steps can be added as soon as responsibilities and the financial framework of archaeological intervention become clear.

III. Preliminary work

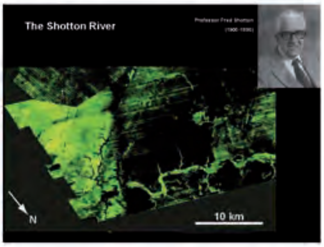


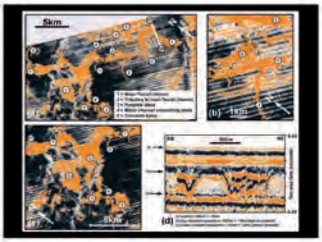
▲ © F.Tauber / IOW. Composite sonar image of the seabed in Wismar Bay, Germany.
Detailed sonar recording of large stretches in a prelimary survey can not only reveal individual sites, but can reveal patterns that indicate the presence of eroding Prehistoric landscapes at the bottom surface. Here, a composite sonar image of the sea-bottom in the Wismar bay in the Baltic shows the presence of trees and their roots, the remains of a forest that drowned 6,000 years ago.

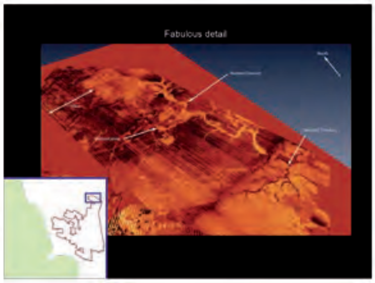
In dealing with any underwater site, it is important not to take any rash action or draw blunt conclusions. This is true for any previously unknown archaeological site, whether or not it is under water. It is important to stand back, reflect and systematically verify which action 'directed' at this particular site would be the most appropriate and realistic, and would be most beneficial for the site's protection, and its role as memory of humankind. The Rules therefore require a project design for any activity as well as a phase of preliminary work to inform this design. *Rule 10* touches on this issue, which is then dealt with more explicitly in *Rule 14* and *Rule 15*.

A site should be evaluated for what it is (*Rule 14*) and then compared to what is already known from history, archaeology, geology and environmental sciences through background studies (*Rule 15*).

Whereas *Rule 14* concentrates on the preliminary work that relates to field evaluation, *Rule 15* concentrates on the background studies known as 'desk-based assessment'. Both are intricately related. The background studies feed into the evaluation of significance and scientific potential. The evaluation of the site *per se* should be completed by placing its characteristics and promises in the context of what is already known and whatever gaps are perceived in the knowledge that results from previous studies. The two processes should each follow their own logic and then be integrated in the conclusion of the preliminary work. This can result in a text that is similar to the synopsis on the back cover of a book, combining characteristics, promises, uncertain relations, issues that might go wrong and unsolved questions.







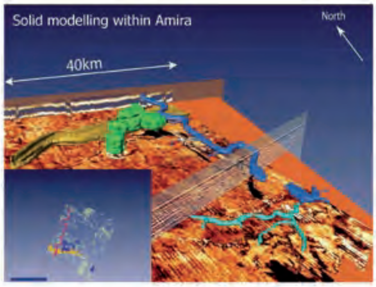
©The Institue of Archaeology and Antiquity, University of Birmingham. Geological data collected during preliminary work on the sediments of the North Sea, UK.

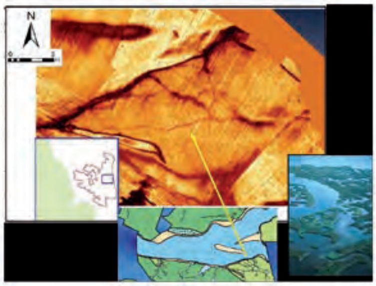
All preliminary study should start with desktop research that brings together all relevant data that has previously been collected. This can be historic data, geological and field data that has been collected for other purposes than the present purpose.

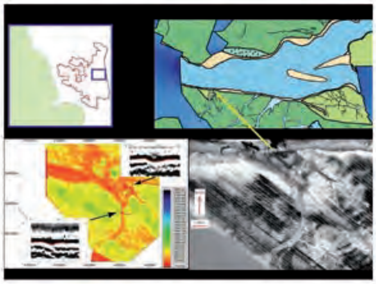
How informative the analysis of the data collected for other purposes can be is shown in this image of a succession of superimposed Pleistocene and early Holocene landscapes hidden in the sediments of the North Sea bottom. It was composed by a research group of Birmingham University that processed the shallow section of seismic data collected in the search for oil and gas in far deeper layers since the 1960s, using advanced 3D computing. This allowed to reveal the true morphology of Quaternary features, highligthening a large river valley (600 m wide and 27.5 km long) from an ancient landscape existing 10,000 to 7,000 years ago referred to as the Shotton River. From an archaeological perspective, questions naturally arise as to the possible climate, ancient settlements and migration patterns 10,000 to 7,000 years ago.

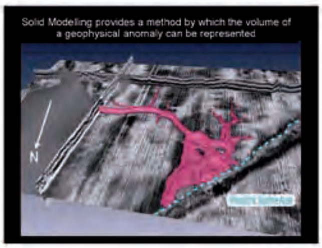
Virtual rending of the Mesolithic sites of the Shotton River based on geo-seismic data, North Sea, UK.

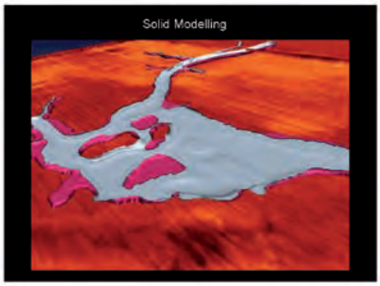
The University of Birmingham undertook a very ambitious project to visualise an otherwise inaccessible Mesolithic site of the Shotton River with Virtual Reality (VR) technology, exploiting real geo-seismic data sources of the southern North Sea and thus to reconstruct the ancient Shotton river valley discovered while gathering seismic data for petroleum in the North Sea. The virtual landscape reconstruction is populated with vegetation types based on pollen records of the same period in nearby region, and 3D models of Mesolithic dwellings have been grouped into villages and positioned near possible settlement areas. The final VR environment has been "brought to life" via real-time interactive walkthroughs, complete with environmental and spatial sound effects.











Site assessment

***Rule 14.** The preliminary work referred to in Rule 10 (a) shall include an assessment that evaluates the significance and vulnerability of the underwater cultural heritage and the surrounding natural environment to damage by the proposed project, and the potential to obtain data that would meet the project objectives.*

A preliminary assessment of a site should include descriptive information and an evaluative section on:

- location
- depth
- stratigraphic position
- extent
- nature of remains
- condition of remains
- environmental conditions

Preliminary work essentially takes place in anticipation of an intervention. No operation must be undertaken without it, regardless of whether it aims at consolidation, at facilitating access or at full excavation.

As regulated by *Rule 14*, the preliminary work needs to include assessments of site significance, vulnerability and the potential to reach project objectives. It should address basic issues, such as the extent of the site, depth, stratigraphic position, the general condition of preserved remains, and site integrity. It should also include a description of other general characteristics and above all else, draw an analytical comparison with other sites.

The emphasis on evaluation of preliminary studies in a project design in *Rule 10* is intended to ensure that decisions concerning heritage are rational and transparent. They define what is known at that point of time and serve the following purposes:

- inform the competent authorities about the site, its context, environment and condition;
- provide a basis for a region's inventory;
- provide the basis for development of a management plan; and
- provide the basis for the design of (any) project directed at this particular site.

Rule 14 specifically refers to the evaluation of:

- the significance of the site and the underwater cultural heritage concerned;
- the vulnerability of the heritage to damage by the proposed project;
- the vulnerability of its surrounding natural environment to damage by the proposed project;
- the potential to obtain data that would meet the project objectives.

The advantage of standard approaches

In view of a proposed project, preliminary work may concentrate on specific points, but ideally it should adopt a form that is very comparable to the assessment of other sites in the region. When assessments and evaluations always follow the same logic, they are easier to understand and to use as the basis for decisions. This is important for comparison and for the purposes of inventory and management. Therefore, the adoption of a common assessment format is desirable, especially within one and the same project area. Arguably, the advantage of standard approaches also applies to a whole region or even worldwide.

◀ © Ships of Discovery. Dr. Margaret Leshikar-Denton carefully mapping in a fire coral-encrusted carronade from the US Navy Brig *Chippewa*, wrecked in 1816 in the Turks & Caicos Islands, British Overseas Territories, United Kingdom.

While the *Rules* concern activities *directed* at underwater cultural heritage, such activities are only a part of the wider heritage field and of wider heritage policies. A standardized approach to preliminary assessment – across the range of different sites and purposes– adds to the possibilities for comparing sites and for prioritizing protection, research and monitoring, both within a region and across national borders. Maritime cultural heritage research is by definition an international discipline: submerged landmasses may have joined presently separate nations. Ships were built to cross maritime borders. Sea routes connected people, markets and cultures. Common standards for assessment are therefore an asset.

Assessment of significance

One of the aims of a preliminary assessment is to establish the significance of a site. This is required in *Rule 14*, but it does not define what significance is; nor could it. Like beauty, significance cannot be defined in legal terms. Nevertheless, although it is difficult to strictly define, significance is quite easy to understand. In relation to a site, an object or a story, significance is the quality that makes it meaningful or of consequence, for a person, for a group, or for humanity as a whole. It is precisely because of its significance that something is regarded as heritage, as a legacy to be preserved and passed on to future generations. That is why significance drives heritage management, interventions and protection. It was in fact in recognition of the universal 'significance' of underwater cultural heritage that a convention for its protection was called for in the first place.

The assessment of significance has an effect on all subsequent choices and management decisions. It:

- determines whether a site is
  - considered heritage;
  - inscribed in the inventory;
  - listed in a specific protection scheme;
- determines what opportunities are recognized;
- prefigures
  - the sentiments of potential 'stakeholders';

- the research questions that are conceived of as relevant to the site;
- the research questions for which the site is conceived of as relevant;
- influences future planning and mitigation schemes; and
- informs discussion on what
  - measures should be taken for sites, especially for those under threat;
  - can and should be preserved *in situ*; and
  - can or should be destroyed for the sake of research and development.

Although preliminary assessment of significance is just one step in the cycle of understanding and managing underwater cultural heritage, it is a very

The criteria used to determine the intrinsic value of a site are:

a. Archaeological significance: the potential to yield important information about the past through archaeological investigation
b. Historical significance: the association of a site or an object with people, events, activities, places and themes in local, regional, national or international history
c. Research significance: the measure in which a site, an object or collection may be relevant to settle topical research questions in archaeology, history or any of the other sciences
d. Aesthetic significance
e. Social or spiritual significance and remembrance value
f. Visibility and experience value
g. Economical significance

Additional comparative criteria are used to evaluate the degree of significance of a site or object in comparison with other sites in an area:

a. Provenance
b. Period
c. Representativeness and group value
d. Rarity/uniqueness
e. Condition/completeness/fragility
f. Documentation
g. Interpretive potential
h. Accessibility

important one. It is even on the basis of that assessment that the choice to revisit the site is determined. It should therefore be carried out in a responsible, competent and transparent way.

Even when significance is hard to define in objective terms, it can be assessed objectively. Besides being subject to change and to the subjectivity of each observer, the significance of a site or artefact is the result of a range of intrinsic characteristics, which can be objectified and make it meaningful. One way to measure the degree of the resulting significance is through comparison with other sites or artefacts.

Intrinsic characteristics

The purpose of significance assessment is to establish, as objectively as possible, the intrinsic qualities the site displays and the different scales or dimensions according to which it may be or become significant. This can be done by the use of a simple scale, on which the intrinsic qualities are scored. Possible associations, opportunities and the significance for different stakeholder groups can then be discussed in a simple but systematic way. By applying such an approach, it is quite possible to argue clearly and transparently why the site is considered significant and why its significance may be enhanced by the intended project. If a site is important for answering questions on a research agenda, it is for instance a legitimate dimension of significance. Aspects such as symbolic memory, the opportunity to integrate conservation with development, or to use heritage as inspiration are equally important. So are the associations of a site with a historical narrative or episode, with a religion or a belief.

Comparison of sites

Thought needs to be given to the assessment of significance in a wider context, i.e. in comparison with other sites. Given the necessarily limited means for archaeological research and excavation, not all existing sites can be preserved, researched and managed. A pragmatic choice of interventions therefore needs to be made, ideally based upon the assessment of all heritage sites and their archaeological, historical, artistic and aesthetic significance, in order to ensure the best use of the existing financial means and personnel.

The approach of scoring on a scale can also be applied to assess significance of a specific site or artefact in the context of active inventory or impact assessment. It can then be used for comparative reasons in order to judge if one site is more significant than another. However, by definition, this significance assessment is not absolute. It applies to the context and to the level of available information. Likewise, a ranking exercise may be highly relevant in preparation for a development project whose effects on underwater cultural heritage are to be mitigated, but it has no absolute value. Significance assessment always needs to be reconsidered, whenever new developments take place.

In comparing sites to assess the significance of one of them, it could be argued that a site has no significance if it has not been discovered. However, the role of archaeological discoveries in our present-day understanding of humanity and its history is proof to the contrary, and has led to the protection of undiscovered heritage. This is the reason for reporting systems, for prohibition of unlicensed excavation and for obligations to survey prior to project development. Through these policies, society recognizes the potential significance of undiscovered sites, at least until they are proven to be of no consequence for research. For these reasons, undertaking regional surveys and inventories are important.

Changes in significance

The perception of significance can be different at the local, national or international level. It depends, for instance, on the strength of historic relations or religious associations. Significance is also subject to change. It can be created and enhanced through research and through raising public awareness. The more a site is publicized and discussed in the media, the more significant it becomes. What is considered significant under present circumstances may also lose significance in the future. A site may,

▶ © C. de Juan. Cargo of amphoras from the 1st century BC shipwreck *Bou Ferrer*, Villajoyosa, Spain.
Assessing the potential to obtain data is part of the standard site assessment procedure. It defines the site's scientific importance. Nevertheless, it is one on the most difficult aspects to assess in a comprehensive manner due to fact that it is hard to predict future research questions. A site may thus be considered very important today because it may provide key information pertinent to current research questions while it may all the same prove very important in the future as a test site for questions that have not been formulated yet. In assessing the potential for obtaining data the following proxies can give indications: Has the stratigraphy been preserved? Are organic macro and micro-remains preserved? Is the site integrity preserved? What is the age of the site? Are there few or many sites of that period?
For some sites the potential for obtaining new data in the future is immediately evident. Other sites are better hidden and covered in sediments and growth. The unrealized scientific potential is a very good reason for cautiousness and for the preference of *in situ* protection as the first option.

for instance, no longer be the only or best-known example of a certain phenomenon. Conversely, sites or remains that are not considered significant now, may prove of enormous consequence in the future.

The realization that these changes happen, has considerably influenced the world-wide development of heritage policies. Precautionary and blanket approaches to protection, as well as a commitment to evaluate significance anew, whenever planning, development, specific circumstances or events give occasion, are therefore part of many heritage policies. Such renewed assessment can yet again be considered to be 'preliminary work'. It is then often carried out within the context of impact assessments for planned developments that might 'incidentally affect' underwater cultural heritage, as addressed in article 5 of the convention.

Involving stakeholders

Besides being transparent in the assessment of significance, it is useful, if not indispensable, to involve crucial stakeholders. This may specifically mean consulting specialist researchers and engaging stakeholders in a consultation process. With underwater cultural heritage, this will also often mean engaging stakeholders from other States. Shipwreck sites are often related to tragedies. If these tragedies live on in popular memory, they may have a very specific significance both where they occurred and in the area where the relatives of crew and passengers lived or continue to live. It is clear, however, that the collective memory fades away over time, whether locally or in other affected regions. If, on the other hand, a site is forgotten because it reflects a time beyond memory, its scientific significance as evidence of early contact and exchange may be all the greater, whereas a memory regained, may also be a powerful force.

Assessment of vulnerability

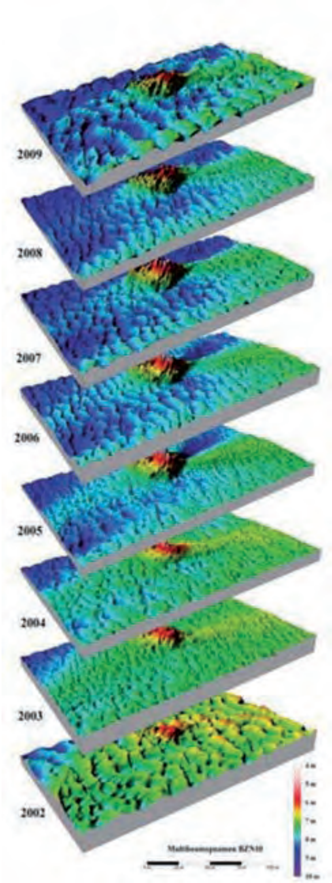
Rule 14 requires the assessment of vulnerability to damage of the underwater cultural heritage in question before the start of any project, as well as the vulnerability of the surrounding natural environment. This concerns the potential impact of a proposed intervention. In a dynamic environment, which the underwater world often is, even a small test pit may have huge consequences on long-term stability, if no measures for consolidation are taken simultaneously.

The vulnerability of a site is a two-sided coin. Stability may be jeopardized even by a small intervention. If, on the other hand, sites are discovered as a result of ongoing erosion, non-intervention may be regarded as a bad management choice, as the environment could be too hostile for long-term preservation. In other words: an assessment of the site's vulnerability may result in arguments for, as well as against, intervention.

In assessing vulnerability it is important not to take any rash action. It might be necessary to decide on full-scale excavation, but temporary measures for stabilization are often faster to be taken and much less expensive. They may gain time for a well-considered decision on the basis of an encompassing research plan and project design. There is also a duty to care for the natural environment in which the site is located. A coral reef or a sensitive ecosystem should not be disturbed without good reason, or without taking care to mitigate negative impacts.

In the assessment, the nature of the deposit and the prevailing environmental conditions will be important. It also needs to be backed up by background studies according to *Rule 15*. There is usually information available on the prevailing environmental factors and forces on the site and its surroundings. Time series relating to depth enable

▶ © Cultural Heritage Agency of the Netherlands/RWS/Periplus. Multibeam sonar view of an 18th century wreck. The ship is probably from northern Germany, whereas the cargo is partly Iberian, but includes South American palm seeds as well. The methods and techniques applied for scientific studies must be as non-destructive as possible and contribute to the preservation of the remains. Surveys with non-destructive techniques can address large areas.
With multibeam sonars a more detailed and scale-corrected image can be obtained. It can for instance show the extent of intrusive disturbance. Multibeam can also be used to monitor gradual change through repeated survey of the same area.



the modelling of erosion and accretion. In addition to tracking formal data, it is very useful to involve the expertise and local knowledge of fishermen, pilots and divers. Factual establishment of the site's current condition and environment, including exact depth and exposed length and width is the basis of the assessment. It is also the base line, which will provide a starting point for future research and monitoring.

Assessment of the potential to obtain data

Each project should be executed in pursuance of project objectives. These may be purely scientific in nature, but they may also address site stabilization, consolidation or providing access. In any case, the project will imply data collection. In projects of excavation or limited intrusion, this implies some measure of destruction, although the process may be of a creative nature. After all, archaeological projects creatively produce knowledge.

The preliminary assessment should determine whether the objectives of a project can reasonably be expected to be met and are well-defined. An important aspect in this is whether or not the site allows for the collection of the data that is central to the project.

Under *Rule 14,* the incorporation of these questions in a preliminary assessment is specifically stressed. It is on the basis of this preliminary work that irreversible decisions on the future of the site will be taken. For the progress of research in a well-defined research agenda, it is justifiable to sacrifice individual sites for a research excavation, and to enhance their significance by in-depth scientific publication. But one should do so with the adequate methods and relying on the sites that provide the best chance of collecting the necessary data,

The assessment of the potential to obtain data pertains to three questions:

- is the site likely to produce the data necessary to resolve the research question(s) at stake?
- are the proposed research methods and techniques adequate for providing that data?
- is any resulting damage proportionate to the urgency of collecting this data?

without unnecessarily compromising sites that would otherwise remain available for future study. Hence a strong preference to target research excavation of sites threatened by development or otherwise.

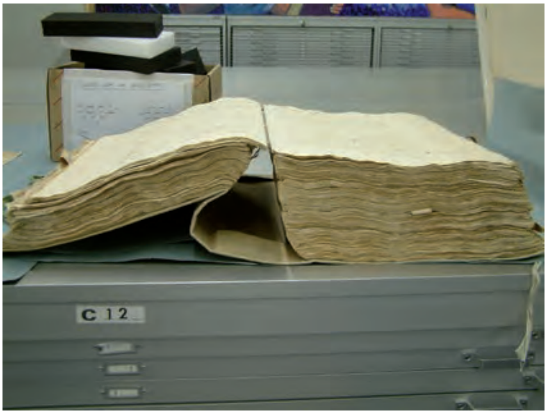
It is also important to reflect on whether the research issues addressed are important and overarching enough to offset the loss of future research potential. Many sites have been ruined in the vain hope of finding definite proof of a possible historical identity. This was frequently done without proper consideration for other, more encompassing research questions for which the assemblage and deposit would in hindsight have provided a unique opportunity.

Background studies

Rule 15. The assessment shall also include background studies of available historical and archaeological evidence, the archaeological and environmental characteristics of the site, and the consequences of any potential intrusion for the long-term stability of the underwater cultural heritage affected by the activities.

Background studies should address the historical and archaeological context of the period in which a site was constituted as well as the concerned region. In this regard, the international character of wreck-sites deserves specific attention, as the verifiable

▼ © National Archives of the Netherlands, The Hague. Documentation on the *Erfprins* from the archives of the Dutch East Indian Company.
Historic background research will include research into the event that led to the site's existence. This is particularly true for shipwreck sites dating to the post-medieval period. Such sites and the historic information on these sites testify to the mixing of cultures and populations that characterize the Modern World as well as providing unique information on local history in many parts of the world. The archives of the English East India Company and Dutch East India Company or the state archives relating to the Estado do India and the Carrera das Indias in Portugal and Spain have therefore been inscribed on UNESCO's Memory of the World.
Historic background research does not just focus on the history of the event. Historical geography provides important information on the development of a specific area and the archaeological sites that it may contain.
The VOC archives in the Netherlands, South Africa, Indonesia and Sri Lanka comprise a total of 2,000 m of shelf for the 200 years of its existence. Individual ships, such as the *Erfprins* – a VOC ship belonging to the Delft Chamber which was lost in 1758 – have their individual folders.



- Evaluation of field data is the first step in the planning of an excavation.
- Desk-based assessment is the way to start inventory and impact assessment.

link of a ship wreck deposit to the region where it is situated may be of a fortuitous nature. The ship may have aimed to link two or more completely different regions, whose historical and archaeological context is equally important for a well-considered evaluation of the site.

The extent of background studies

Field evaluation and desk-based assessment are complementary. Nevertheless, depending on the context, there might be a need to put more emphasis on one or the other.

In a project addressing a particular site, the evaluation of field data is often the first step. If the observations onsite do not warrant the formulation of an extensive project, no such project should be approved or committed to, whether there are extensive background studies or not.

Under other circumstances, desk-based assessment may be the first step. This is especially true for inventory projects or for impact assessment for projects that will 'incidentally affect underwater cultural heritage'. According to Article 5 of the Convention, States Parties commit themselves to *"use the best practicable means ... to prevent or mitigate any adverse effects that might arise from activities ... incidentally affecting underwater cultural heritage"*. It is an obligation that reflects standing practice in many parts of the world and which is also included in other international legal instruments, such as the European Convention on the Protection of the Archaeological Heritage of 1992, or the Convention on Environmental Impact Assessment in a Transboundary Context of 1991.

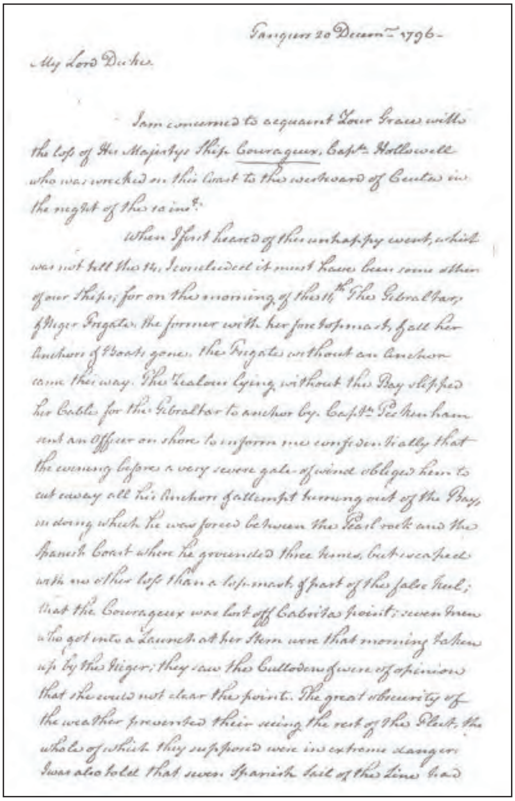
In developing a Project Design for an activity directed at a specific underwater cultural heritage site, the preliminary observations that were made on-site, and that are the subject of *Rule 14*, are important. The extent to which they can be integrated with the different kinds of background studies depends on the nature and detail of those observations. If they indicate that a site is extended, eroding and unstable but give no indication as to a date (other than that the site was previously unknown, and thus beyond memory), and if, as a consequence, a small project is proposed to establish the date of the deposit, then the Project Design should limit itself to discussing that fact. A full discussion of the region's history would not be requisite. If, however, more is known about the site, and a larger project, including excavation, is proposed with the aim of settling a historical question, then that question and its context need wider coverage.

The production of archaeological understanding and knowledge is an iterative process. Decisions are taken one at a time. Each project or management decision should be informed by the previous work - work that is 'preliminary' in that respect.

- Archaeology is an iterative process.
- Each study is preliminary to the next.

Historical and archaeological evidence

In instances where more evidence is available, background studies should be far more comprehensive. According to *Rule 15,* the assessment should include background studies of available historical and archaeological evidence. The desk-based studies should thus integrate all the available archaeological evidence that has previously been gathered and refer to all historical evidence that is available.


Tangiers 20 Decem.r 1796.

My Lord Duke

I am concerned to acquaint Your Grace with the loss of His Majestys Ship Courageux, Capt.n Hallowell who was wrecked on this Coast to the westward of Ceuta in the night of the 10 ins.t

When I first heard of this unhappy event, which was not till the 14, I concluded it must have been some other of our Ships; for on the morning of the 11th The Gibraltar, & Niger Frigate the former with her foretopmast, & all her Anchors & Boats gone. the Frigate without an Anchor came this way. The Zealous lying without the Bay slipped her Cable for the Gibraltar to anchor by. Capt.n Pakenham sent an Officer on shore to inform me confidentially that the evening before a very severe gale of wind obliged him to cut away all his Anchors & attempt turning out of the Bay, in doing which he was forced between the Pearl rock and the Spanish Coast where he grounded three times, but escaped with no other loss than a topmast & part of the false keel; that the Courageux was lost off Cabrita point; seven men who got into a Launch at her Stern were that morning taken up by the Niger; they saw the Culloden & were of opinion that she could not clear the point. The great obscurity of the weather prevented their seeing the rest of the Fleet, the whole of which they supposed were in extreme danger. I was also told that seven Spanish sail of the Line had

Research into historical and archaeological evidence is an essential component of an archaeological project as it can provide a wealth of historical context and moreover assist in establishing contact with other researchers working in the same field or related disciplines. There are different levels and intensities of research that can be undertaken depending on the purpose, as, for instance, the identification of a shipwreck, the contextual background of a specific site, the historic overview of an area, or comparative analysis of a site type.

The challenges faced during background studies in historical archaeology are

- the identification of sources,
- the acquisition of access to these sources and
- the possession of the necessary skills to make actual use of these sources (i.e. language skills, technical understanding, deciphering difficult writing, etc.).

◀ © MMRG. Letter of the English Consul of Tangier to the Governor of Gibraltar that helped recognizing the wreck of the *HMS Courageux* in the Straits of Gibraltar, Morocco.
The first page of the 20 December 1796, letter from the English Consul at Tangier, J.M. Matra, to the Governor of Gibraltar, Lt. Gen. Charles O'Hara. The letter, found in the National Archives, Kew, recounts the wreck of the 74-gun British ship-of-the-line, *HMS Courageux*, on 10 December 1796, on the Moroccan coast of the Straits of Gibraltar. This letter helped the Morocco Maritime Survey identify a cultural assemblage located during their 1999 survey off shore of Jebel Musa, Morocco

In terms of evidence types, there is a basic distinction to make between primary and secondary sources. Primary sources are original documents established at the time of the event or at the time of earlier investigation of the site. These may be ship logs, original accounts or survey-records. Secondary sources, on the other hand, analyse the event or the original document, or report analytically on the observations that were made in previous interventions. The consultation of reliable secondary sources enables an initial overview of a topic. In many instances, however, it is indispensable to verify the information obtained with the help of primary sources.

International, national, local and personal archives across the world contain an impressive breadth of historical information relevant to underwater archaeological research projects. In complement to geological, environmental and archaeological data, they encompass a wide array of documents that are relevant to different classes of underwater cultural heritage. The following types of sources are, for example, relevant to the research of ship losses, especially from the postmedieval period:

- depictions and iconography (paintings, drawings, etchings, etc.);
- aerial photographs;
- recorded accounts of witnesses;
- maps and charts;

- ship plans, such as blueprints of the construction of a vessel, and models;
- logbooks, repair lists, lading bills (shipping receipts), muster rolls (name lists), passenger lists and cargo manifests;
- combat records, war diaries, regimental and vessel histories;
- ship records;
- lighthouse keepers' logs and lifeboat records;
- port and customs records;
- insurance records;
- private letters, diaries, journals and company correspondence;
- memorial plaques, rolls of honours, etc.

Not all archives possess catalogues and specific information is often difficult to track. Moreover, a vast number of websites contain information, which may be of interest, but needs to be controlled for merit, authenticity and quality. Many archives and libraries, however, have started to put amazing amounts of records on the web, creating a digital memory of the world. As with information contained in books, there are simple criteria that can help in assessing the reliability of a website: author of the page, date, URL, references to other sources, objective reasoning and fair coverage, reviews of the site, etc. Excellent sources available on the Internet can be museum and library databases, as well as official archives with online catalogues and academic journals.

▼ © National Archives of the Netherlands, The Hague. Map of the Indian Ocean from the Cape of Good Hope to Japan as included in the archives of the Dutch East Indian Company. Early maritime maps are a very important and international source of information. Ever more historical map collections are accessible through internet. This map of the Indian Ocean is part of the archives of the Dutch East Indian Company (VOC) which are inscribed in the UNESCO Memory of the World Programme.

Independent of the sources consulted, a thorough and scientifically rigorous approach is needed to avoid gross errors and the perpetual prolongation of myths that can be easily falsified. As any written account of an event always reflects a singular point of view, and is framed by the circumstances and the time, historic research

▶ © Zmaj. Apoxyomenos statue found in the Adriatic Sea in 1999. Zadar Museum, Croatia.
The identification and dating of the Croatian Apoxymenos statue illustrates the importance of the study of historical evidence.
On the basis of the historical information and the archaeological context, this Croatian Apoxyomenos statue is likely to be a copy dating from the 4th century BC. It is presumed that it does come from a shipwreck that occurred between the 1st century BC and the 1st century AD. Roman period life-sized bronze statues are very rare, about 20 have been recovered, and there are only a few original works. Copies are much more frequently done in stone, hence the significance of the bronze Croatian Apoxyomenos. The best known Apoxyomenos was made by Lysippos in the late 4th century BC. The manufacture of statues of athletes is most often associated with victory at the Olympic games, and they were a votive gift to a god, and an expression of the pride and glory the winner brought to his city. Apoxyomenos has also been depicted on grave stele, reliefs, gemmas and statuettes. The Croatian Apoxyomenos is very similar to the one kept in Vienna, which was believed to have been an original, and which was found in 1896.

needs to critically reflect all the information obtained. Any information discovered in the course of archival research should be supported by confirmatory evidence from additional sources.

In background research for activities directed at underwater cultural heritage, the key information of any document consulted needs to be recorded in order to ensure traceability and comprehensibility of the research undertaken: title, author and place of publication, or the reference number, together with page or folio number. Records should be safely stored and copies made. Upon completion of the project, all information gathered during background research should be integrated into the project archives.

Archaeological and environmental characteristics

Rule 15 specifies further that preliminary assessment shall include background studies of archaeological and environmental characteristics of the site. The assessment of the archaeological characteristics has already been discussed in the context of the evaluation of significance under ***Rule 14***. Background studies on the environmental characteristics of a site primarily refer to those environmental factors that are relevant to an interpretation of site formation processes, stability and degradation. Such study needs to take a wider area as its focus and will typically concern evaluative study of:

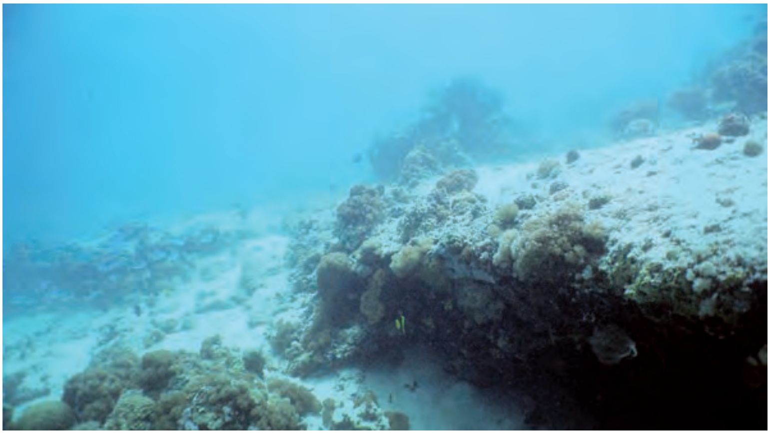
- depth contours according to recent and older navigation maps;
- the substrate and the type of seabed also with respect to shifting sands, scouring (erosion) or silting (deposition of seabed materials);
- the sedimentary make-up of the area;
- data on local sea-level change in relation to submerged land-surfaces;
- seawater composition;
- weather conditions and sea-state, dominant winds and fetch;
- tides, currents and underwater visibility;
- information on historical use of the area, including the presence of historical ports and navigation channels;
- information on shipwrecks in the area;
- previous archaeological observations in the area and its wider surroundings, including both loose finds and sites.

It is wise to back-up the assessment through interviews with people with thorough local knowledge, such as fishermen or pilots. The data combined in a deskbased assessment may have to come from very different archives, institutions and informants. Project archives of previous construction or clearance projects may be highly informative.

▼ © Syddansk Universitet.
Diver exploring the wrecksite of Skjernøsund, Norway.
Environmental factors such as sand movements, longshore drift and geomorphology need to be considered in surveys as they greatly impact what has been preserved, in what way it can be surveyed and in what way it can be managed.
A shallow wrecksite in Skjernøsund in southern Norway was discovered due to anomalous vegetation on the seabottom. The salinity is high in these waters and all uncovered timber is quickly infested by the common ship-worm *Teredo Navalis*. Long term preservation *in situ* does not seem to be an option. The competent authority therefore instigated full documentation and research.

Consequences of potential intrusion for long-term stability

Rule 15 requires that an assessment should be made of the consequences of any potential intrusion for the long-term stability of the underwater cultural heritage affected by the activities. Such an impact assessment evaluates whether and to what extent a project is likely to cause changes for a site or its environment. Here, the modelling of site stability is crucial for an assessment of a site's future.



◀ © University of York. Prehistoric shell mound, Red Sea, Farasan Islands, Saudi Arabia.
Along the Red Sea coast prehistoric shell mounds and submerged Palaeoshorelines, regularly occur just above the beaches at locations where the sea has eroded a rock shelter. Using these environmental factors as a lead and since during most of the Pleistocene the sealevel was much lower, a team of researchers tries to locate similar phenomena dating to an earlier period of prehistory under water.

▶ © Maritime Archaeological Division Sri Lanka. Wrecksite of the *Avondster*, Sri Lanka. Once a site is opened up it will be more vulnerable to biological degradation. Gribble and shipworm flourish on the *Avondster* site under excavation, before it was covered with mesh and sandbags.

The impact of intrusion on the stability of a site should be assessed with the objective to anticipate and avoid, minimize or offset adverse effects, and site stability needs to be constantly monitored throughout the project and beyond.

Preliminary work and impact assessment

In discussing preliminary work referring to the evaluation of field data and background studies, regular reference has been made to impact studies that are carried out in advance of major development projects. In fact, whether preliminary work is carried out in the context of a project design for an activity directed at underwater cultural heritage, or in the context of an impact study for an activity that will incidentally affect it, the approach is similar.

Alterations to coastlines and to sea and river beds in conjunction with shifting erosion and sedimentation patterns may have serious implications on the conservation of underwater cultural heritage. The natural causes for such processes include climate change whereas other causes are manmade and their impact can be mitigated. Development projects such as the construction of barriers, dykes and ports that change the course of sea and river currents, the intrusive exploitation of natural resources, especially mining for aggregates, oil extraction activities, the

◀ © E. Khalil. A diver recording the extension of the wreck site, Marsa Bagoush site, western Alexandria, Egypt.

▶ © Syddansk Universitet. Documentation of remains on FPL17 site, Prerow, Germany. The underwater phase of preliminary work may include the full documentation of remains extending above the bottom surface, as depicted here on site number FPL17 off Prerow on the southern Baltic coast as a consequence of a possible harbour construction. It may also be limited to more cursory inspection and assessment of sites.

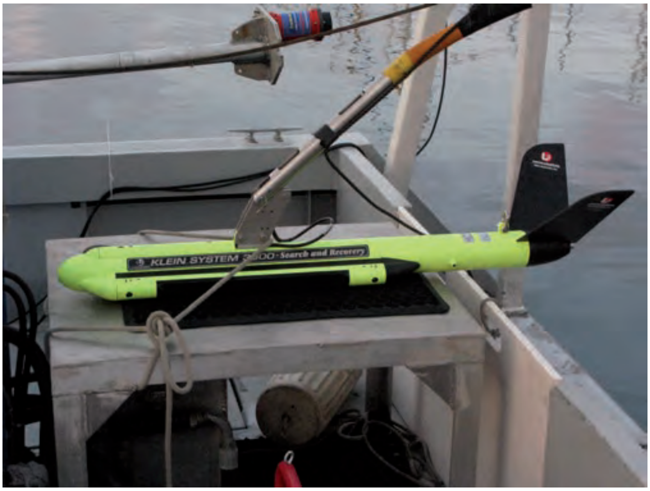
regeneration of beaches, dredging, the construction of underwater outfalls and the laying of submarine cables, all potentially impact underwater cultural heritage.

Efforts to conserve the cultural heritage need therefore to be compatible with the development of today's society and thus the overall development programme of the area they are located in, if they are to succeed. Conversely, the planning of major projects should also include the mitigation of impact on the underwater cultural heritage and thus contribute to that compatibility.

Interestingly, in large-scale and international maritime project development, i.e. projects that are not directed at archaeological sites, more and more initiating operators include impact assessments in the preparation of their development proposals. These well-documented project proposals will be screened formally as soon as the competent authority is notified. The national authorities should also take the underwater cultural heritage fully into consideration in their strategies. It would be wise for the competent authority to require deposition of all underlying research results and raw data in the inventory of underwater cultural heritage.

To this end, it is essential to have the most possibly accurate inventories of underwater archaeological sites so that public- and private-sector construction projects implemented in proximity to them can make provisions in their design for whatever corrective measures are required to fully protect the cultural heritage. Indeed, the assessment of impact of planned interventions for authorized industrial interventions potentially affecting a site is nowadays becoming the most typical form of preliminary study and active inventory of underwater cultural heritage. This is due to the fact that impact on heritage is considered to be part of the collateral costs that are integral to the project. Benefits and collateral costs make up the balance sheet of political decision-making in the process of authorization. Consequently, this kind of survey is usually paid for by the enterprise.

Inventory



▼ © National Museum of Underwater Archaeology. ARQUA. Towfish of a side scan sonar. The side scan sonar is a technical device that is used to locate, map and investigate sites of archaeological interest. It can also be used in repeat surveys of archaeologically sensitive site to examine site development over a certain time period.
The side-scan system originally developed in the 1950's from experiments using echo sounders tilted at an angle from vertical. Initial experiments were conducted to detect shoals of fish, but results immediately showed the potential of this method for studying seabed geology and the detection of wrecks.
The side scan sonar uses narrow beams of acoustic energy (sound) transmitted from either side of the towfish and across the bottom. Sound is scattered back from the bottom and from objects to the towfish. The intensity of the backscattered signal (reverberation) is a direct function of the bottom roughness and the angle of incidence.
The rougher the bottom, the stronger the reverberation. However, roughness is a relative term and is dependent upon the frequency (and more importantly the inherent wavelength) of the acoustic pulse.
The sonar image is constructed one line of data at a time. In general, hard objects reflect more energy causing a dark (black) signal on the image, whilst soft objects do not reflect as much energy and are displayed in lighter tones of grey. The absence of sound that as shadows behind objects show up as white areas on a sonar image causes.

Under the Convention, States Parties are obliged to establish a ‘competent authority’ and to provide for the establishment, maintenance and updating of an inventory of underwater cultural heritage (Art. 22). In practice, this inventory is the archive or the index to the archive in which cumulative information on existing heritage sites is retained. It is a key element in the protection and management of underwater cultural heritage. Preliminary work builds on the inventory, on the one hand, and is one of its major sources on the other. For this reason, the sidebar on inventories has been integrated in the chapter on preliminary work.

In the process of compiling an inventory, the competent authority will be confronted with very different kinds of information. Part of this will be acquired accidentally. In addition, it will typically be enhanced by corroboration and gradual addition whereas other elements of information will be acquired by focused desktop research and active field inventory.

Reasons for inventorying

Inventories are important for a number of reasons:

- to enable effective protection of the underwater cultural heritage;
- to identify and record the underwater cultural heritage;
- to get an overview of all the heritage sites;
- to compare sites in order to correctly direct funds and attention to significant heritage;
- to provide a single point of access to information on the underwater cultural heritage;
- to provide a major resource for heritage researchers, consultant archaeologists, local government authorities, government agencies, developers and students;
- to raise support for the endangered heritage;
- and ultimately, to celebrate the wealth of underwater cultural heritage and to safeguard the underwater cultural heritage.

Accidentally acquired information

In order to inventory existing heritage, a competent authority can start by actively acquiring data that is collected for other purposes, such as navigation safety, mapping of other resources, clearing of navigation channels or fishing. It can then evaluate this data for its heritage relevance. Various government and private agencies can provide such information on finds in the underwater environment. National authorities, ministries and departments undertaking activities on the seabed or riverbed, as for instance coastguards, the navy, dredging services, research services, fisheries monitoring, etc. should be required to confidentially communicate information on underwater cultural heritage that is found, or on activities concerning or affecting such heritage, to the competent national authorities. Information and cooperation can also be requested from hydrographic and oceanographic services.

Furthermore, fishermen and mariners will also collect relevant data. Private individuals, people in the recreational diving industry, tour operators and others can provide the competent authority with information. Many sites are also likely to be first reported from hearsay. The underwater world is still a world of limited access. Making use of informants is mutually beneficial as it helps the authority and gives the informants a role. It also helps the latter to understand the policies and values of heritage. It is especially used in reporting incidental observations that interested recreationists and vocational archaeologists can be of enormous value for a better protection of heritage.

Although it is important to distinguish between established facts and uncorroborated information, it is also important to keep track of even hazy and vague reports by entering them in the inventory with the necessary qualifications and question marks.

Desk-based study and background information

Typically, an inventory also includes the investigation of historical, geological and environmental data that is available in a range of repositories, in just the same way as discussed for preliminary research. A comparison with conditions, processes and heritage found on land can for instance provide insight concerning the possible existence of submerged landscapes and prehistoric sites under water. Library research can provide information on catastrophes. Shipping registers and naval inventories can provide information on shipwrecks.

Before undertaking any practical survey a desk-based inventory and assessment of data would also address questions, such as: are there any records on submerged or sunken heritage? What does the geological record

▶ © MMRG. A team running a diagnostic check on an IVER2 Autonomous Underwater Vehicle (AUV) made by Ocean Server, Inc., in the fishing port of Larache, Morocco.
The AUV is equipped with side-scan and multi-beam sonars and was used to map the bathymetry and search for exposed cultural material in the Oued Loukkos, as part of the Morocco Maritime Survey's investigation into the location of the ancient port of Lixus, Morocco (October 2010).
In this photo, Ocean Server technician Eric Wingate holds on to the GPS unit and float of the AUV while marine geologist Mohamed Ali Geawhari (middle) and Ocean Sever technician Jason Aiello (right) assess its ballasting.

tell us about subsidence and submergence? What does the historical record tell us about beaches, natural harbours and their use? What can a careful analysis of the coastal landscape contribute to a better understanding of the underwater area? Can time series of depth records be constructed that allow for the modelling of erosion and accretion? Have corings or geotechnical soundings been made prior to the construction of breakwaters or offshore installations? Is there other relevant research? A combined scrutiny of such data would first of all help prioritize which bodies of water deserve special attention on the basis of prior knowledge on underwater cultural heritage and its potential for preservation. Predictive modelling in a simple or more advanced Geographical Information System (GIS) can be an enormous help in this process. It provides an inexpensive tool to manage large amounts of very disparate data in combination with expert knowledge.

Active research

While a 'passive' inventory by assessing accidentally acquired information and historic information is relatively inexpensive, it can help more targeted work enormously. It also provides a basis to assess the reliability of different informants and information sources. It is not, however, the only option the competent authority has at its disposal. It can also actively commission or undertake specific surveys, or it may make use of impact assessments for projects to investigate an area.

Specific surveys in the field can be undertaken, and will usually include an on-water phase deploying geophysical techniques and an underwater phase for ground truthing by diving, sampling or remote access through the use of autonomous or remotely operated underwater vehicles. Normally, such inventory would be limited to a project area. This allows for good state-of- the-art surveys, without costs getting out of hand. The project areas should be strategically chosen in order, for instance, to manage the heritage of a specific reserve, or to target areas that are under particular stress. These could be estuaries, harbour approaches or areas of anticipated development. Active inventory and impact assessment are very often tools that complement each other and that follow the same logic. They differ with regards to the occasion and the costs. Impact assessment is an integral part of a proposed project and is therefore generally regarded as an integrated cost-factor, while an inventory project needs to secure its own funds. It is therefore advisable to aim for synergies and to build up an inventory on already available existing information.

It is preferable, if not indispensable, for all sites in a project area to be assessed individually. If this is the case, a decision on each individual site can be taken. Some will be considered significant enough to warrant full-scale excavation. Others will demand a limited number of observations and some may be sacrificed in favour of the most important ones or more important purpose. The relative weight that is given to their importance in the context of the development project and relevant policies will inform the selection process.

Phases and techniques of survey

A full-scale survey should be based on prior desk-based assessment and will then generally involve extensive field-data acquisition in combined on-water and underwater phases. The geological and geophysical techniques involved are seismics, coring and resistance sounding for the general stratigraphic make-up, and such acoustic techniques as sidescan sonar and swath bathymetry or multibeam echo-sounding to map the bottom surface.

A survey is usually conducted today using a combination of four techniques:

- Side-Scan Sonar
- Magnetometer
- Swath Bathymetry (Multibeam Echo Sounder)
- Diver (in shallow water) or video/ROV (in deep water) ground truthing

It is important to train the operating staff well. The time for the project depends on the area covered.
Data collecting should be integrated with GPS-positioning.

A side-scan sonar survey should include overlapping lanes and cross-angles in sufficient redundancy to warrant discovery.

A magnetometer is of no use for submerged sites and of limited use for wooden wrecks predating the use of iron guns.

Multibeam sonar and visual inspection can be deployed to get a better image of an identified irregularity.

A multibeam area survey, also called Swath Bathymetry can be highly revealing, especially at high resolution. It is still, however, an expensive technique, requiring an expert operator. Besides being attractive for archaeology, it is preferred by more and more water and harbour authorities. This means it is useful to try and combine objectives and seek cooperation.

A survey will only detect objects on the surface of the seabed, so always include depth of sedimentation and prediction of potential in a report.

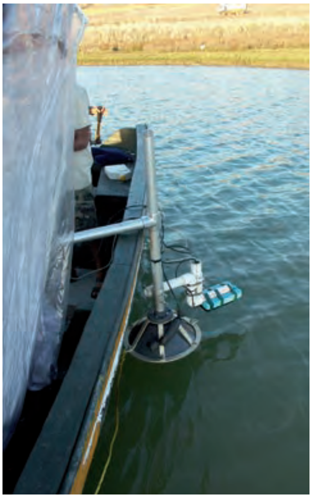
Seismic techniques are generally not finegrained enough to enable the direct location of archaeological sites. The integration of cumulative seismic data in a regional analysis, however, produces fascinating and informative images of submerged palaeolands capes. Large amounts of seismic data have been produced by industry during exploration for mineral resources. This applies to all water regions of the world. Although produced for other purposes, their analysis on the basis of archaeological research questions is highly informative, both in inventory and impact assessment. Hence, also, the importance of desk-based work, using data collected for other purposes.

◀ © MMRG. A Knudsen 320 BP
Echo-sounder in use over the port side of *Zouhair 3*, a small fishing boat, in the Oued Loukkos during the Morocco Maritime Survey investigation into the location of the ancient port of Lixus, Morocco.
A cockpit built of pvc pipes and plastic sheeting sheltered the electronics used during the survey.

Like seismics, acoustic techniques, such as sidescan and multibeam sonar, are used for many purposes beyond heritage. Nevertheless, sidescans and multibeams are more regularly put to direct archaeological use. So are magnetometers and sub-bottom profilers. All such techniques acquire their data digitally and can be integrated with GPS position control so that the resulting images give amazing detail.

Sidescan sonar and GPS instruments come in different price ranges and are available for mounting on large and small research vessels or even rubber boats alike. In all instances, however, the equipment is only as good as its operator. In preliminary work, there is much to be said for combining different purposes in one survey, undertaken by technically competent operators in combination with ana-lysis by knowledgeable archaeologists. The de-veloper will want to know what kind of obstructions feature on the surface of the seabed and how they warrant the presence of archaeological sites. Side-scanning sonar can obviously be used for both, possibly followed by targeted survey to produce more detailed images by multibeam or video. Magnetometers show the presence of metal and can be deployed to locate metal in underwater

An example of a site potentially rich in underwater cultural heritage and concerned by intensive development is the reclamation and offshore islands for housing along the coasts of Bahreïn, partly just offshore Qal'at al-Bahrain. The very extensive site was inscribed on the World Heritage list in 2005 as the Ancient Harbour and Capital of Dilmun. The offshore areas are outside the protection zone. Some have been surveyed and inventoried, but most have not, to the great concern of those presently integrating heritage values in planning.



▲ © MMRG. A Knudsen 320 BP Echo-sounder and external receiver, modified by Prof. Lloyd Huff (Center for Coastal Ocean and Mapping, University of New Hampshire), prior to submersion during the Morocco Maritime Survey, Morocco.
The echo-sounder, along with its GPS unit, were mounted on a small fishing boat and used to document palaeo-channels and present riverbed bathymetry of the Oued Loukkos as part of the investigation into the location of the ancient port of Lixus, Morocco (October 2010).

cultural heritage as well as to locate lost or dumped ammunition or erratic mines.

Sub-bottom profilers are used in the same way as seismics, but for shallower sediments. They are also used for intensive survey of features that only partly show on the surface of the seabed. Scour-marks may, for instance, reflect buried features.

In addition to being only as good as the operator, surveys are only as good as their terms of reference. It is therefore essential to make the most of the screening and scoping phases of an impact assessment for an industrial project. The resolution that is needed for one purpose may not be good enough for another. It is easier to locate a pipeline for instance, than to interpret a vague feature of potential archaeological importance. Coordinating and agreeing upon terms of reference may avoid requiring a survey to be done twice, and will thus save substantially in costs. Heritage sites that are fully covered by sediment are still hard to locate prior to disturbance of the silt material. It is therefore useful to agree on supervision of a development project during critical phases of dredging or ground moving in sensitive zones, and to agree on set protocols on how to deal with those finds that can be expected to turn up during realization.

Strategic search

The potential for the presence of underwater cultural heritage is a factor in prioritizing where to engage in active survey. Another is the anticipation of political and spatial planning that may result in threats to the long-term preservation of underwater cultural heritage.

Known battlefields, indications on the location of sunken cities or the historic documentation of events in relation to ports or landing places can help focus the survey.

Moreover, it can often be anticipated in which areas future windfarms, offshore installations or artificial islands will be planned.

Prioritizing such areas in an inventory will help in future decisions and will facilitate the prominent inclusion of underwater cultural heritage in the terms of reference for impact studies. Planning major development projects in the maritime environment implies a preliminary study and an assessment of their impact. This should be preliminary to the decision to realize the project. It should also be done before deciding on the project's final location and spatial scope. One of the objectives is to minimize harm to underwater cultural heritage. Sometimes the most significant heritage sites can thus be preserved and excluded from the development project area, at other times they can be meaningfully integrated. In both cases, destructive excavation can remain limited in favour of *in situ* preservation. For other sites, this will not be possible. Making the best of them is a major challenge. However, it is also a major opportunity for research through excavation. If researchers strategically address those sites that will be demolished anyway, they can warrant that destruction combines with creation. Preparing a research agenda in advance may be very helpful in this context.

It is still difficult to locate sites that are deeply buried. This is the case on land, but even more so at sea, where planned developments may imply extensive dredging. If deep layers of sand, clay and peat are to be dredged, the preliminary assessment should address the probability of sites being present, whether they have actually been located or not. These can be sites of different categories, for instance sites related to deeply buried land surfaces in an area where such land is submerged, or wreck sites relating to periods of major sedimentation. On the basis of such prediction, a plan can then be drawn. A strict scenario or protocol of mitigation can be included in the planning of the development project. Protocols can be different for each category of potential find. They can, for instance, include crude removal of large remains and more careful treatment of other types of sites. Agreeing on such protocols has a dual benefit. On the one hand, it will urge researchers and heritage managers to think clearly and positively about opportunities and priorities. On the other hand, it will make the planning of contingencies controllable, and that is an asset in complicated project management.

Note that many of the techniques used in archaeological inventory, including desk-based research, on-water survey and underwater truthing, equally apply to elements that are not explicitly identified as heritage. If these constitute dumped or otherwise lost polluted material, containers with toxic substances or ammunition, then it is very important for management to be aware. In planning active inventorying, it is essential to identify synergy through combination of objectives right from the start in the inventory project design.

IV. Objective, methodology and techniques

For every activity directed at underwater cultural heritage the project's objectives should be very clear and the methodology and techniques should be chosen accordingly. This applies to safeguarding, consolidation and research alike.

Matching objectives with methodology and techniques

Rule 16. The methodology shall comply with the project objectives, and the techniques employed shall be as non-intrusive as possible.

An underwater archaeological site is an extremely fragile historical record that is a repository of information about developments in human history. The potential historical information it contains varies enormously. The objects a site contains may have been designed to be used outside, on or under water. They were submerged accidentally or on purpose. They range from religious and ritual deposits, bridges, dockyards, light-houses, dykes and ports, settlements, towns and necropolises to fishing installations, naval, merchant and fishing vessels, and other anthropogenic evidence. Locations may vary as well, from sea-shore, to lake or river, and from an aquifer of a few centimetres to depths of thousands of metres below the surface of the sea.

Threats to sites

Underwater archaeological heritage is exposed to the following threats, among others:

- *Physical-mechanical*: Erosion and abrasion by currents, tidal movements or changes in water circulation; erosion/mechanical deterioration due to dredging, fishing, anchoring.
- *Biological*: Marine borers (especially *Teredo navalis* or shipworm), fungi and bacteria, for the most part dependent on the presence of oxygen.
- *Chemical*: Oxidation reactions of organic material and corrosion of metals.
- *Human*: Treasure hunting, souvenir collecting, fishing, dredging, infrastructural or development works, pollution, ship movements, archaeology, oil drilling and pipeline laying.

All these aspects greatly influence the project objective, methodology and techniques and need to be taken into account during their design. Therefore, no action should be taken without the prior identification and validation of specific goals appropriate to the site and a methodology that matches those goals and the technical challenges involved.

▲ © Jon Henderson. Divers measuring a cist grave at Pavlopetri site, Greece. Archaeologists surveying Pavlopetri, which is supposed to be the world's oldest submerged town, have found ceramics dating back to the Final Neolithic. Their discovery suggests that Pavlopetri was occupied some 5,000 years ago. The Pavlopetri site is unique in that it has almost the complete town plan, the main streets and domestic buildings, courtyards, rock-cut tombs and what appear to be religious buildings, clearly visible on the seabed.
The Pavlopetri Underwater Archaeology Project aims to establish exactly when the site was occupied, what it was used for and through a systematic study of the geomorphology of the area, how the town became submerged. →

Project objectives

The 'objectives' describe the purpose of a project or major research questions that it will address. These could include questions about:

- What the site could reveal about advances in technology of a particular society - such as in ship-building, mining, fishing or other technologies;
- How information from one site could compare with information from another site (underwater or on land or from recorded history);
- How trade was conducted by the people associated with the site;
- What the site could reveal about migration, exploration, social advances or the disappearance of a cultural group, the time in history when the site was formed, used or abandoned;
- Other technological achievements or cultural developments.

Research is not the only possible objective of a project. For a management intervention there can be a range of reasons, for example, to stabilize the site or to facilitate access because the site is considered a tourist attraction for recreational divers.

Without exception, the objectives should fit into a more encompassing vision for research or conservation that is realized through a range of projects. Such a vision can have many open ends, but the design of a single project should not be open-ended.

A log frame matrix or similar scheme can be very helpful in strategically organizing objectives, activities and outcomes with a view to the short, medium- and long-term.

	Inter-vention logic	Objectively verifiable indicators of achievement/ benchmark	Sources and means of verification	Assumptions and risks
Archaeo-logical Objective(s)				
Immediate Objectives or Project Goals				
Expected results				
Activities				

Project objectives must be in line with the principles stated under ***Rules 1 to 8***. Most importantly, action on underwater cultural heritage is justifiable only if undertaken to protect it, to obtain detailed and reliable scientific information or to share its enjoyment with the public.

Working methods and techniques

In order to correctly intervene, archaeologists must well-define project objectives and then use appropriate methods and working techniques. Research is integral to any intervention though there is no single recipe, but it is up to the archaeologist to identify and use the best methodology available. The scientific method, as implied by its etymology, is a means of arriving at reliable knowledge. Irrespective of the concrete methodology chosen, it will have to meet some minimum conditions if it is to respond effectively to the challenges that working under water presents.

→As a Mycenaean town, the site offers potential new insights into the workings of Mycenaean society. Pavlopetri has added importance as it was a maritime settlement from which the inhabitants coordinated local and long distance trade. These remarkable findings have been made public by the Greek government after the start of a 5 year collaborative project involving the Ephorate of Underwater Antiquities of the Hellenic Ministry of Culture and The University of Nottingham. During the fieldwork session in summer 2010, the team carried out a detailed digital underwater survey and study of the structural remains, which until this year were thought to belong to the Mycenaean period — around 1,600 to 1,000 BC. The survey surpassed all their expectations. Possibly one of the most important discoveries has been the identification of what could be a megaron — a large rectangular great hall — from the Early Bronze Age period. Their investigations revealed another 9,000 m² of new buildings as well as ceramics that suggest the site was occupied throughout the Bronze Age — from at least 2,800 BC to 1,100 BC.

◀ © B. Jeffery. Smoke stack on the *Tokai Maru* showing where a boat anchor has been dropped onto it, Guam, United States. Underwater archaeological heritage is greatly exposed to physical-mechanical threats such as erosion or deterioration caused by dredging, fishing, anchoring. This deterioration can equally be due to tidal movements or changes in water circulation.

The working method will have to be:

- **Clearly explained**. It will need to be understood by the team working under water, often taking turns, which will have to take individual decisions.
- **Rapid to implement**. There is a limit to the time that can be spent under water.
- **Straightforward to implement**. Working under water is hard enough without the addition of further complications.

A basic rule is that not everything that can be done on land ought to be done on the working platform, and things that can be done on the surface ought not to be done under water. Furthermore, every contingency will need to be exhaustively planned for, so that problems can be resolved under the best possible conditions. If there is anything besides discipline and orderliness that should characterize the operations of an underwater archaeological excavation, it is planning for possible incidents that might affect the safety of individuals and the site itself.

▶ © MMRG. Dredging taking place in the Oued Loukkos, outside the mole of the modern port of Larache, Morocco. The dredging is for construction aggregate, and by removing ca. 600 m3 of sand a day, this process is adversely affecting the natural sedimentation regime of the tidal river. In addition, as the dredging is taking place in a river basin with numerous archaeological sites including the settlement of Lixus, associated submerged cultural material could be destroyed in the process.

The Method of Research

- Research is integral to any intervention.
- There is no recipe for dealing with the underwater cultural heritage. Only a properly trained, qualified and competent archaeologist following a scientific methodology can ensure that society is provided with reliable knowledge.
- The working method must be clear, rapid and straightforward.
- More technical resources do not necessarily mean better scientific results.
- Before starting to excavate, the archaeologist must have adequate knowledge of the culture of the human group concerned by the site.
- The purpose of the methodology is not to recover objects but to obtain knowledge.

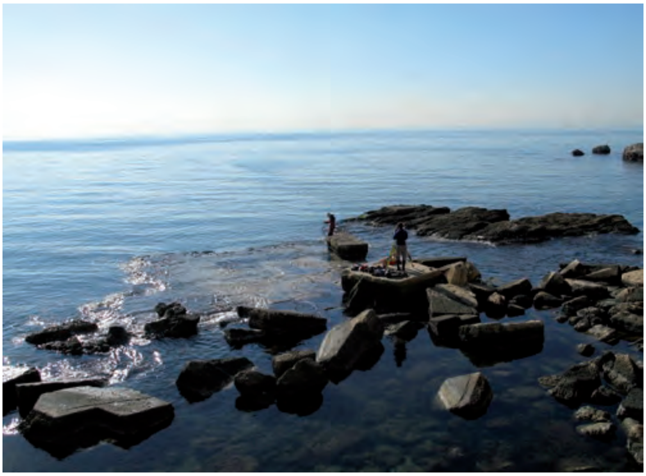
To be effective, the methodology and techniques used must be appropriate for the scientific objective being pursued. This means that the archaeologist needs to have the requisite intellectual training, first to establish the scientific objectives, and then to design and apply the methodology and techniques best suited to the project's goals. A successful excavation is of no avail in the absence of the capabilities and knowledge required to draw scientifically reliable conclusions that can be communicated to society.

The next step in developing the methodology is thus to identify the appropriate techniques that are available and practicable in the context of the project. Whatever research question is being studied, each site requires consideration about which tech-nologies are most appropriate for answering that question. If the question is about the age of the site, then dendro-chronology, radio-carbon dating, thermo-luminescence or sedimentology studies may be considered, but not all may be appropriate. Dendro-chronology, for example, is only appropriate if certain wood species are present and if enough samples can be taken. On the other hand, it then also produces information on the provenance of that wood. If the question is about construction techniques, (e.g., a shipwreck lost at a known time in history), then the techniques may focus on three-dimensional recording of the structure of the site. More often than not, a chosen approach can contribute to several aims at once, thus adding to the efficiency of the drafted project.

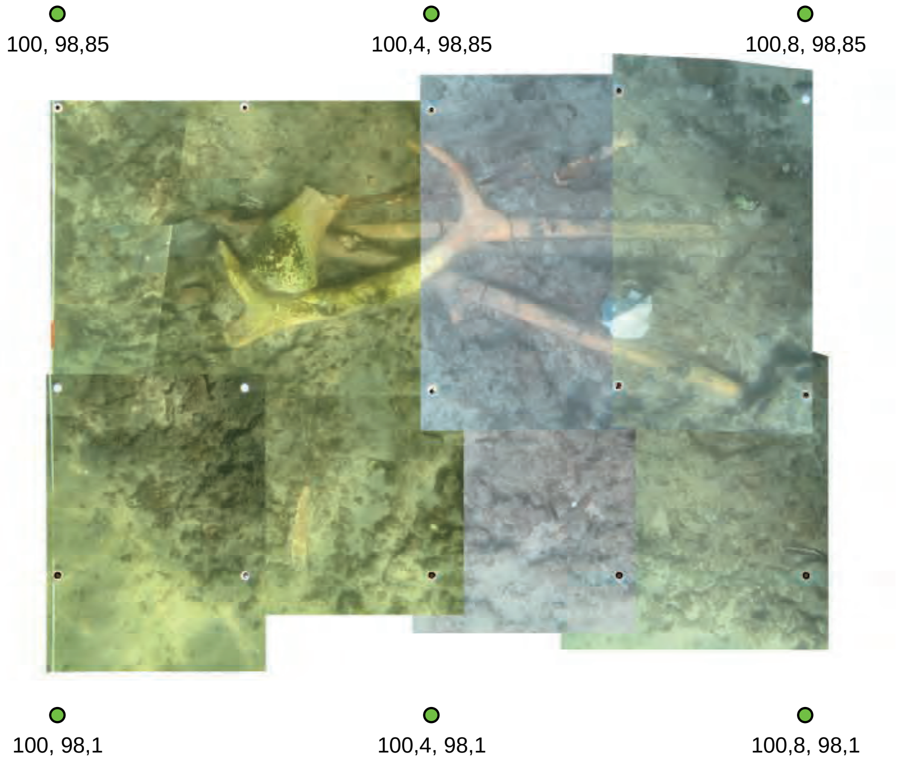
▲ © M. Manders-Ghostwreck Project. Controlling a Remotely Operated Vehicle (ROV) to survey a Dutch trading ship from the beginning of 17th century, Gotska Sandön, Sweden.
In the case of a deep site in clear waters, such as the "ghost wreck", a presumably Dutch Baltic trader of around the late 16th or early 17th century, are the use of an Remotely Operated Vehicle (ROV) to survey and produce images is the obvious choice of technique.

The Project Design needs to clearly advise the competent authority about the technical equipment that will be used, how it will be used and the extent of site disturbance. This will enable the authority to assess the relevance of the project in relation to its long term impact on the site.

Unfortunately, some television documentaries have given the false impression that greater technical resources mean better scientific results, so that underwater archaeology has come to be seen as something hugely complex and expensive. What is overlooked is that in a difficult environment like the marine environment, an excess of equipment is not only a drain on financial resources, but actually tends to create problems which then have to be solved, leaving less time for investigating the site.



◀ © Zea Harbour Project. Digital survey of a submerged tower, Piraeus, Greece.
Archaeologists from the Danish-Greek Zea Harbour Project digitally survey a partly-submerged tower in the fortifications of the Classical-period naval base in Mounichia Harbour (modern Mikrolimano). In the shoreline interface the 5th century BC harbour tower is documented using terrestrial archaeological methods, such as total-station survey, and in the sea, underwater archaeological methods (Zea Harbour Project 2006).



▲ © P. Moe Astrup.
Georeferenced pictures of a prehistoric site in Horsens fjord, Denmark.
A Prehistoric Ertebølle site in Horsens fjord in Denmark was found to be eroding in a preliminary survey. It is monitored ever since and georeference pictures are combined in a photmosaic. The objectives match the methodology as it is a simple project, using simple methodology.

Types of research methodology

Site survey, investigation (including, if appropriate, excavation) and analysis describe the main steps of archaeological research.

Site survey

The underwater archaeological survey comprises the process of locating, exploring and recording a site. Its aims and objectives are determined in the project design, thus the survey is an end point in itself. Two main types of survey can be distinguished:

- pre-disturbance survey
- site monitoring survey

Surveys are conducted to obtain an accurate representation of the site and in view of recreating it on paper and digitally. They facilitate the understanding of the relationship between the ar-

◀ © Archivo del Centre d'Arqueologia Subaquàtica de Catalunya. Planimetric survey on the wreck of the *Triunfante* sunk in 1795 in Sant Pere Pescador, Girona, Spain.
The planimetric survey gives a readily understandable impression of the extent and nature of a site at a given time. The scale and techniques of planimetric surveys are determined by the map's purpose and the assigned area.
The traditional planimetric survey based on angular and linear measurements (diver survey applying triangulation) limits itself to the plane features, giving the site's outlines and the locations of local objects without reproducing the relief of the area.
In such surveying the outlines of each feature and its contents are depicted. The topography is shown by a dumpy level.
This traditional approach and instruments have largely been replaced by the total station EDMs. The features which appear on the survey are fixed using *x*, *y* and *z* coordinates (eastings, northings and height).
The aim is to place the site and its features in relation to known points; the survey is tied in to OD heights and ordnance survey features to provide a contextual framework.
The survey is a necessary prerequisite to understanding and interpreting the archaeology, environment and subsequent factors affecting site formation.

chaeological material, the site and the people who are connected to the site.

The following area search and survey methods are available for *locating, exploring and recording a site:*

1) the accumulated knowledge of local people, especially scuba divers and fishers; survey and excavation work should be taken as an opportunity to involve them in the conservation effort;
2) information in archives and libraries;
3) toponymy, palaeotopography and ethnography;
4) data from archaeology on land;
5) historical cartography and aerial photography;
6) topography and climatology;
7) findings of visual prospecting;
8) findings of marine geophysical prospecting;
9) findings of position fixing methods;
10) 2-dimensional and 3-dimensional survey methods

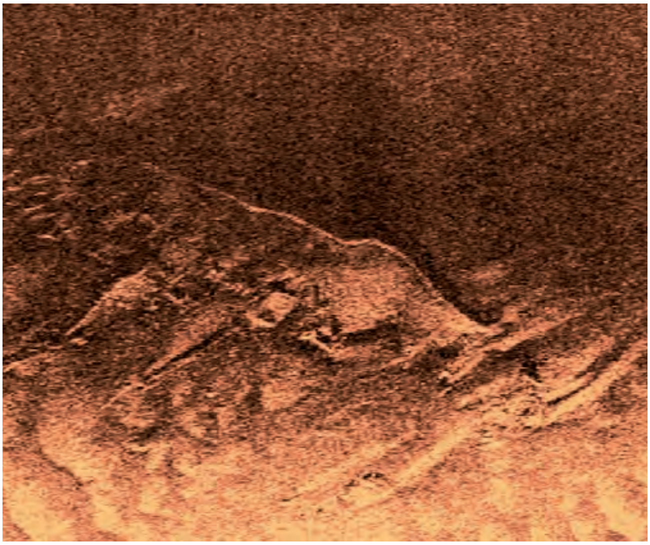
Survey tools are used to sketch the site, to record the position of features (detail points on artefacts and structure in relation to known fixed control points), thus determining distances and bearings. Control points should be permanent, stable, uniquely identified, located around the exterior of the site and at different heights. At least four measurements should be taken from such control points to each detail point, always recording the depth.

With this range of methods, informed predictions can be made. Unfortunately, the current limitations of geophysics as applied to underwater archaeology mean that a negative result from this method of prospection does not necessarily rule out the presence of archaeological sites in the area prospected. In addition, the archaeologist will always need to carry out soundings. Moreover, the depth of sedimentation needs to be assessed for its potential of containing archaeological traces.

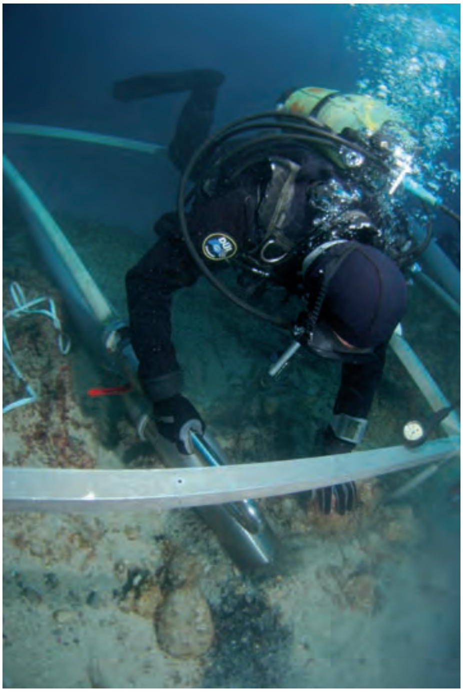
The preparation of underwater archaeological surveys is a basic management tool and needs to be a priority objective of the authorities responsible for conserving the underwater cultural heritage. If it is to be successful, the underwater archaeological survey must conclude by specifying the location of the artefacts, their state of conservation, their scientific interest, the risk of alteration and the corrective measures envisaged. ***See also under Chapter III.***

Investigation and analysis

With proper scientific and technical training, the archaeologist will be able to use the minimum of technical resources needed to obtain the best possible scientific results at the lowest cost and with a methodology that is simple to execute. Essential stages of investigation and analysis, planned in



▶ © Wessex Archaeology. A sidescan sonar image of a metal wreck lying off the south coast, United Kingdom.
On this image, two masts can be seen extending from the ship. The side-scan sonar imagery allows detailed planning for higher resolution ground-truthing surveys, which can involve the collection of physical samples from the seabed or underwater video. These surveys are usually carried out by a Remote Operated Vehicle (ROV) or submersible, capable of operating in very deep water.



◀ © Robert Mosković. Diver exploring a 16th century merchant ship, Sveti Pavao shallows, Island of Mljet, Croatia.
The archaeologist is using a water dredge to remove spoil (unwanted sediments loosened in the process of revealing archaeological material), that is generally less consolidated than on land. The water dredge is effective for delicate work. Alternative devices are the airlift or the water jet. A merchant ship wrecked on the Sveti Pavao shallows off the southern shores of the island of Mljet was passing along the chief trade route between Venice and the commercial ports of the east that ran through the eastern Adriatic Sea in the 15th, 16th and 17th centuries. The extensive Turkish Empire was becoming an expansive market and a growing number of merchants benefited from the lucrative opportunities, sailing the Adriatic Sea to the Levant with goods coming from across Europe. Oriental merchandise travelled the same route to western ports. Research at the Sveti Pavao locality started in 2007, and has to date seen 3 campaigns, which have yielded numerous valuable finds. The ship's structure and ship's equipment, a large iron anchor and 8 bronze cannon were located at the site. Based on these objects, the shipwreck has been dated to the second half of the 16th century, which is confirmed by silver coins found among the other finds. What sets this shipwreck apart from other sites is that it is completely intact, which will contribute greatly to the quality of the research and its interpretation. The results of this research will complete the picture of life and material culture in the 16th century, provide insight into the links between centres of manufacture and commerce in the Levant with those in the south west of Europe, and confirm that the →

accordance with the data obtained from the archaeological survey, should be:

(a) **Removal of sediment**. The low- and high-pressure compressors used to charge the compressed air tanks and operate the suction tubes will need to be mounted on a working platform. It is sometimes possible to use the shore itself for this purpose.
(b) **On site documentation**. This is the phase of the excavation that will justify all the work done and it thus needs to be taken extremely seriously, since the quality of the results will largely determine the reliability of the conclusions reached. Excavation involves the destruction of the site, so the objective is attained when enough information is produced for the site to be subsequently reconstructed. It is essentially this phase that distinguishes an archaeological excavation from the pure underwater recovery of ancient artefacts. ***See Rules 26 and 27.***
(c) **Site stabilization / *in situ* preservation**. After having evaluated the stock of archaeologically interesting sites, the state or condition of selected sites may need to be preserved. Unless

→ Adriatic Sea played an important and irreplaceable role in establishing these trade routes.

effectively safeguarded, many good examples of maritime heritage will be lost forever. In stabilizing a site under water, the idea is to create an archive under water that is accessible and to make sure that the heritage is kept until this archive is opened. It is important to have an idea how long the protection has to be effective: for 5 years, 20 years or a hundred years. The protective measures have to be selected in a way that deterioration of the site can be reduced to a minimum and that it is still possible to access the site in the future for archaeological research. ***See Rule 24.***

(d) **Extraction**. Objects should not be removed if there is no valid objective and not until secure arrangements have been made to conserve them properly out of the water. An underwater conservator needs to be on hand to ensure that adequate safeguards are in place when an extraction is carried out.

(e) **Preventive conservation**. As soon as an archaeological object is removed from the water, it begins to undergo physical and chemical processes that may result in major alteration and even destruction. It is thus essential for a conservation specialist to be on hand to see that the object is transported to the conservation laboratory under the best possible conditions. ***See Rule 24.***

© Archivo del Centre d'Arqueologia Subaquàtica de Catalunya. Use of a laser beam to identify the sections of the ship *Triunfante* sunk in 1795 in Sant Père Pescador, Girona, Spain. Underwater archaeological explorations, which are being carried out both in shallow as well as in deep waters, need an accurate positioning system for locating any artifact and to plot them on suitable scales. Several conventional methods and instruments are available for obtaining underwater positions in shallow water areas. But due to limitations under water like poor visibility conditions, etc. the diver archaeologists find difficulties in measuring angles and distances under water.
The laser track method that measures distance by timing the passage of a light pulse fired at a target and its return can be applied effectively for shallow water archaeological surveys (max 15 m with a coverage of 5 km and a distance accuracy of 10 cm). ▶

◀ © Wessex Archaeology.
Image of a protected shipwreck in British waters obtanied by combining multibeam and side scan sonar survey data, United Kingdom.
This image is created from millions of echo points, collected as geophysical survey data (multibeam and side scan). The wreck is one of the protected vessels in British waters. The integration of the multibeam data with other datasets originating from side-scan sonar allows the assessment of seabed processes from a 3D perspective. Moreover a precise bathymetric map can be created by means of multibeam echo-sounder and side scan sonar measurements (digital relief of the bottom). The use of multibeam and side-scan sonar facilitates collecting a large amount of spatial information in a limited period of time and establishing a bathymetric map thereof. This map allows archaeologists to accurately determine the positions of underwater cultural heritage sites and distances between them, to document sites and to establish the first maps of sites.

(f) **Documentation and analysis**. Every object extracted needs to be inventoried, documented and studied. The information thus obtained, in conjunction with what has been learned during the excavation, will then allow conclusions to be drawn. The number and variety of the artefacts yielded by an underwater investigation mean that a large team of specialists usually needs to be involved. Thanks to technical advances in archaeometry, key objective data can be obtained by laboratory analysis. ***See Rules 26 and 27.***

(g) **Conservation and restoration**. Proper restoration using secure, tried and tested methods ensures that pieces are better conserved, restored and can be exhibited to the public. ***See Rule 24.***

(h) Scientific reporting. Scientific publication is the only way of advancing knowledge and obtaining conclusions that can then be presented to society. ***See Rules 30 and 31.***

(i) Dissemination. All the hard work done and the money spent would be of no avail if we failed to provide society with clear, accessible and reliable information on its past. It is the effort of dissemination that engages society with the work to protect this heritage, and public commitment depends upon a sense of ownership. ***See Rules 35 and 36.***

Techniques for in situ preservation

In deploying a policy for the protection of underwater cultural heritage, it is sometimes useful to temporarily consolidate an important site. A lot can be achieved with very simple techniques, but more extensive measures may be necessary if the aim is to consolidate a site for longer periods or to make sure that public access is compatible with protection and management. Examples of techniques used for site stabilization and *in situ* protection are sandbags, polypropylene debris netting, specific hands-on solutions, sand deposition, road barriers, artificial sea grass and the covering with geo-textiles. Artificial metal cathodes have been tested to stop metal corrosion. It is also possible to establish under water depots in proximity to the endangered sites, in order

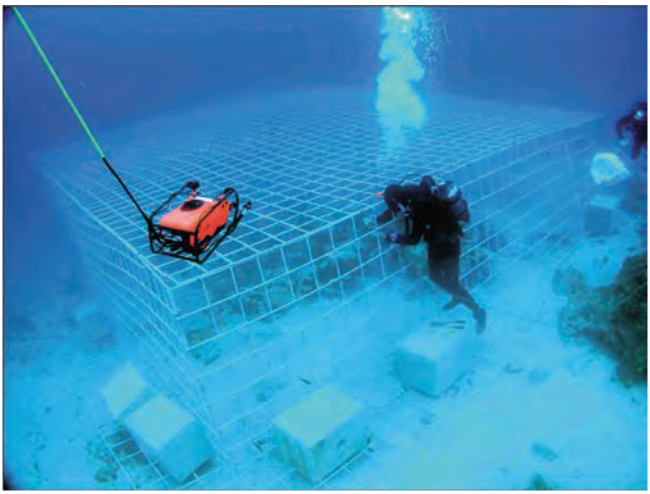
© MMARP. Hull remains being covered with sandbags by divers to prevent intrusion, Montenegro. During the Montenegrin Maritime Archaeology Research Project (MMARP), a 7 m long section of modern hull remains were exposed for documentation in the small bay of Bigovica, Montenegro. After documentation, the wood hull was covered to prevent intrusion from recreational divers and damage from open exposure to the elements. Re-used grain bags were filled with sediment from near the site by divers and then laid over the wood with a mixture of sand infill amongst the bags. The bags were then secured by a layer of sand and small stones. Here, Dejo Drasković (left) and Dr. Athena Trakadas (right) adjust some of the sand bags during the final stages of the covering process (September 2010). ▶

to stock timbers while avoiding their extraction from under water.

All of these techniques have their advantages, but also their limitations. Sandbags may change currents, textiles may block biological gas and thought should be given to these issues beforehand. Changes should be monitored that might occur in the condition of the site, in order to measure the effectiveness of the chosen *in situ* protection strategy and to be able to act upon any possible detrimental changes. The methodology for management projects should be well-chosen and should be as non-intrusive as possible.

Considerations on excavation

Excavation may produce important scientific results, but only if significant and up-to-date research questions have been formulated in advance. As excavation means destruction, it is irresponsible to excavate without knowing what research questions are asked: once a site is excavated, it has lost its most valuable and vulnerable information. Before taking such a drastic step, one needs to tread carefully and after much consideration. Is excavation indeed the correct choice? What are the questions that need answering? Would it be wise to test the questions elsewhere and then reconsider them for this particular site? What other purposes can this site serve?



▼ © I. Radić Rossi. Fotodocumentation of the Croatian Conservation Institute. Diver above the protective cage at the 3rd - 4th century Cavat site, Croatia.
Cages, covering vulnerable underwater sites, have proven to be effective as physical protection and dissuasive element against pillage. The efficiency and duration of such protection depends heavily on the materials used and their fixation to the ground. They can be placed over a first sand layer. If maintenance and cleaning is ensured, divers can visit such sites looking through the cage or entering it with permission. This allows for cooperation with local diving centres which can obtain the right to visit with their diving tours in exchange for surveillance of the sites or a certain fee serving its protection. In Croatia, 8 underwater cultural heritage sites are protected by steel cages, which allow visitors to see them, but prevent their devastation.

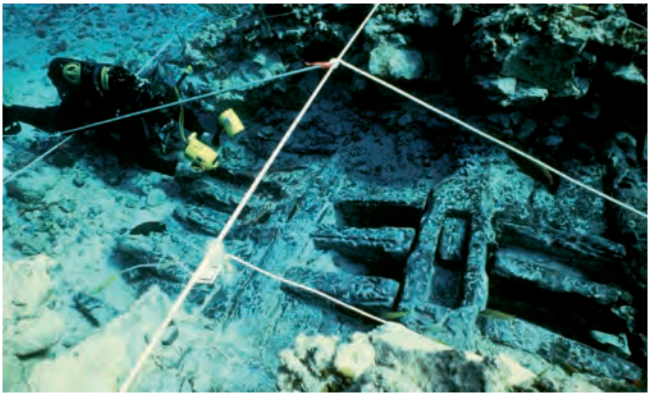
▶ © Archivo del Centre d'Arqueologia Subaquàtica de Catalunya. Excavation of the Greek archaic vessel (end of the 6th century BC) of Cala Sant Vicenç, Pollença, Isla de Mallorca, Spain.

Excavation must be embedded in a wider context of research questions with which the team is fully familiar. While carefully documenting and combining evidence as recognised, excavation also destroys the coherence and context of a site that existed in the first place. Although excavation can make the heritage more accessible, it also compromises to a greater or lesser extent the site's authenticity, the quality that is most respected in experiencing and enjoying a place, in identifying with it, or in terms of commemoration. An ill-considered excavation can neither be undone nor can its results be amended once the original evidence is destroyed.

Rule 1 indicates that *in situ* preservation shall be considered as the first option and that in authorising any activity, this possibility should be considered first as well. But 'first option' is not the same as '*only option*', or '*preferred option*'. Partial or total excavation may be necessary under certain circumstances and preferable for a number of reasons. The arguments for excavation should be convincing and will mostly include a combination of reasons. In exceptional cases a contribution to knowledge can be enough.

How can it best be enjoyed? Which techniques can or should be employed in this specific case? Can this site provide the answers we seek? Has an assessment been made of all other similar sites? Is it justifiable to partially or wholly sacrifice the site for answering the research question?

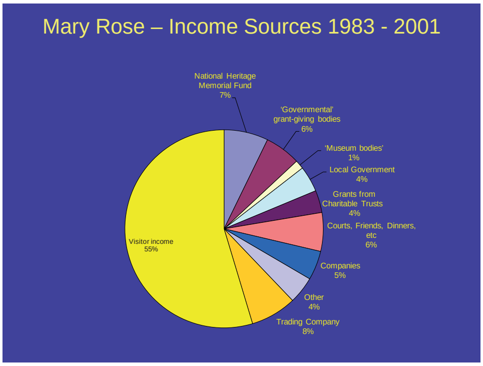
The research questions will determine how much of a site needs to be disturbed and the type of excavation techniques that will be employed. Investigation of a 19th century ship's galleys may for instance only require that the area around the galley needs to be disturbed, although at the cost of the general integrity of the site. A general principle is that site disturbance should be kept to the minimum required to answer the identified research questions. This allows the value of a site to be retained for future research or for exhibition for tourism purposes.

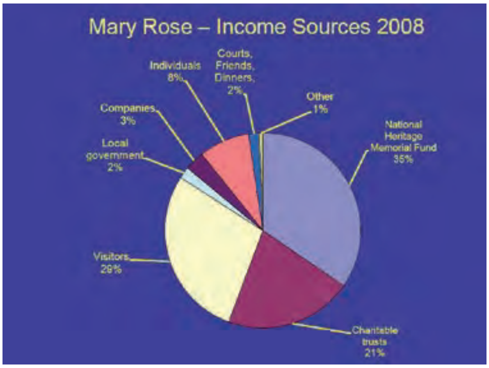


◀ © Ships of Discovery.
Excavation of the Highborn Cay Wreck 1985-1987, Exuma Islands, Bahamas.
The well-preserved hull remains of this early ship wrecked in the Bahamas in the mid-16th century provided important clues to the construction of the keel, keelson, mast step, stempost, framing, planking, notches for the bilge pumps, and floor–futtock joinery at midships. The overall length of the keel revealed a ship of the exploration and discovery period originally about 19 m in length and 5.0 – 5.7 m in beam.

Given the need to conserve underwater cultural heritage for future generations, and the limited resources available for this purpose, the archaeological survey will reveal which archaeological sites should be a priority for excavation in view of the risk of destruction and their scientific interest.

V. Funding





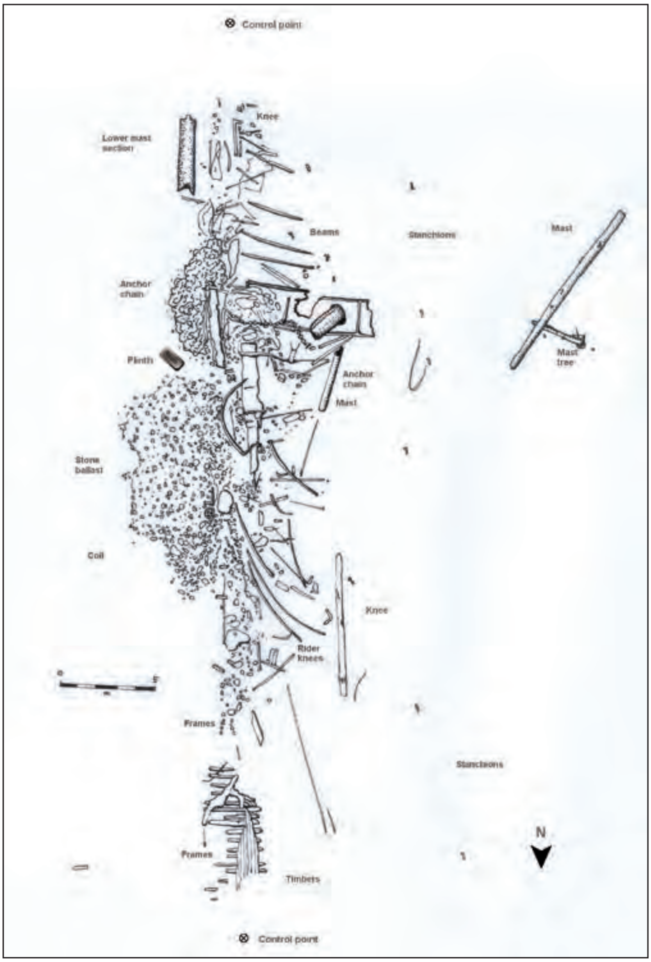
▲ © Christopher Dobbs, Mary Rose Trust. Left: Overview of the income sources of the Mary Rose Trust between 1983 and 2001. Right: Overview of the income sources of the Mary Rose Trust in 2008.
The Mary Rose Museum of Portsmouth displays the 16th century Tudor navy warship *Mary Rose*, one of the main vessels of King Henri VIII fleet, as well as its historical context. Built in 1509 - 1510, it sunk in 1545 while leading a battle against a French fleet. Discovered in 1971, the wreck was recovered in 1982 and is now displayed in the museum.
The comparison between the sources of funding for the period 1983 - 2001 and for the year 2008 shows a significant change in the income sources. In 2008, one can observe a concentration on 3 principal funding sources: visitor income, charitable trusts and the National Heritage Memorial Fund. More specifically, the support obtained from charitable trusts rose from 4 to 21% and the support obtained from the National Heritage Memorial Fund rose from 7 to 35 %.

Securing funding is a recurrent problem for underwater archaeological projects. It is a stumbling block over which naïvely planned operations come to grief. The result may be major damage to the heritage affected, without this being offset by project results. In view of the fragile nature of underwater cultural heritage and its nature as a public resource, this
is indefensible. An adequate funding base should be assured in advance of any activity. No less than three *Rules* of the Annex address this issue.

Financial planning

Rule 17. **Except in cases of emergency to protect underwater cultural heritage, an adequate funding base shall be assured in advance of any activity, sufficient to complete all stages of the project design, including conservation, documentation and curation of recovered artefacts, and report preparation and dissemination.**

Although *Rule 17* addresses funding, it is perhaps even more about integral management and planning. It refers to the project design described in *Rule 10* and is particularly adamant about the fact that



◀ © T. Smith. Site plan of the Centurion (1887), Sydney Harbour, New South Wales, Australia.
Funding estimates must include consideration of the time and cost of developing detailed site plans before, during and after the intervention.

The planning of project **funding** follows a series of steps during each stage of the project.

Project design

- Evaluation of needs, depending on objectives
- Estimation of costs
- Planning risks
- Elaboration of a funding plan
- Identification of funding sources
- Presenting a request / application for funding

Execution and finalization

- Initiation of activities subject to the actual availability of funding
- Financial monitoring and control
- Reporting on the use of the funding and objectives achieved

the planning of funding should include all stages of the process. Conservation should be catered for from the beginning. Report preparation, and a communication and dissemination plan should be included, and all practicable measures for long-term curation and documentation of recovered artefacts should be taken in advance of any activity directed at underwater heritage.

Rule 17 starts with the clause *'Except in cases of emergency to protect underwater cultural heritage…'*, as it is hardly possible to address unforeseen situations and to integrally manage all potential ramifications. Nevertheless, it can be foreseen that unanticipated situations will occur. This needs to be taken into account when a policy for protection of underwater cultural heritage is developed. Like a project design, an emergency strategy should include provisions for conservation, documentation of the site and recovered artefacts, curation of recovered artefacts, report preparation, and dissemination. In such a strategy plan, 'unforeseen situations' are best dealt with through arrangements using the heritage infrastructure of a country or region. Long-term curation can be arranged through specific repositories or existing museums. The fieldwork in such an arrangement may well fall to another body. Universities may be involved in specialize research. Museums may have conservation departments, but other conservation facilities may equally exist. Despite this, conservation is a bottle-neck. So it may be wise to include cross-border institutional cooperation in the arrangements, building on expertise available elsewhere. Typically, different institutions and partners in such arrangements will have their own funding base (and funding problems), and it is not necessary to merge them for such an arrangement to work. This should not, however, prevent from planning in an integral way.

The entrepreneurial approach

In planning an individual underwater archaeological project, it is advisable to adopt an entrepreneurial approach. Before the question of financing is settled, it is recommendable to devise a project structure, based on a thorough analysis of the significance of preserving this heritage for the public and the costs to be incurred. In every individual instance, fund-raising calls for a dedicated effort to define objectives, means and strategies. It is therefore necessary to make an analysis of feasibility, the match between available means and objectives, and to think in terms of evaluation of the public benefits at the start of the Project Design stage. In adopting this approach, the research director of an archaeological project may have to reconsider predisposed attitudes and to rethink available options, without compromising professional ethics. Note that in project management and project funding, every project must have its beginning and its end. Open-ended solutions are not an option. Broad visions and strategies are certainly the best foundation on which to build a project, but the specific project objectives should not go beyond what can be overseen and evaluated. It is only by drawing up a 'balance sheet' of its costs and benefits that the equation underlying the financing of a project can satisfactorily be solved.

To assure successful project funding and implementation, one must adopt a professional approach. This means that one must optimize the project, face up to realities and potential risks and adopt the best possible funding plan. A professional, competent and responsible team to carry out the project and to assure its funding is the *conditio sine qua non* for success. This applies to all underwater archaeological projects, irrespective of their ultimate objectives, their settings or any special constraints. For larger projects in particular, the archaeological team should consider soliciting assistance from professionals with viable experience in project financing, and even consider entrusting the issue of acquiring and administering finances to specialists in this field.

The professional approach

Adopting a professional approach is not the same as adopting the logic of the capitalist market, geared to profit-making alone. Heritage management counts its benefits in assets other than hard and short-term cash. It means planning and proceeding by

New approaches

New approaches and valid alternatives to commercial exploitation ofsites are under consideration to finance underwater archaeological research. Permission for exclusive access to selected sites can for example be negotiated by the national authorities with controlled dive clubs in form of a dive club guardianship of sites. This will guarantee the integrity of the sites and ensure paid and controlled public access. Also public visits of archaeological work can finance and even valorise this work. A third approach is the evaluation of cultural development needs. Before deciding on which archaeological site should be excavated, a pre-evaluation of needs of a region can be undertaken from a scientific, and a developmental point of view. Instead of researchers responding to chance finds and museums being created out of a need to store material, it is promising to evaluate if a museum would be needed for a region's cultural development. Greater attention can also be devoted to tour and exhibition opportunities, as well as film and book rights in planning archaeological excavations.

stages through a continuous, consistent process of decision-making that covers the entire project, from the design stage to that of its implementation and final evaluation. Throughout all the successive stages of the project, specific tasks relating to financial aspects need to be carried out.

Information is the first of all assets and its decisive role cannot be emphasized too strongly. Being fully informed about development, rehabilitation and tourism projects in the area, developments in the offshore and maritime industry, locally or historically closely related archaeological projects, international projects and techniques, as well as specific forms of financial assistance will result in gaining a great deal of time and can yield rewards in terms of funding.

Professional project management proceeds through a series of clearly defined stages, from initiation and definition, to project design and planning, to execution and finalization. For issues relating to funding, project design and project finalization are obviously decisive stages. In each of them a number of funding issues must be addressed in a logical sequence.

Evaluation of financial needs

The objectives of a project govern the need for means. It needs to be determined how much funding is needed to achieve the goal of an intervention. The project's efficiency is ensured by choosing appropriate means, whereas gearing the means to the results determines effectiveness.

The objectives of underwater archaeological projects are informed by assessing:

- the historical, archaeological and public significance of the heritage;
- the potential threats the heritage is exposed to when left unattended under water;
- the technical opportunities and constraints for protection, exploration or research;
- general policies and visions;
- the time frame;

- the ecological consequences of an intervention; and
- the benefits for the public, for research and specific stakeholder groups.

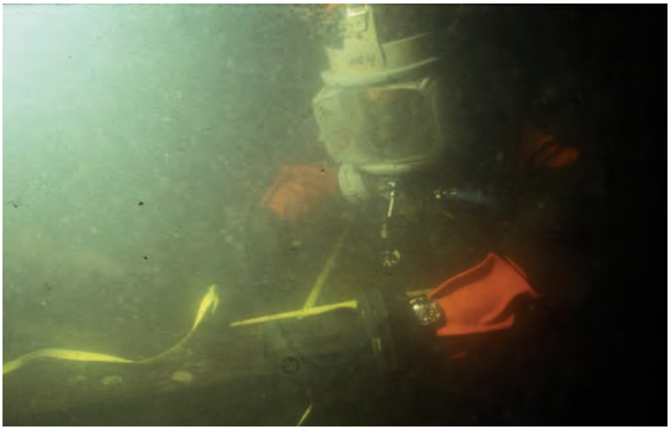
By analyzing these aspects, the archaeologist in charge can decide on an adequate intervention and the methods to be employed: non-destructive underwater exploration including documentation of visible remains, *in situ* preservation, or archaeological excavations and conservation/restoration operations. The project objectives, cost estimate and the amount of financial resources required will depend on this choice.

Estimation of costs

A detailed and balanced budget estimate is indispensable for the successful completion of the project. It needs to take account of both the costs of the archaeological intervention and the costs for conservation, documentation and curation of recovered artefacts, report preparation and dissemination in the short- and long-term.

Precise and reliable cost estimates of the individual phases should be combined in a global budget estimate. This is required to determine the total amount of funding needed, but also to correctly allocate funding to the individual project phases and their accurately calculated partial budgets. The funding plan needs to take account of possible price increases, particularly for long-term projects, as well as for changing environmental conditions.

▼ © Thijs Maarleveld. Archaeologist Thijs Maarleveld mapping the sixteenth century wrecksite *Scheurrak SO 1* in the western Wadden Sea, using trilateration and voice recording. In estimating the cost of a project the number of hours used in basic recording is an important factor. The shifting shallows of the Wadden Sea with strong tidal currents and lots of sediment in suspension and transport, feature low visibility and generally disadvantageous working conditions. This is a factor that influences the methods chosen and the number of hours to be invested in basic documentation and therefore influences the estimation of costs.



The calculation of the cost-estimate and the amount of resources to be involved in the realisation of the project will depend on the method, the manner and extent of the research planned, and the duration of the envisaged project.

Planning risks

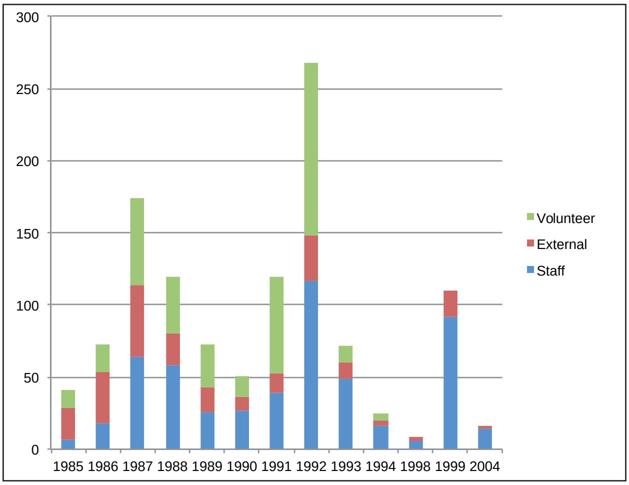
Planning for contingencies and risks is an essential part of project management. Breaking up policies, programmes and strategies into projects is in itself a form of risk management, making sure that results are obtained and that costs do not get out of hand. Although many other risks exist, financial risks are certainly an important category. If funding stops, it needs to be ensured that conservation, documentation and curation of recovered artefacts, report preparation and dissemination continues as planned or appropriate. It is for this that the Annex includes *Rule 18* and *Rule 19* that specifically address these issues. Planning of risks has an important role in the project design. This is reflected in cost estimation and has an effect on the funding plan. Proper risk planning, included in the budget estimate, may indicate one or more thresholds or breaking-off points at which the project could – if need be – be interrupted or discontinued and still be properly wound up. It may also include predefined monitoring and evaluation points, at which partial budgets can be reallocated. Generally, risk-included costs will lead to a higher global budget estimate, which will contain entries for contingencies and interruption. In combination with a risk-discounted budget, however, such an approach may have the effect of installing greater confidence in funding bodies, leading to a higher probability of success.

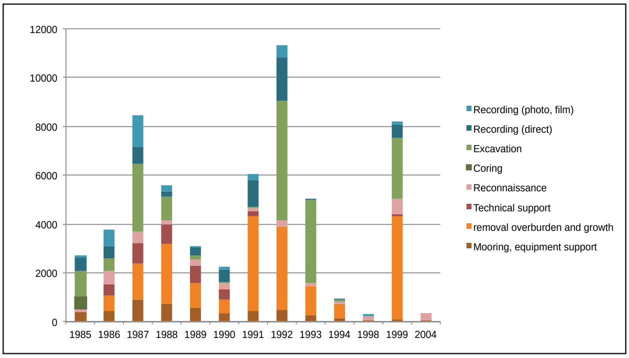
Elaboration of a funding plan

A good funding plan is a coherent, well-documented and clearly presented dossier. It must take into account the objectives of the project, the foreseen activity and the projected cost estimates . It will then assemble the following basic requirements:

- **Analysis of the project's significance** (evaluation of the project's intrinsic quality)

- **Examination of the project's suitability** (illustration of the matching of means to objectives)
- **Detailed budget plan** (delivering credible risk-discounted cost and return expectations)
- **Evaluation of the team** (competence of those involved in project execution, who act as guarantors of its materialization and durability)





Always include a concise executive summary, explaining the funding plan in as few words as possible.

The funding plan must also meet certain formal requirements for content and form in case it is submitted as a formal funding application. It must then be suited to the sensibilities and demands of the funding partner. It is therefore wise to ascertain beforehand whether there is a deadline for submission and whether there are certain standard forms that have to be completed, however demanding this may be, in order to rework the same plan according to different formats.

Funding as a pre-condition

A project's financial needs must be fully covered by the appropriate sources of funding before starting its implementation. The funds have to actually be available (i.e. in the bank account) before the start of each phase of the project. In case there is not one funding source covering the entire project, it is advisable to divide the project into separate archaeological project phases with independent funds.

◀ © T. Maarleveld. Financial monitoring of expenditure should be combined with monitoring of the exertions and their efficiency. In the multiyear *Aanloop Molengat* project, an analysis of bottom time was made in relation to primary and supportive tasks. In the second graph invested manpower is expressed in fieldwork man-days. As this was a public archaeology project, it involved a mixed team. The *Aanloop Molengat* site lies offshore in the North Sea, exposed to the predominantly westerly winds in just 16 m of water. The project comprised the excavation of a ship laden with ingots of lead and tin from Poland and Czechia among other consignments. It showed that the ship departed from the Dutch Republic in 1635 or shortly after. It was a ship of considerable size as its cargo weighed more than 600 tons.

Structure of a funding request

Executive summary

Project description including:

- description of planned activities, timetable, methods and specialists involved
- discussion of preliminary studies and significance of site and proposed project
- expected results and deliverables
- expected spin-off

Description of competence and qualifications including:

- reference to previous successful projects of the research director
- CVs of key staff
- copies of appropriate publications, videos, press-clippings, etc.

Funding plan including:

- detailed, balanced budget estimates, signed and dated by the legal representative of the project

Administrative information including:

- Letter by research director explaining funding scheme, the amount of assistance requested and its specific purpose
- Name, address, e-mail and telephone of registered office of the organization promoting the project
- legal status and statutes
- names, addresses and positions of those in charge of the project
- a balance sheet for the past year of the body promoting the project
- bank references
- signed references of the other financial partners who have already agreed to participate

A golden rule for all projects is never to leave out the technical parts of the dossier, i.e. the details of the administrative and financial aspects.

A phased approach to decision-making on an underwater cultural heritage site is a good idea anyway. If the conditions allow for it, it is wise to address a site with a well-defined, overseeable project, the evaluation of which will allow for the next step in decision-making.

Financial monitoring

Professional project management supposes a professional project administration that allows for monitoring progress and expenses. Depending on the scale of the project, the financial administration can be managed by the accounting department of one of the promoting institutions, or by a specific accountant hired for the project. Funding bodies may put specific demands on periodical reporting. In any case, there should be a very direct and close link between accounting and project management in order to appropriately monitor and adjust.

Reporting to the financing source

At the completion of the project, the final report has to be submitted to the financing partners, demonstrating and illustrating the objectives achieved with their funds. This report has to be honest and audited and ideally enclose all invoices. It should respect in detail the reporting requests of the funding agency or donor and be submitted respecting the agreed deadlines.

Raising funds

Rule 18. The project design shall demonstrate an ability, such as by securing a bond, to fund the project through to completion.

A long tradition of government concern for archaeology and archaeological projects suggests that the financing issue is only to be solved through public funding, whether in the form of institutional funding or subsidies. Force of habit is in this case a powerful factor, and, while for instance the cultural industries operate under market constraints and therefore reason more or less in terms of profit margins and capital outlay, archaeology has a tendency to think of itself as different; so different, that it would be compelled to use other than the normal, well-known channels followed by all enterprises. Of course archaeology has its specific features. It is far from certain, however, that archaeological projects are as specific as is generally believed. In view of the comparative diminishing of dedicated public funding, the involvement of the business and financial world in cultural life, in the form of sponsoring, takes ever greater importance.

There are various types of funding and sources. A range of them can be considered to support an underwater archaeological project. Eligibility to apply for them will depend, for example, on the project team's institutional character: the kind of legal *persona* that is financially accountable for the project; the kind of legal *persona* that is applying for funding.

Types of funding

Institutional funding

Institutions like government archaeological services may have an annual budget to perform their duties. Such a budget may have entries for fieldwork, staff and other functions that can be used to implement projects. Such budgets are always limited and are best reserved for foreseeing the 'unforeseen'. For larger and long-term operations, integral project management as advocated here is highly compatible with budgets allotted in a budgetary cycle. The annual budget is then treated as a source for subsidy and more projects can be developed.

Subsidies

For many project leaders subsidies are the first and most evident source of funding of cultural projects. They may come from local, regional, national or international sources related to governments. The most important sources are the public authorities responsible for the protection of culture. Other sources may be intergovernmental or similar organizations, operating, for instance, under the United Nations and the EU. Subsidies may include aids for research on preservation and dissemination of underwater cultural heritage, marine research subsidies, job creation subsidies and company creation grants. In particular, there may be opportunities arising from regional or urban tourism, or infrastructure development strategies that may involve considerable financial resources.

▲© T. Maarleveld. Research on the remains of a Roman bridge in the river Meuse, right outside the walls of the city Cuijk (ancient Ceuclum), was possible only through the initiative and contribution of a wide range of sponsors, mostly local firms, whose logos were displayed with the project information on the river quay from where the activities could be seen. Here the project team, including discoverer Joost van de Besselaar, directing archaeologist Boudewijn Goudswaard, public archaeologist Joost Mioulet, communications manager Carin Barten, professional team members Jeroen Marée, Roeland Hilgers and Ruud Paesie as well as a large portion of the local support proudly pose in front of the 'sponsor – wall' in their newly acquired –sponsored!- red coveralls.

Some subsidies may be conditional, i.e. subject to the involvement of other partners in the project (other public authorities or private partners under a 'matching contribution' system). Subsidies may be one-off or renewable. Regular subsidies towards operating costs usually entail a form of contractual agreement between donor and recipient. Subsidies may be in cash but may also - like patronage and sponsorship - be in kind (making premises available, provision of equipment, secondment of staff, technical assistance, etc.).

Receipts

The presupposition that numerous archaeological activities are chronically underfunded often leads to overlooking the fact that receipts are an increasingly important source of funding. This is attenuated, however, by the fact that financial benefits, also those in receipts, may flow to other administrative units than those directly involved in determining the cost of a project. Nevertheless, receipts could make up a larger proportion of the budget than they generally do.

Receipts can stem from the production of publications, films, picture rights, conferences, se-minars, exhibitions and diving concessions on the visit of protected underwater sites. A drawback is that these types of receipts are mostly received only after the completion of the project. And – as in all cultural activities – receipts are certainly not the only benefits that are produced. Their increment should also not conflict with other interests. Nonetheless, they can be accounted for in the initial funding plan, and be used to fund additional dissemination activities or integrated in the funding of an activity that follows the first phase. Receipts can be a decisive factor since they are taken into account by financial backers in assessing the economic feasibility of a project and show that it is geared to demand.

Patronage and sponsoring

Institutional patronage and sponsorship derives usually from three possible sources: firms, semi-public bodies and national or international foundations. Though certain countries have a long tradition of patronage (particularly in the English speaking world), nearly all States are today seeking to encourage more private support for conservation and archaeology, for instance, by offering tax incentives.

Private patronage by individuals is another option. Unless there is a particularly rich patron or group of patrons, private patronage is an option for projects likely to strongly appeal to a specific segment of the population. This is for instance the case when a strong historical bond exists between a population and a site, as for the excavation of the *Mary Rose*. In this situation, calls for donations and internet collection tools can raise considerable funds.

Another, often overlooked, possibility is the use of donations and bequests, which in the United States, for example, account for the major part of endowment funds.

In-kind contributions

Apart from financial contributions, the supply of non-financial contributions in terms of professional

◀ © T. Maarleveld. Coastguard and specialist patrolling vessels are deployed in any case. They can carry out simple, but extremely crucial and beneficial interventions in the course of their everyday work.
This includes the reporting of the discovery of new sites or of activities going on at known sites.

and expert personnel or specialist equipment is of particular relevance for underwater archaeology. Expertise can often be provided by arrangements of association with other institutions.

Inter-institutional collaboration is an essential factor in the reduction of costs occurring during archaeological research. Supportive activities that are essential for archaeological projects can for instance be integrated in the activities and work plan of government departments, whose objectives are tightly connected with the water, the sea, and the seabed. The ministries of defence, maritime affairs, internal affairs and public establishments, and port authorities, help and facilitate the work of archaeologists. Coastguard and specialist patrolling vessels are deployed in any case. They can carry out simple, but extremely crucial and beneficial interventions in the course of their everyday work. This includes the reporting of the discovery of new sites or of activities going on at known sites. Institutions concerned with oceanography, geology or biology, are another category. They also have a presence at sea and they can engage in joint projects with underwater archaeologists to reduce the respective costs of exploration. The biggest share in terms of collaboration with the archaeological team can be borne by the local community, which will, over the long-term, benefit from projects, and which should take an active part in them, irrespective of whether their help is material, logistic or financial. Coastal communities tend to closely associate with the sea.

Private sector sponsoring may also take the form of assistance in-kind, such as the loan of premises, equipment or personnel, technical assistance (project studies and expert advice) and the provision of services free of charge or at a reduced price (travel, technical supplies, equipment etc.).

Last but not least, the contribution of volunteers, amateur divers or NGOs, may represent a major contribution in-kind, with the added benefit of embedding the operation more within society. Encouraging the active participation of students, divers and youth in exploration, but also in other protection interventions or activities may even prove a long-term investment in the practical training of experts, who will in the future run similar projects themselves.

Equity financing, advances and loans

Advances and loans are often a subject of discussion between the promoter of a project and funding agencies. Advances and loans may take various forms: cash advances (discounts on subsidies, permission to overdraw, etc.); short-, medium- or long-term loans; ordinary loans or loans with a State-subsidized interest rebate. Obtaining a loan is normally subject to guarantees (save in exceptional cases such as subordinated loans). It is therefore at this level that guarantee funds and mutual security funds (vocational or public) have a decisive role to play. Certain investment schemes give the right to special loans at a reduced rate of interest and many different financing sources should be contacted, if necessary via a broker. Public authorities may also, either directly or indirectly through specialized mechanisms, accord loans or advances against receipts that are repayable only if the project is a success.

Interests

Cash management is too often neglected, and no due advantage is taken of the numerous opportunities for short-term investment that offer remuneration for sums not at present being employed and ‘lying idle’ in a current account. Just as one pays interest on advances and loans, so it is possible to receive financial returns that can add up to a worthwhile sum. This applies both to the project organization and to a sponsor who makes committed funds available with a delay. It is an aspect that can play a decisive role in negotiations.

Long-term financial mechanisms

Project managers can resort to long-term financial mechanisms to secure the completion of an archaeological project. This is all the more relevant for projects that are designed to run over many years and for which the financial stability is hard to foresee in total. Securing the project in a way that shows that the demands of *Rule 17* can nevertheless be met is then all the more important. *Rule 18* makes this point and suggests that one of the ways of doing so is by securing a bond. A bond is a debt security in form of a formal contract to repay borrowed money with interest at fixed intervals. It functions like a loan: the issuer is the borrower (debtor), the holder is the lender (creditor), and the coupon is the interest, with the difference that bonds are issued in the primary market (underwriting). Bonds are thus marketable and transferable. They provide the borrower with external funds to finance long-term investments backed by the borrower's specific assets as collateral. These can be sold by the bondholder in case of a default (secure form). Bondholders have a creditor stake in the issuing company and usually have a defined term, a so-called 'maturity', after which the bond is redeemed. An exception is a consol bond, which is in perpetuity (i.e. a bond with no maturity).

Regarding the possibility to issue bonds, the legal nature of the archaeological project team or its affiliated institution is of importance. In fact, in many cases it will block this option. Bonds can be issued by public authorities, credit institutions, companies and supranational institutions in the primary markets. A project director, the archaeologist leading the project, is usually not eligible to underwrite a bond, and thus the bond would have to be issued by the responsible institution.

Bonds are not the only way to secure a project and bank guarantees or guarantees by institutions or authorities may serve equally well to secure a project's completion.

Sources of funding

There exists a wide range of funding sources: public or private, local to supranational; from private individuals to enterprises, public authorities, finance institutions, non-governmental organizations, international organizations, vocational or semi-vocational organizations, foundations, tourism offices and so forth. Multiple funding has become the general rule. Indeed, potential partners who can provide assistance themselves seek out and encourage - sometimes through coercive measures – the enlistment of other financial partners.

To identify the appropriate funding source, projects should be distinguished in terms of scale and ambition: a weighty archaeological project or museum construction will have a better claim to national, or even international funding than a project with limited scope. In each case, the presentation of the project to the potential sponsor needs to be adapted, so as to address as closely as possible concerns and objectives of the potential backer.

International and supranational organizations

International organizations may fund significant archaeological projects, but will give priority to multinational or at least regional projects, in particular those aimed at setting up international networks. Appropriate organizations that can be contacted are, for instance, UNESCO or the European Commission and its several subordinate bureaus. For projects seeking partnership arrangements with UNESCO, it is advisable to apply initially to the National Commission for UNESCO in the country of origin of the project. Similar other international or supranational organizations have their own procedures that should be respected for requesting funding or support.

In addition to financial assistance, the moral patronage of an international organization can also be of great advantage in approaching other funding sources.

National authorities

Public authorities from the local to the national level may award a variety of financial aids that cover the full range of subsidies, from research or study grants to pre-purchase schemes. At the local level assistance may be in-kind, at higher levels it is usually in ready money. In almost all cases, it is necessary to approach the higher funding authorities through the local authorities.

One point deserves to be given particular emphasis: from the administrator's point of view, an archaeological project nearly always relates to several fields of competence. For example, a project might be eligible for aid on account of its archaeological, historic, and cultural nature, but also for its economic and tourism dimension, its marine dimension or its international dimension. Even where there exists a structure such as a ministry of culture, it is not uncommon to also obtain support from the ministries of tourism, education, marine affairs, research, science, or foreign affairs.

Foundations and non-governmental organizations

Foundations pursue their own particular programmes of action, but many of them may be willing to help fund projects submitted to them. Assistance is usually financial, more rarely in kind. Some foundations are private, i.e. established by a single person or perhaps by a group of persons, others may have been set up by firms (small or medium enterprises or large multinational corporations). A distinction should be drawn between foundations with national and those with international aims. The former usually limit their activities to a particular geographical area, usually a country, but sometimes also a region or local district.

Non-governmental organizations (NGOs) are non-profit bodies created on private initiative. Many of them enjoy consultative status with an inter-governmental organization (such as the European Union or UNESCO). Some of them may give direct financial support to a cultural project. Due to their usually limited means, these are, however, not many. Nevertheless, they often serve as vital go-betweens through the information they are able to provide and above all through their influence and their role as moral guarantor in the eyes of potential backers. Sometimes, their services are indispensable to gain access to certain earmarked programmes. In other cases, NGOs may benefit from co-financing by International Organizations. The International Council on Monuments and Sites (ICOMOS) is a worldwide network of heritage professionals that closely monitors policies related to the UNESCO heritage conventions. It is therefore affiliated with UNESCO, just like ICOM, the International Council of Museums. ICOMOS has a specialist International Committee on the Underwater Cultural Heritage, ICOMOS-ICUCH. It does not fund projects, but it provides counsel and acts as a clearing house for professional ethics and quality. It tries to integrate professional members from as many countries as possible.

Vocational and semi-vocational bodies

Vocational and semi-vocational bodies (tourism bodies, marine institutes, chambers of commerce, etc.) may provide considerable assistance, whose value, especially at the decisive stage of project design, is often underestimated. Such aid may be of three types: the provision of information that might save money or facilitate the search for financial backers, technical assistance in the form of advice, expert assistance or even training, and in exceptional cases, financial assistance.

Financial institutions

Banks are normally the least receptive to cultural projects. However, a good project with an economic dimension (often tourism or regional development) may receive a favourable hearing. Certain banks, however, have come to specialise in associations or cooperatives, whereas others have taken an interest in the arts and archaeology. It is therefore essential to collect information in order to address requests to the appropriate institution. Moreover, there exist specialist funding agencies (companies specializing in venture capital, mutual-security schemes or regional development).

The private sector

Private firms may assist archaeological projects through patronage and sponsorship, either directly by offering finances or by providing assistance in kind. Such opportunities are largely dependent on the tradition of a firm's involvement in civil affairs, which may differ from country to country. The readiness of firms to sponsor archaeological projects also depends largely on the existence of tax incentives aimed at developing partnerships with business.

One of the main incentives for firms is their public reputation, i.e. advertisement advantages by connecting themselves to projects that are to public benefit. They will usually prefer projects that have a high visibility within the public.

Decisions on which project may obtain funding, are usually taken within the firm by the managing director, by the head of the communication department or – in larger firms – by the unit in charge of sponsorship.

Individuals

Private individuals may contribute to the financing of an underwater archaeological project through the receipts they may generate in return for goods or services. Their contribution can also take the form of private patronage (gifts, bequests or donations). A public appeal to investors is still exceptional, save under innovative funding schemes that attract investment from close 'active sympathizers'. Private individuals may also provide substantial assistance in kind through the loan of equipment or through voluntary work.

Contingency planning

Rule 19. **The project design shall include a contingency plan that will ensure conservation of underwater cultural heritage and supporting documentation in the event of any interruption of anticipated funding.**

Numerous incidents can be incurred during an archaeological project. Appropriate planning needs to facilitate appropriate action when they happen. Contingency plans (also referred to as back-up plans, worst-case scenarios or plan B) are emergency strategies devised beforehand to explore and prepare for any eventuality, thus addressing risks, accidents and incidents that might occur. They are required to help projects to survive serious incidents and recover in minimum time with minimum cost. They consist of strategies and a plan of appropriate actions to deal with specific deviations from the original plan, which was based on assumptions at the start of the project.

In fact, archaeological projects that include excavations are always based on ranges of assumptions. After all, they pursue research into the unknown. However, as in any science, the operations can still be planned in a controllable way, by making sure that one proceeds step-by-step and that from the very outset one allows for several scenarios. A find layer may contain material that calls for a specialist's attention. Documentation may be more demanding if features are hard to interpret. The site may continue deeper than foreseen. These, however, are the normal aspects of an archaeological operation, and if one part turns out to be more time-consuming than expected, another part may take less time. Also, the project design may prioritize certain activities, with others remaining optional.

A special consideration for on-water and underwater activities in archaeology, is their extreme dependence on adequate and well-functioning equipment, and on even marginal changes in the environment. Sea state, weather, extreme tides, shifting current patterns and shifting sands are what determine progress. Furthermore, changes in underwater visibility will obviously affect documentation by visual or photographic means. All these can be planned for to a certain extent. After all, preliminary study will show what kind of weather pattern one can expect according to the time of year. Specific actions within the project will be more dependent on dead calm than others, although all will profit from it. If conditions are variable, the plan –and even more importantly, the team– should be extremely flexible to make the best of a spell of favourable conditions. One can recover from the extra effort when the weather breaks. If conditions are more stable, one can be slightly more relaxed on running the extra mile. Equipment-wise, redundancy does not seem to exist. Backups that can be deployed at short notice, when a compressor, a pump, a generator, or an outboard motor fails, are essential. Nevertheless, there will always be weak links and unforeseen setbacks that may build up in a way to threaten the project. Besides the purely archaeological contingencies and the logistics of making sure that all pieces of equipment arrive before they are needed and that specialist operators are available at the right moment, there are other aspects that need to be part of the risk-assessment in view of funding.

▲ © J. Auer. Archaeologist Thijs Maarleveld taking notes on deck on a sunny day during the annual field course of the Maritime Archaeology Programme of the University of Southern Denmark in 2010, when the course was organized jointly with Archaeological Agency of Schleswig Holstein in the Kieler Bugt, Baltic Sea. Timekeeping, recordkeeping and bookkeeping are crucial to the success, efficiency and safety of any project. Archaeological projects and projects at sea, with their many contingencies are no exception to this rule; to the contrary!

There can for instance be

- extreme weather conditions;
- changes in the legal context (a permit is withheld, a contract is not signed etc.);
- failure of expensive equipment or an anticipated research vessel;
- accidents (emergency situations for the staff etc.); and
- problems of funding (sudden end to funding or a delay in receiving the foreseen subsidies etc).

A risk profile should be drafted for all archaeological operations based on the evaluation of external and internal risk factors, including emergency responses and alternative operations. Furthermore, one should consider contracting an insurance that, depending on the project, can cover the whole project or some particular risks that could be incurred, despite planning for their avoidance. Diving accidents are such a risk and a severe one.

Interruption of funding

Contingency plans shall cover all eventualities, but particular attention should be paid to unanticipated cuts in funding. *Rule 19* addresses this and concentrates on the effects such an interruption will have on the underwater cultural heritage in question. If the project is purely non-intrusive, the on-site effects may be minor. Nevertheless, in that instance, care should be taken to make sure that the documentation will be secured, as it is essential for preliminary studies relating to the future management and enjoyment of the heritage in question. If, on the other hand, the project contains intrusive steps, like excavation, the effects of interrupted funding can be considerable, including the destruction of the site or increased vulnerability to degradation and erosion, which are not offset by project results or creation. It is therefore that the project design should include a contingency plan to make sure that even in the event of an interruption in funding, the project can still be wound up properly, and that the site and the supporting documentation can be secured in a responsible way.

A major means of making sure that the site is not disproportionally endangered is to plan in phases. Even when the long-term vision is in to fully expose the site, it is recommended to divide the archaeological project from the outset in distinct sections. The works should be separated in phases with clearly assigned individual budgets and sources of funding (for instance: Phase 1: Exploring; Phase 2: Planning; Phase 3: Intervention and first aid conservation; Phase 4: Conservation and Reporting; Phase 5: Documentation and Archiving). Taking a phased approach allows for reconsideration on the basis of the then available information. It may also improve decision-making on the site's future. One could also decide to consider each phase that fits into the wider scheme as a separate project. No archaeological work must begin before funding for the completion has been secured and received. A clear timetable with deadlines for the receipt of funding and the start of project sections should be devised. Strict adherence to this schedule guarantees that no phase in progress is exposed to risks of sudden interruption. In case a lack of funding for a subsequent phase occurs, the archaeological work is only interrupted after the completion of the current phase and the project could be left at this stage without putting the vestiges at risk.

It may be helpful to obtain funds from diverse sources to limit the risks of funding interruptions and their consequences. Multi-source financing may in the long-term contribute to ensuring the completion of the project in its planned volume, in all phases, and limit consequences of unpredictable situations.

Alternative sources of funding, to cover emergency situations, need to be already identified while planning the project financing. These provisions have to be kept up-to-date throughout the project. Some countries offer special procedures and government grants to help in emergency situations.

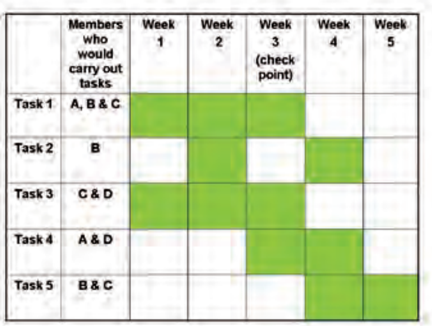
Benefits of Protection

Underwater cultural heritage holds a vast potential for sustainable development. It opens long-term tourism and economic development opportunities. The investment in museums of underwater archaeology, dive trails and other forms of access for the public, promises a beneficial and lasting return. Studies show that every dollar invested in heritage increases the economic activity around the site by a factor between 1.2 to 8, depending on the significance of the site and the form of its valorisation by museums and individual access. Exceptional underwater heritage can also be a strong factor for urban development. The Vasa, *Mary Rose*, Bodrum and Roskilde Museums have considerably changed the way Stockholm, Portsmouth, Bodrum and Roskilde look today.

VI. Project duration – timetable

Setting a timetable for the whole of a project, as well as for each of its individual phases and activities, is a fundamental component of a good quality project design.

The project timetable



▲ © E. Khalil. Example of Gantt chart for a project timetable. Tasks are represented along the y-axis while time (in weeks in this case) is arranged along the x-axis. Note that week 3 in this project is a major evaluation point during which the progress of the project and its activities is assessed and evaluated.
In the second column the members who will be carrying out each task are identified.

Rule 20. ***An adequate timetable shall be developed to assure in advance of any activity directed at underwater cultural heritage the completion of all stages of the project design, including conservation, documentation and curation of recovered underwater cultural heritage, as well as report preparation and dissemination.***

During archaeological projects, a number of specified activities are carried out within time and budget constraints. In this respect, archaeological project management is no different than project management in other fields. Nevertheless, archaeology has its specificities.

One of the major aspects of archaeological project management is the ability to control the use of time and money. It needs to be ensured that all tasks and activities that will be undertaken during a project are adequately resourced and carried out in the correct order and with appropriate use of the available resources. The timetable is a tool that enables the monitoring and assessing of the progress of a project throughout its duration. In this way, a timetable assists with identifying unforeseen circumstances that could affect the development and successful outcome of the project.

The complexity of an archaeological project requires that some of its tasks be performed sequentially, while some can be performed in parallel with other activities. This combination of sequential and parallel tasks can be presented through a project timetable.

A timetable is an essential means of setting a project's aims and activities into an achievable schedule given the available resources.

Without a timescale for the different activities, it is likely that time and resources will be wasted, and a project could face problems that might result in its early termination or its failure to achieve the planned objectives. Such problems can be avoided if a realistic project timetable is formulated.

The necessity for a project timetable also arises from the fact that an ideal project, where unlimited resources are available and every piece of evidence is recovered and studied, is unattainable.

Establishing a timetable

There are **three main elements in a project timetable**:

(a) The **activities to be carried** out during the project:
A timetable should consider all project tasks and activities from initiation through to completion. This should include fieldwork, assessment, analysis, conservation, dissemination and curation considerations. Accordingly, the timetable will be significantly influenced by the project scale, the type of site, the different methods used for data-gathering and the expected post-fieldwork activities.

(b) The **time and resources required** to carry out a project's planned activities:
To draw up a project timetable, the timescale and different resources (funding, personnel, equipment, etc.) necessary to undertake each of the project›s tasks need to be estimated. Also, the logistics related to carrying out the different activities (permissions, health and safety requirements, etc.) should be taken into consideration. Therefore, an assessment of the human, material, and financial resources, including any particular facilities and expertise, is necessary for drawing up a project timetable.

▲ © J. Auer. The success of an archaeological project relies completely on teamwork, but this extends far beyond any diving team. It also includes fundraisers, bookkeepers and all those that make the work of scientists and heritage managers possible.

(c) The **order** in which a project's activities should be carried out:
In an archaeological project, certain activities have to be carried out before others. Therefore, in order to create a project timetable, the relation between different tasks and activities and the sequence in which they are executed has to be properly determined.

Team-work: Drawing up a timetable for an archaeological project is not a job to be done solely by the project director. It should be a collaborative act that involves the senior specialists in charge of the different aspects of the project. Therefore, before creating a project timetable, the project director should adequately consult with the key members responsible for the excavation, geophysical investigation, conservation, finds handling, photography, administration and other relevant activities associated with the project. For example, if the project involves diving, consideration should be given to health and safety regulations and the limitations of diving operations. Failure to collaborate with the relevant specialists could result in the establishment of an unrealistic timetable and cause many hours to be wasted in trying to solve problems that could have been avoided with proper planning.

The success of an archaeological project relies completely on teamwork. Therefore, it is important for each member of the team to become familiar with the project timetable. Once the timetable is compiled, and prior to the start of the project, each team member should have a clear understanding of his/her role in the project, of the timetable and of the order in which their tasks are to be undertaken, and ideally completed.

Visual representation

The best way for making the timetable accessible and clearly understandable to those who are involved in the project is by presenting it in a clear and simple **graphic format**.

This graphic representation should show:

- all the tasks to be undertaken
- the correct sequence in which the tasks will be undertaken
- the inter-relatedness and interdependence of these tasks
- time-critical elements and considerations
- the length of time allocated to each task
- the personnel allocated to each task
- agreed monitoring points

There are a number of different ways to represent a projects timetable visually, such as cascade charts, Program Evaluation & Review Technique (PERT) and Critical Path Analysis (CPA). The size and complexity of the project will influence the method best suited to presenting the timetable. However, one of the most widely-used methods is the **Gantt chart**, named after the American engineer Henry Gantt (1861-1919).

A Gantt chart is a useful tool for planning and scheduling projects and monitoring their progress. It consists of a bar chart that graphically represents the duration of tasks against the progression of time. Along the y-axis of the chart individual tasks and activities are identified and arranged, while along the x-axis the time is represented. It can also include the allocation of project team members to specific tasks.

According to the nature of the project and the activities performed, the timetable on the chart could extend over a day, weeks, months and even years. The chart can be broken down into smaller time allocations for specific tasks. Putting a project timeline in a visual format can be an important outcome of the project planning stage and is good management practice.

Specific timetables: In addition to the general timetable for the project as a whole, more detailed timetables should be created for specific activities. For example, a specific timetable can be developed for field conservation which is carried out for excavated artefacts, prior to their transportation to a specialized conservation laboratory. The process of field conservation, also known as first-aid conservation or preventive conservation includes a number of tasks, such as cleaning, desalination, consolidation and packing. A timetable could be created in order to prioritise the treatment process of the excavated objects according to their material and condition, given the time and resources available.

▼ © Archivo del Centre d'Arqueologia Subaquàtica de Catalunya. The Wreck *Sorres X* (14th century) sunk in the Canal de Remo Olímpico de Castelldefels, Barcelona, Spain. This is a rare case of a ship with two types of rudders: an axial rudder (stern rudder) and a lateral rudder(side rudder a.k.a. quarter rudder). It was discovered during the construction works of the Olympic channel of Castelldefels in 1990. After preparatory work, it was excavated between 1990 and 1991 under the direction of A. Martín. The project report was published in 1992.
The efficient and timely completion of this project from preparatory work to publication was achieved through rigorous planning and accurate implementation of the project design.

Project length

Archaeological projects vary in their nature, scope, methodology and budget, resulting in great variation of duration. Some basic surveys could last only for a few days, whilst some excavation projects can take decades to complete. However, the scale and complexity of many archaeological sites may prevent the undertaking of a full excavation, especially when advances in research and analysis techniques can turn the study of one quite small site into a lifetime of work. In view of this, it is wise to break up lifetime ambitions into smaller, manageable and easy-to-schedule projects. The nature of the project, objectives and its allocated budget will often determine the method or combination of methods that can be used in the various phases of the project.

Accordingly, when setting a timetable for a project, it is essential to keep the following in mind:

- What do we want to achieve during the project as a whole (long-term) and during intermediate stages (short and middle term)?
- What resources do we have or are we expecting to have for the project (funding, facilities, equipment, expertise, etc.)?
- How much time could be dedicated to each phase of the project (fieldwork, assessment, analysis, dissemination and curation)?

Due to many variables, the length of time that a project will take can be difficult to estimate. Nevertheless, some aspects of a project are easier to estimate, and it is less difficult to establish a timetable for them than for others.

Prior site evaluation

Quite often with underwater archaeological investigations, work is planned in a place where the investigator has not worked before. In this case, it is important to gather as much information about the area as possible, in order to have a realistic idea of how long the work will take and how it will be carried out. The advice of others with a thorough local knowledge, such as fishermen and local sailors or divers, should not be ignored. Moreover, the preparation of a major fieldwork plan could be preceded by initial evaluations of the site in the form of archival research, field survey or even limited excavation. This will result in a better understanding of the nature of the site and the fieldwork requirement (what needs to be done and how it will be done). Site evaluations are archaeological projects in their own right and should have a set timescale similar to major projects.

Several factors add to the planning. If they are left open-ended, unknown or ill-considered they could result in fieldwork taking longer to complete. Therefore different aspects should be taken into consideration:

- **Aims of the project**: A full excavation where all possible material evidence is investigated, recovered and processed takes more time than a preliminary survey.
- **Location**: A remote area where the team will be living in on-site facilities and to where all equipment and supplies need to be brought requests the investment of more time than a place close by.
- **Conditions**: A project where working conditions are difficult or unstable usually takes longer. For example, if the site is in a tidal zone where work can be carried out only during a limited interval every day.

▼ © Ships of Discovery. Two divers examine one of the 22 cannons found on the *HMS Endymion*, a British 5th rate wrecked in 1790 in the Turks & Caicos Islands, British Overseas Territories, United Kingdom. All fieldwork, especially the eventual excavation, needs to be carefully planned on the basis of initial site evaluations. This planning includes the establishment of precise time scales that assign specific durations to all activities.

- **Team Members**: Team members who do not correspond with the requirements of the project, for example, a small and inexperienced team working on a deep shipwreck site, will have to be accounted for.
- **Budget & resources**: A fieldwork project that has already started and depends on an unsecured budget, such as private donations, without a contingency plan of how it will be funded through to completion risks interruption or discontinuation
- **Work atmosphere**: A negative work atmosphere and an unmotivated team can have a devastating effect on all phases of the project .Daily briefings and debriefings are indispensable.

▼ © Archivo IAPH-CAS. Conservation and restauration laboratory of the Underwater Archaeology Centre of Andalusia, Spain.
Conservation is an integral part of the archaeological process and the post excavation study of archaeological finds. However, it is also an aspect of a project that can take much longer to complete than many others.

Conservation

Conservation is an integral part of the archaeological process and the post-excavation study of archaeological finds. However, it is also the aspect of a project that can potentially take much longer to complete than many others. For example, the wooden hull of the English Tudor warship, *Mary Rose*, which sank in 1545 and was discovered in 1971, has been under

conservation treatment since it was raised in 1982, and will probably continue this treatment for at least another decade.

In any project, the timescale of the conservation process depends on a number of factors, such as the size of the excavation, the range, volume and condition of the excavated material and the availability of conservation facilities and resources either on-site or at the conservation laboratories of the receiving museum or institution.

Since it is usually quite difficult to know beforehand many of the factors that influence conservation requirements, particularly the types, amount and condition of the archaeological material, an accurate conservation timescale is difficult to establish. Nevertheless, a conservation strategy and an estimated timetable have to be considered and developed in the planning phase. This strategy should include pre-excavation considerations, possible on-site conservation, laboratory conservation and long-term stabilization requirements. To do this, consultation with conservators and other relevant specialists is essential. Also, an initial site investigation and a sampling strategy are advisable. Finally, reference to similar projects could be used as a guide. Without due thought being given to conservation before excavation, a project can face serious problems when unexpected materials and conditions are found, and the recovery and treatment of finds could significantly affect the project timetable.

Post-fieldwork activities

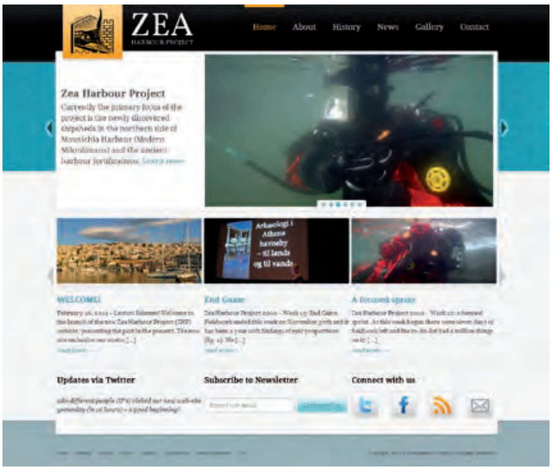
Post-fieldwork activities include the assessment and processing of data gathered during the excavation as well as the study and analysis of excavated material. Obviously, some of these activities should be carried out simultaneously with other activities. For example, the artefact records should be kept up-to-date while the fieldwork is underway; once the fieldwork is done, the artefact records in all likelihood are finished as well. Other activities, however, need to be completed in a sequence; so one activity can not start until another one has been completed. For example, the study of a particular material might not be possible until it has been conserved and stabilized. Both parallel and sequential post-fieldwork activities should be included in the timetable. Early dialogue with finds specialists and other team members, in light of the available and expected resources, would enable the compilation of a timetable encompassing most aspects of the post-fieldwork activities.

Dissemination

Making information and data about investigated sites available to other institutions, scholars, NGOs and to the public at large should be the ultimate aim for any archaeological work. The results of a project can be publicized through various means, such as written reports, internet websites, leaflets, displays, press and media outlets, public talks, academic publications and conferences. Such activities can be done at different stages before, during and after the project, and can extend for a long time after all other phases of the project are completed.

The target audience and the reason for dissemination will influence when, how and for how long a project is publicized. To attract potential sponsors and funding bodies as well as volunteers who might be willing to help with the fieldwork and post-fieldwork tasks, it can be useful to publicize a project at an early stage. While research is being carried out, the preliminary results of a project could also be publicized to receive feedback from other researchers and spread interest in the initial achievements of the project. By the end of the project, the final publication should be compiled and disseminated. Another common way of publicizing the results of a project during and after its completion is through museum exhibits. This enables the dissemination of the project among a much wider audience and for a longer period of time. Accordingly, the project timetable should indicate when and how

▼ © Zea Harbour Project. Homepage of the Zea Harbour Project.
The Danish-Greek Zea Harbour Project team has communicated the findings from its survey work in Piraeus, Greece, via its website, www.zeaharbourproject.dk to other institutions, scholars, NGOs and to the public at large. Making information and data about investigated sites available should be the ultimate aim for any archaeological work. Nowadays the Internet is an all important tool for communicating the past in the present. The dissemination strategy is an integral part of the project design and needs to be taken into account when establishing the project time scale.



the project would be publicized and when each form of dissemination would be used.

Contingency planning

Rule 21. The project design shall include a contingency plan that will ensure conservation of underwater cultural heritage and supporting documentation in the event of any interruption or termination of the project.

Due to all the variables associated with an archaeological project, it is quite likely that a project will face some unforeseen circumstances that could result in its interruption or delay. Technical equipment that malfunctions or that is not delivered in time is a classic example. Underwater projects tend also to be extremely weather dependent and the weather may not be as predicted, for an extended period of time. During fieldwork, the excavators could, for example, come across unexpected materials that require conservation treatments that are not available on-site. This could result in the interruption of fieldwork, on-site conservation, finds processing, etc. However, the sooner such circumstances are realised and assessed, the easier it is to get the project back on schedule.

Most circumstances that impact the course of a project can be predicted and planned for to a certain extent, but others cannot. Contingency planning is about taking account of many risks that are likely to be incurred.

Project monitoring

To ensure that the timetable is adhered to and to detect any interruption that might occur in the project schedule, it is essential to carry out **regular assessments** for all project activities and tasks based on the original project plan and timetable. Therefore, **detailed records** of the time spent on project tasks should be kept by all team members and reported to the project director. It is also necessary to monitor

▶ © K. Vandeevorst / Flanders Heritage Agency. The timbers of the medieval cog awaiting full documentation, conservation and analysis in containers in a field near Antwerp, Belgium.
The chances of a project being interrupted, disrupted or delayed are substantial as the history of archaeology has shown. Especially in larger, multi-year projects delays occur for many reasons: interruptions of funding, policy changes of authorities and sponsors, changes to priorities as well as the relocation of capacities in function of new urgencies. Project management should account for possible changes and elaborate contingency planning that allows for winding each project phase in a sustainable way. In the case of the so-called Doel cog (Sea harbour of Antwerp, Belgium) full excavation and field documentation were completed during the construction of a new basin for Antwerp's sea harbour. Then the project was interrupted. The timbers of this medieval ship awaited full documentation, conservation and analysis for almost ten years in containers in a field, gradually overgrowing with local vegetation. The analogue and digital archives can suffer from the intermediate period, both physically and in accessibility after changes in computer technology. All the same, the cautious winding up of the excavation phase allows for the continuation of this important project after the interruption.

the progress of each phase of a project. This will ensure that the project objectives are achieved within the planned time and budget. It also enables the identification of any deviation that might occur in each phase, which could affect the project as a whole. Monitoring a project's progress should be a continuous process that is carried out regularly throughout the duration. However, there are key milestones that provide major evaluation points, such as before and after fieldwork.

If the assessment and monitoring process reveals an interruption or deviation in project activities or timescale, the reasons must be established. Also, the necessary rectification procedures have to be carried out. This could include modifying the project design, altering project activities or adjusting the timetable to incorporate any unexpected delays. However, in all cases, any changes or modifications in the project plan should be circulated to all members concerned and consultation with the competent authorities may be necessary.

Contingency planning for interruption and delays

The most common error in planning is to assume that there will be no errors in the implementation.

A realistic project timetable takes into consideration possible delays and interruptions in the project plan. This allows for the original plan to be adapted in order to accommodate all changes. As a result, contingency planning requires prediction and early detection of activities that are more likely to face interruptions during a project. These activities might then be given a more flexible timetable or more resources might be allocated towards them to compensate for the possible disruption.

For example, it could be that some team members might not be familiar with new techniques or equipment used in fieldwork. Accordingly, a contingency fieldwork plan should be made to compensate for the disturbance and delays resulting from training the team members in those techniques. This might include rescheduling some of the activities or reallocating some of the team members to different tasks.

As the main priority in any archaeological project is safeguarding the site and the data it contains, the priority in case of sudden or unexpected interruption in the project plan lies with the preservation and stabilization of the archaeological material, both the excavated and *in situ* materials. For example, if an unexpected cut in the project budget occurs during fieldwork, resulting in a funding shortage that does not allow for the completion of the originally-planned fieldwork and post-fieldwork activities, the contingency plan should include the termination of fieldwork and redirection of the remaining funds to the conservation of the already-excavated material and to other post-fieldwork activities such as analyses, data processing and reporting. Close and continuous review of the project plan and activities helps in the identification of any unexpected disruptions and hence the quick creation of a contingency plan that takes into account the new circumstances and ensures the well-being of underwater cultural heritage.

Planning for an archaeological project is a multi-faceted endeavour that requires consideration of the particularities and specifics of each project. It should also allow for the project to be modified, improved, extended and, if necessary, handed over without difficulty to other researchers at any point during the project's duration.

- Use a timetable to plan
- Use the timetable to monitor progress
- Use a graphic format
- Develop the timetable together with team and partners
- Make sure that everyone understands the timetable
- Plan for contingencies

VII. Competence and qualifications

▲ © Wessex Archaeology. A diver putting on his equipment. Surface-supplied diver with the diving helmet and the umbilical device that supplies the diver with air, a communication line, video line to his/her camera, depth guage, acoustic tracking and safety line.
All project members involved in an underwater archaeological project must possess the necessary knowledge, qualifications, skills, training and understanding to ensure that their actions do not endanger this precious heritage. They must thus be competent in their specific field of action and with respect to the specific task assigned to them in the framework of the project.

Rules 22 and *23* address competence and qualifications, both very central concepts in archaeology, conservation and the heritage discipline in general. Interventions and activities directed at the underwater heritage should be carried out professionally as the continued well-being of the heritage is at stake. Professional attitudes and professional ethics are contextually related.

Underwater archaeologists

Rule 22. Activities directed at underwater cultural heritage shall only be undertaken under the direction and control of, and in the regular presence of, a qualified underwater archaeologist with scientific competence appropriate to the project.

The results of archaeological work or investigation will outweigh the 'damage' to the site that intervention, and in particular excavation, entails if it is professionally and competently carried out. In order to minimise the damage by and maximise the benefit from intervention (such as knowledge about the past) those involved must possess the necessary know-ledge, skills, training and understanding to ensure that their actions do not endanger this precious record. They must be appropriately qualified and competent to undertake the work planned.

Defining competence and qualification

Competence can be defined as being in adequate possession of the required skills, knowledge, qualifications and capacity to undertake the task at hand.

Qualification can be defined as 'a quality, ability or accomplishment that fits a person for some function' or 'that makes a person suitable (or competent) for a particular position or task'. Qualification is often based on a formal training process with a measurable outcome, such as a university degree, for example.

The key words are skills, knowledge, capacity, ability and formal training.

From these definitions it is clear that competence and qualification are closely linked and that a person's qualifications contribute to the competence in the activities undertaken. However, it is important to remember that these are separate concepts. Being qualified in a field does not guarantee that a person is also competent to carry out a specific task. The two concepts should therefore always be judged separately.

The qualified underwater archaeologist should have scientific competence appropriate to the project.

Qualifications for underwater archaeologists

The key requirement of *Rule 22* is that interventions on underwater heritage should be directed, controlled and overseen by a qualified and competent underwater archaeologist.

Archaeology is a scientific discipline concerned with reconstructing past human life and culture from the material remains that survive. In the case of under-

▼ © Emad Khalil. Alexandria Centre for Maritime Archaeology and Underwater Cultural Heritage, Alexandria University, Alexandria, Egypt.
The first class of maritime archaeology in the University. A small number of universities worldwide offer degrees of underwater or maritime archaeology at undergraduate or postgraduate level. The study at the university is a first step towards becoming an underwater archaeologist. However, this theoretical formation should be supplemented by years of full time professional experience applying the theories, methods and practices of underwater archaeology to the identification, evaluation, documentation or treatment of underwater archaeological sites.

Requirements for determining qualification will vary from place to place, as will rules governing the conduct of archaeological excavations. For example, the code of ethics of the Australasian Institute for Maritime Archaeology (AIMA) defines a maritime archaeologist as someone:

- holding an 'honours or other post-graduate degree in Maritime Archaeology or in another area of Archaeology with a major in Maritime Archaeology'; or

- who has 'gained recognition by Australian State, Commonwealth or New Zealand governments as a maritime archaeologist plus a minimum of two and a half years of full time professional experience applying the theories, methods and practices of Maritime Archaeology to the identification, evaluation, documentation or treatment of maritime archaeological sites in Australasia (one year experience in maritime archaeology must be under supervision of a maritime archaeologist); and products and activities that demonstrate the successful application of acquired proficiencies to the practice of maritime archaeological preservation'.

water archaeology, the focus of study is the long human relationship with the sea and other water environments. Archaeologists professionally quest for traces of the human past through the investigation, recording and interpretation of cultural heritage.

Their conception of what archaeology means and requires is very different to the perception amongst many divers, particularly those with an interest in the commercial exploitation of underwater cultural heritage. There is a risk that by paying lip service to archaeology, and drawing an odd rough site plan, some national authorities might be persuaded that a proposed commercial intervention in an underwater heritage site is a legitimate archaeological excavation. However, the practice of archaeology is not easily picked up to meet permitting or licensing requirements.

Archaeology is a professional discipline with:

- a strong theoretical base;
- a set of investigative techniques; and
- a common, established set of guiding principles.

All three can only be mastered through thorough training, including practical experience, and it is this training and the qualifications that result from it that ensure that the archaeological record is not compromised by an intervention.

To be deemed qualified and competent an archaeologist must therefore possess a university degree in archaeology and demonstrate:

◀ © Archivo IAPH – CAS.
Training course in underwater survey techniques, Cartagena, Spain.
In addition to university courses on underwater archaeology, practical training in the application of the methodology of the displine complete the profile of an underwater archaeologist. Training sessions are regularly organized by a number of institutions and research centres worldwide.

- thorough understanding of the way in which scientific knowledge is produced;
- ability in a range of field techniques from pre-disturbance surveys to complex excavations;
- training in artefact recovery;
- familiarity with at the least basic artefact handling and conservation techniques;
- skills in research and laboratory analysis; and
- ability and commitment to report and publish the detailed results of investigations and analysis.

All these abilities and competences need to be learned through patient application, time and effort. *Rule 22* and *Rule 23* of the Annex imply that just as competence and qualifications are non-negotiable and expected of members of any professional field, from medicine to engineering, they are just as applicable and important to the practice of underwater archaeology.

The importance of ethics:

It is training and qualifications, underpinned by a professional commitment to ensuring that interventions are carried out to the highest professional and ethical standards that sets archaeologists apart from treasure hunters and those with an interest in underwater cultural heritage which is at odds with its proper investigation and conservation.

Archaeologists have an ethical obligation to the archaeological record and to society. This is a very important part of what makes an archaeologist – just as important as the technical skills needed to competently carry out an archaeological investigation. It is what separates archaeologists from treasure hunters and others that only claim to do archaeology.

Respecting ethics

Most archaeologists work under local, national or internationally accepted codes of practice and ethics. As members of a range of professional bodies, archaeologists are required to abide by professional standards and codes of conduct. Their work will be subject to peer review and they can be disciplined and exposed if they act in contravention of professional ethics. Bodies such as the Association of Southern African Professional Archaeologists (ASAPA) in South Africa, the Institute for Archaeologists (IfA) in the United Kingdom, or the Australian Institute for Maritime Archaeology (AIMA), are important instruments in setting and maintaining national standards in archaeological qualification and competence. Membership of such a body will signify a certain level of qualification and competence in an archaeologist.

Determining qualification

Whether an archaeologist is deemed to be qualified will be determined by the requirements of the competent authority in whose territory the archaeological work takes place. In assessing competence, competent authorities with little experience in this matter may seek advice from professional organizations. Most countries will demand certain qualifications and set minimum standards, but in general terms

© M. Staniforth. Jun Kimura (Maritime Archaeology Program at Flinders University) and Dr. James Delgado (Institute for Nautical Archaeology/ National Oceanic and Atmospheric Administration, USA) at the Bach Dang battlefield site (1288 AD), Vietnam.
The project was carried out jointly by the Institute of Archaeology, Vietnam, the Vietnam History Academy, the Institute of Nautical Archaeology, the Maritime Archaeology Program, Flinders University, and the Ecole Francaise d'Extrême Orient.
An archaeological project should take place under the direction and control of, and in the regular presence of, a qualified underwater archaeologist with scientific competence appropriate to the project. Depending on the countries' requirements the archaeologist should be present all the time or the archaeologist should conduct regular site visits during fieldwork. The responsibility for the intervention and its results lies with the project director and he ensures that the work being executed is line with appropriate standards and according to the agreed project design. ▶

what constitutes archaeological qualification and competence is likely to include at least:

- A degree in archaeology or similar qualification recognized by the country in which the archaeologist is working;
- Practical experience in a chosen field/area of speciality;
- Demonstrated research abilities; and
- Knowledge of the specific type of site or archaeological period being investigated.

Although there will be national and even local differences in definitions and minimum standards, what constitutes acceptable archaeological qualifications and competence will in essence generally be, or should strive to be, underpinned by common archaeological principles and ethics set out in the *Rules*.

Scientific competence appropriate to the project

Being qualified does not mean that an individual archaeologist is necessarily competent for a particular project. The person may be highly qualified, but a particular site or specific area of underwater investigation may be outside or beyond individual abilities.

In assessing proposals for an archaeological intervention or for the composition of a team, it is important to be aware that – as in any other discipline – stated qualifications and competences are not necessarily what they seem.

- Check qualifications and competences:
    - Formal qualifications, such as degrees, diving and other licences are easily checked with the issuing institution;
    - Competence profiles and ethics are indicated by membership of professional organizations whose profile and track-record can also easily be checked;
- Independent peer review is a further, powerful instrument; Professional organizations and the Non-Governmental Organization ICOMOS can assist in identifying suitable reviewers.

To be scientifically competent to undertake or direct an intervention on an underwater heritage site, an underwater archaeologist must be fully acquainted with the subject of the investigation before work begins. The archaeologist must also be honest enough to leave alone those sites which are beyond competence or experience.

The question of individual archaeological competence is a common thread in most recognized archaeological standards and codes of professional practice, and this should guide archaeologists in remaining within their own competence. The European Association of Archaeologists' Code of Practice (1997) states, for example, that no archaeologist should undertake a project for which the person is not competent – i.e. adequately trained and prepared. The Code of Conduct of the UK Institute for Archaeologists (IfA 1985, as revised in 2008) contains a similar clause.

The competent authority involved, whether local, federal or national has a responsibility in this regard. In considering an application for an intervention it must not only ensure that the archaeologist is qualified, but must also assess competence. This can be done through the project design process and peer review of the application.

Questions that can be asked of an archaeologist to assess competence include:

- Does the archaeologist have the necessary historical background for the site/s proposed to be investigated? If the intention is to investigate a British naval vessel of the mid-18th century, for example, has the period been researched and is the historical context of the site understood?
- Has consideration been given to other similar archaeological interventions? Have the authorities in the field been consulted and have the results of parallel studies been examined?
- Have not only the 'mechanical skills' of archaeology been acquired– i.e. the know how

to properly excavate, record and report the site – but also a suitable working knowledge of the contemporary maritime technologies likely to be encountered on the site, which will allow an interpretation of the material?
- Continuing on from the above, will s/he be able to recognize and interpret the artefacts encountered?
- Does s/he have access to and knowledge of specialized authorities in the field? A wide range of specialities are likely to be associated with any underwater heritage site and an individual archaeologist cannot be expected to be the master of them all. However, it must be demonstrated that one knows who or where to go to for answers.
- What previous, practical archaeological experience is possessed?
- To what extent has the archaeologist kept abreast of developments in knowledge, methods and technology in the chosen maritime archaeological specialisation?

To be assessed as competent, an archaeologist wishing to undertake or direct a project must thus be well-versed and experienced in key excavation issues, must demonstrate good practical archaeological knowledge and skills and must be in a position to draw on appropriate specialists as needed.

Regular presence of a qualified archaeologist

Rule 22 requires that work takes place 'under the direction and control of, and in the regular presence of, a qualified underwater archaeologist with scientific competence appropriate to the project'.

Historically, the involvement of archaeologists in many projects directed at underwater heritage had been limited. This has much to do with a lack of suitably qualified professionals in many countries, and has meant that much of the work directed at underwater heritage has been only marginally archaeological. Even where project archaeologists did exist, they were often not maritime archaeologists,

▲ © Syddansk Universitet. Dr. David Gregory of the Conservation Department of the National Museum of Denmark analyses samples to study the degree of degradation in the context of a project aiming at preservation of a site *in situ*. All persons on the project team shall be qualified and have demonstrated competence appropriate to their roles in the project, which can be in the laboratory as well as in the field.

could generally not dive and could therefore not actually visit the sites being investigated. Their input and control was thus always limited. As a result, much of the artefact material recovered lacks proper provenance and is today of only limited archaeological and historical value. A lack of proper record-keeping and limited compliance with the professional or ethical requirement to publish has been the result, and the quality and quantity of what is known today from the many wreck investigations led by non-archaeologists is alarmingly limited. This is of course not exclusively the case. There are some shining examples of projects carried out to a very high standard by individuals who have not been trained as professional archaeologists.

Development of new standards: The growing body of professional, academically qualified underwater archaeologists around the world has gradually seen this situation change. A shift in legislation and policy around the world, given impetus by first the ICOMOS Charter on the Protection and Management of Underwater Cultural Heritage (1996) and the Annex to the 2001 Convention, has seen more and more countries rightly siding with the credentialed professionals for close overall supervision, not oceanographers and not treasure hunters.

Many competent authorities are now rightly insisting in line with the Annex that interventions in underwater heritage must take place under the direction, control and regular presence of a suitably qualified archaeologist. Just as the refereeing of an important national or international sporting event would not be put in the hands of someone lacking the necessary qualifications, accreditation and experience, so there is no reason why it should be considered acceptable that the responsibility for the investigation of the fragile, common underwater heritage should be entrusted to an unqualified non-professional.

Some countries require the archaeologist to be present all the time. In others this is not a requirement, as long as regular site visits take place during fieldwork and the archaeologist and field team –

whether professional or avocational – are in regular contact. With increasing professional capacity and more and more suitably qualified and competent archaeologists available worldwide, the project director should always be present on site unless there is a significant reason for this absence.

The bottom line is that the responsibility for the intervention and its results lies with the project director. The archaeologist thus controls the work being executed. He or she must be on site to ensure that the project is undertaken to the appropriate standard and according to the agreed project design.

Project Staff

Rule 23. All persons on the project team shall be qualified and have demonstrated competence appropriate to their roles in the project.

Most of what has been said about archaeological qualifications and competence is applicable not only to the archaeologist directing a project but also to each member of any team planning an intervention in underwater heritage. The individual qualifications and competence of each team member are as important to the success of an intervention as those of the project director.

◀ © E. Khalil. Project team from the Alexandria Centre for Maritime Archaeology and Underwater Cultural Heritage on their way to dive.
Each team member involved in an underwater archaeological project should be qualified and competent to fullfil the assigned tasks. The success of an intervention depends equally much on all team members as on the project director.

The nature of underwater cultural heritage is such that any single intervention will require a wide range of expertise and specialization. This is usually a mixed bag of interdisciplinary specialized skills – ranging from archaeology to artefact conservation, nautical history and ship construction to marine biology to oceanography – and requiring a multifaceted team of people to accomplish. The project director must give careful thought to the team requirements and must ensure that the skills and expertise needed to successfully carry out the project are available within or to the project team.

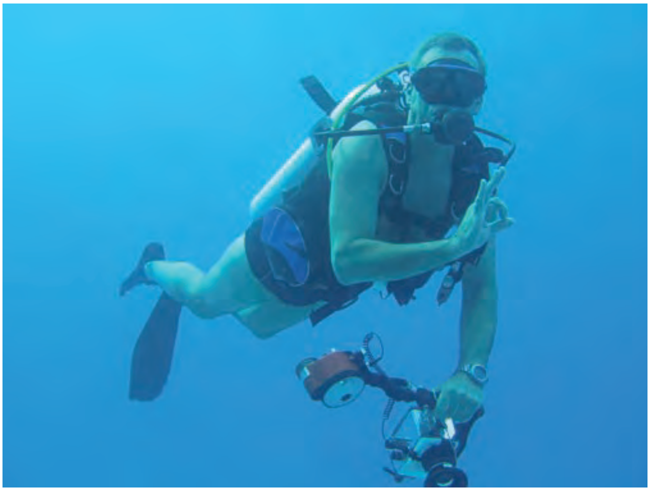
Any project team must therefore be appropriately sized, qualified and competent for the particular project being undertaken. Individual members' expertise, knowledge and experience will be complementary and as the team works together this should add up to more than the sum of its parts. No team will, however, have all the answers. In addition to their individual and collective experience and knowledge, it is just as important for the project director and team members to know when and where to go for additional advice, information and guidance.

All team members should

- be members of appropriate professional bodies and subscribe to professional standards and codes of conduct;
- from the beginning, and throughout the project, be fully briefed on project goals, research agendas, field methodologies, diving and other operational issues, health and safety arrangements, and individual and team responsibilities. The project director must ensure that each and every team member understands what is required, and how his/her specific expertise or role fits into the work programme and project goals.

The participation of non-archaeologists in projects

As the requirement for professional direction and control of underwater heritage projects becomes increasingly understood, accepted and possible to



◀ © Z.Morsy. Archaeologist diving during the Red Sea Survey 2010.
Divers and other members of the public are very keen and should be encouraged to actively participate in investigating and managing underwater heritage. These avocationals are a valuable potential resource to professional archaeologists and successful projects have been run in many places around the world using avocational staff. The requirements for avocationals' qualifications and competence will be set by the project director, usually in consultation with the competent authority, or based on formal local or national policy or guidance.

achieve worldwide, archaeologists and competent authorities must not lose sight of the fact that there is a large body of divers and other members of the public who are very keen to actively participate in underwater heritage projects. Archaeologists and competent authorities must encourage responsible participation and involvement by the wider diving community in investigating and managing underwater heritage. An informed and enthusiastic diving community is a wonderful ally and asset in the work of managing and investigating underwater cultural heritage.

Referred to as 'avocationals', these are individuals who are principally engaged in a career other than archaeology, but who commit themselves, usually in their free time, to archaeological work. Avocational team members are a valuable potential resource to professional archaeologists and successful projects have been run in many places around the world using avocational staff. One of the best-known projects in which large numbers of non-archaeologists participated was the excavation between 1979 and 1982 of the Tudor warship, the *Mary Rose* in Portsmouth in the United Kingdom.

Avocationals are usually keen, dedicated and committed, and many provide their time and services to projects at no charge. They often have skills and expertise that can be useful to a project – whether it be computer database design, engineering skills or a flair for logistics and project management. Most importantly, they are interested in the archaeology for the right reasons and if involved in projects will be assumed to have the same ethical responsibilities as archaeologists.

The requirements for their qualifications and competence will be established by the project director, usually in consultation with the competent authority, or based on formal local or national policy or guidance. Where avocational team members fit into this scheme will vary from country to country, but it will always be the responsibility of the project director to ensure that all avocational team members have a suitable minimum level of training, appropriate to their role in the project. This training may take place as part of the project, or it may have been acquired as part of a more formal training scheme, such as through the Nautical Archaeology Society (NAS), whose training scheme developed out of the avocational interest and involvement on the *Mary Rose* project.

Whether avocationals come to a project with recognized competence, or whether they are given training on the project, project directors and archaeologists on teams should always be aware of the degree of competence of avocational colleagues in the tasks they are given. At the same time, however,

© MMRG. Prof. Lloyd Huff (right), Prof. Nadia Mhammdi (centre) and Mohamed Ali Geawhari (left) examining echo-sounder data during the Morocco Survey investigation of the Oued Loukkos, Morocco.
The Morocco Maritime Survey investigation of the Oued Loukkos, Morocco, includes a multi-disciplinary team that is documenting the remains of the ancient port of Lixus and establishing the geological evolution of the Oued Loukkos basin over the last 3,000 years. In addition to maritime and terrestrial archaeologists, the team also includes hydrographer Prof. Lloyd Huff, of the Center for Coastal and Ocean Mapping, University of New Hampshire, and marine geologists Prof. Nadia Mhammdiand Mohamed Ali Geawhari of the Dépt. Physique du Globe, Université Mohamed V- Agdal (Rabat, Morocco). Here, they are examining echo-sounder data in real-time whilst surveying the river in a small fishing boat. The electronics 'room' where they are working is protected from the elements by a pvc pipe frame covered by plastic sheeting (October 2010). ▶

avocational team members should be encouraged to explore their potential and develop their skills.

Whatever its composition, the project team is the vehicle that will deliver the project objectives, and as such, is a particularly important aspect of any project planning, which, if neglected, has dire consequences for the archaeological record.

Ensuring the enjoyment of the public

The growing trend of requiring the presence of a qualified archaeologist and a competent project team has not been greeted with universal enthusiasm. It may mean the end to interventions by purely commercial enterprises, with so-called experience in 'investigating' underwater heritage, and has been met with accusations that archaeologists are being given exclusive rights to own and control a public asset.

▼ © National Museum of Underwater Archaeology. ARQUA. Special visit for kids with costumes and theatre performances at the National Museum of Underwater Archaeology ARQUA, Cartagena, Spain.

There is no such exclusive right for archaeologists and it is important to stress that underwater heritage remains a public asset. Heritage has a unique value for humanity and should be managed and investigated in a manner that is consistent with this status, taking into account its fragile and non-renewable nature, and for the benefit of everyone.

Many past interventions in underwater heritage sites have benefitted only the commercial enterprises involved, at the expense of both the archaeological record and the public. This needs to change. However, requiring the presence of an archaeologist is not to say that non-professionals may not participate in projects. It should nonetheless be a qualified and competent professional who sets the research agenda and controls and directs any project.

Directing and controlling underwater heritage investigations is a demanding and onerous responsibility for archaeologists. It carries with it heavy responsibilities. Archaeologists must

- ensure that whatever work is undertaken results in minimum 'damage' to underwater cultural heritage, while maximising public return in the form of increased knowledge and understanding of the past; and
- ensure public access, where appropriate.

VIII. Conservation and site management

All projects directed at underwater cultural heritage affect the heritage even if safeguarding may be its purpose. Adequate measures implemented as part of the conservation and management scheme ensure that the deterioration of the site and any objects, finds and samples is limited.

Conservation

Rule 24. The conservation programme shall provide for the treatment of the archaeological remains during the activities directed at underwater cultural heritage, during transit and in the long-term. Conservation shall be carried out in accordance with current professional standards.

The term 'conservation' in *Rule 24* refers to the whole subject of care and treatment of movable and immovable underwater cultural heritage. *Rule 24* is closely linked to the excavation techniques and objectives mentioned in *Rule 16*.

Definitions

Archaeological finds have often only survived under water by reaching a physical and chemical equilibrium with the surrounding context. These artefacts are particularly vulnerable and their removal from their burial environment speeds up the processes of corrosion and decay, potentially leading to the destruction of archaeological evidence. Conservation and restoration aim at halting these processes, thereby preserving the heritage. They are the essential link between excavation and exhibition for underwater cultural heritage, from the sunken site to the museum. Conservation is, however, distinct from restoration.

Conservation encompasses all measures and actions aimed at preserving cultural sites and artefacts

◀ © D. Nutley. Anchors of the *Vernon* on public display outside the Australian National Maritime Museum, Sydney, New South Wales.
Conservation costs for individual objects can be very significant. Estimating the cost of conservation in a research plan must consider a range of factors including the size of the object and where the object is to be displayed.
The anchors of the *Vernon* represent an example of conservation by application of a protective coating (both physical and chemical) for the iron and anti-rot preservatives for the timber. The cast iron of the anchors is from 1839 and the timber stocks date to 1905. They have not been returned to an 'as new condition'.
The decision to display the anchors outside and in an accessible environment to visitors creates a challenge for the ongoing preservation of the objects because of the artefacts' exposure to the elements of wind, rain, sun, hail, humidity, sea spray as well as attack by vandals.
In the case of the *Vernon*, a display and mounting system was built for the anchors which includes an aluminium mesh on which the anchors rest. Mesh rather than solid metal allows water to drain away and aluminium was chosen because of its electrode potential relative to the iron in the anchors. As the conservation treatment applied to the anchors (removal of the outer corrosion, blasting of the surface with copper slag, treatment with zinc epoxy paint) is less permanent than electrolytic techniques, the *Vernon* anchors are regularly inspected for deterioration. Being on public display as a memorial has also exposed the anchors to vandalism (2 rings were repaired and refitted after vandalism in 1992). →

in view of stabilizing their existing state while ensuring their accessibility to the present and future generations. Conservation actions can be divided chronologically into preventive conservation and curative conservation:

- **Preventive conservation** includes all indirect measures and actions aimed at avoiding and minimizing future deterioration or loss of materials or artefacts. It is carried out *in situ* within the context and surroundings of an object or a group of objects, or in the excavation laboratory. It should be undertaken regardless of the age and condition of the artefacts concerned.

- **Curative conservation** includes all actions directly applied to an object or group of objects and is aimed at arresting damaging processes and, when possible, stabilizing their condition against further deterioration.

Restoration is the continuation of the conservation process, when the latter is insufficient to re-discover the original surface of the artefact (without falsification), aiming at returning to the original appearance of an archaeological item as closely as possible and thereby providing a condition in which the artefact can be exhibited.

The conservation and restoration of underwater cultural heritage call for comprehensive knowledge of the environment in which a shipwreck or

→The anchors are also hosed with freshwater on a regular basis to reduce salt build-up which occurs close to the sea.

submerged site and its artefacts are found, as well as an awareness of the juxtaposition of artefacts and structures throughout a site. Consideration should also be given to the significance of the artefacts according to the research objectives. A familiarity with the materials from which these objects were constructed or which are likely to be found, is also necessary, as is an understanding of the degradation processes they have most likely undergone. Their potential for future analysis should also be envisaged, along with their ultimate use in display or research.

The need for conservation

The aim of conservation is to preserve or rediscover the object's original surface according to current professional standards. The main objective is to "make the artefact talk", via its ornamentation, manufacturing marks, surface treatments, preserved organics and traces of use, about where it came from and how it was made and used.

The environment and its impact on the artefacts

As soon as a land site, a vessel or an object is submerged, it is subject to the impact of the new environment by the infiltration of water in the porosities, corrosion, colonization by fungi and algae, deposition of calcareous species, sand erosion, hydrolysis, etc. A process of degradation begins which is directly linked with the immediate environment and dictated by physicochemical, biological or geological para-

▶ © B. Jeffery. The remains of a Yap Aech, Lubumow, Yap Islands, Federated States of Micronesia. The Aech Survey Project began in 2008 with the aim of documenting the material remains of the aech in addition to their histories, how and when they were used, and their placement in context with the reef and coastal environments. The documentation of the aech provided a good understanding of the aechs and thereby enabled the conservation, restoration and sustainable preservation of the aech sites for future use and appreciation.

◀ © U. Guérin / UNESCO. In 2000 and 2002, two wooden wrecks were found in the harbour of Antwerp during the construction of the Deurganckdock. Specialists soon identified these wrecks as medieval cogs, the typical large merchantmen from the time in which the Flemish cities had their economic height. The first cog, is one of the most complete of all medieval shipwrecks ever found in Europe. At the time of the finding there was very limited time to do research on site. Therefore every plank and timber had to be disassembled and was put in a container with water to prevent it from rotting. In total 455 timbers of both cogs were placed in 33 containers. The Flemish Heritage Institute (VIOE) started its multidisciplinary research in the summer of 2010 at the Flanders Hydraulics Research (Waterbouwkundig Laboratorium) in Borgerhout, Antwerp.

meters. These parameters are related to the nature of water, to living organisms (microscopic and macroscopic), and to the type of substrate and silt/sand upon which the site is located respectively. After a few years, equilibrium is achieved between the surrounding water and the artefacts leading to a relative stabilization of degradation processes. Burial in underwater environments may thus have several effects: structures are weakened though they may still appear solid while on the seabed, and layers incorporating sediments and concretions (thick surface overgrowth) may develop.

Recovery and its impact on artefacts

Raising objects from underwater inevitably results in them drying, which in turn accelerates degradation. This is due to the presence of soluble salts dissolved in the surrounding solutions on the seabed. In the new environment they dissolve or crystallize de-pending on relative humidity. Damages to the artefacts are likely to occur due to these potentially destructive physical pressures applied onto very

As part of "preventive conservation" it is crucial to ensure that from the minute it leaves the water, any object is kept in an environment identical or close to that in which it was found.

fragile objects. Exposure to continuous fluctuation in relative humidity may even lead to the complete destruction of an object. In this way all activities related to recovery weaken artefacts' structures and surfaces resulting in the cracking of pottery and ceramics, delaminating and crumbling of glass, shrinkage of organic materials such as wood, hemp, leather and fabric and corrosion and cracking of metals. In the short- or medium-term, this will bring about partial deterioration of the objects' original surface, culminating in the long run in the global loss of all historical, epistemological or technical information, which could otherwise be de-rived from the object.

Principal threats to artefacts during and after recovery:

- Drying may result in the cracking and delaminating of surfaces, irreversible shrinkage, salt crystallization and mould growth;
- Increases in temperature and oxygen may result in increased speed of decay, biodegradation (algae and mould), corrosion, differential expansion and contraction;
- Increases in light exposure may result in photo oxidation, fading, accelerated decay rates, growth of green algae;
- Storing different metals together in one solution may result in galvanic corrosion;
- Insufficient physical support and poor handling may result in fractures and cracks of the structures;
- Negligence in labelling, recording.

Current professional standards

Rule 24 states that conservation shall be carried out in accordance with current professional standards. The conservation standards and ethical approaches that need to be respected in the conservation laboratories are best described as follows:

> **Registered interventions:** all actions which are taken concerning an artefact must be registered in a reference book or database to ensure traceability of each artefact from the site to the museum, and to allow for the understanding of the long-term behaviour of materials. As far

▶ © Igor Miholjek, Mladen Pešić, Fotodocumentation of the Croatian Conservation Institute. Bronze cannon of the 16th century merchant ship, Sveti Pavao Shallows, Island of Mljet, Croatia.

Surveying the waters surrounding the island of Mljet underwater archaeologists of the Croatian Conservation Institute found in 2006 the remains of a post medieval shipwreck at the Sveti Pavao Shallows. Among the varied archaeological material found on this 16th century shipwreck were 7 bronze cannon. During the continued research of the site in late 2007, the bronze cannon were extracted from the sea and subsequently transferred to the conservation workshop of the CCI's Department for Conservation of Underwater Archaeological Finds in Zadar, where conservation processing on them was initiated.

Upon their delivery the cannon were immersed in pools containing tap water, from which they were then individually withdrawn for documentation and cleaning. Delivered to the conservation workshop from the archaeological site along with the cannon were 6 cannonballs, 3 made of stone, 3 of iron. A preliminary inspection established that all 7 cannon were manufactured of bronze, with 4 sizes present. The surfaces of all of the cannon were covered in algae and deposits of calcareous growth and calcification. There were larger aggregations of iron oxide at the rear sections of some of the cannon. These corrosive aggregations are all that remains of the entirely decayed iron breeches – the cannon's loading mechanism.

In the 16th century cannon were divided into two basic groups based on the type of projectiles they fired: perriers, constructed for firing stone shot and having a mascolo mechanism for breech loading, the group to which cannon no. 2 belongs; and those constructed for the firing of iron projectiles, without a breech, and loaded from the muzzle, such as cannon no. 6.

After a preliminary inspection of the cannon and the documentation of their condition, the cannon were cleaned of sand and easily removable deposits, and then stored in desalinisation pools. The desalinisation process lasted for 9 months during which, with instruments used to monitor salinity, the water in the pools was changed on a monthly basis. For the first 7 months the desalinisation process took place in tap water, while the last two months the process took place in deionised water. The cannon were removed from the pool and gradually air dried upon the completion of the desalinisation process, which was followed by the cleaning of cannon no. 6 and no. 2. The cleaning of these cannon was undertaken using mechanical methods. Rough deposits of calcification and calcareous growth were removed from the surface of the cannon using a chisel, while the remaining products of corrosion were carefully removed from the surface of the objects using precise instruments.

During the cleaning of cannon no. 6 an iron ball was found inside the barrel. The cannonball was entirely corroded with no preserved iron core, and was structurally impregnated with acrylic resin in order to retain its form. To retard the development of further corrosive process on the metal, an chemical stabilisation procedure was applied to the cannon whereby its surface was treated with a bronze corrosion inhibitor, the BTA solution. Once the stabilisation of the cannon's surface had been completed, protective coatings of the Paraloid B-72 solution and microcrystalline wax were applied, which will protect the object from impurities and harmful atmospheric influences. With the interventions that have been carried out, cannon no. 6 has been entirely restored and conserved, while conservation work on cannon no. 2 is in the final phase. The iron breeches on the remaining cannon have entirely decayed, and will be X-rayed to establish their shape and to determine further interventions, following which the conservation work on these cannon will continue.

▶ © G. Adams. Soft Coral on Rio de Janeiro Maru, Chuuk Lagoon, Federated Sates of Micronesia. Seawater is a highly complex environment composed of water, mineral salts, dissolved gases, bacteria, a whole food chain of micro-organisms and macro-organisms, suspended organic matter and sediments. For archaeologists, its aggressive nature lies in the chemical and electrochemical reactions of the various types of seawater with immersed objects, the mechanical actions of waves and sediments, and the effects of biological – especially bacterial – colonization (microscopic and macroscopic living organisms). The factor to consider from the point of view of deterioration is the amount of dissolved oxygen in the environment both during an object's burial and after its excavation. Amounts can vary from one geographical site to another. On a single site, the quantity of dissolved oxygen decreases with depth, temperature (according to the seasons) and the nature of the sediment (sand, mud or rock). The deeper under water the wreck, the better preserved it will be. In addition, the more deeply buried it is and the denser the silt, the better preserved the state of the artefacts. After a few years, equilibrium is achieved between the surrounding water and the artefacts leading to a relative stabilisation of degradation processes. In terms of preservation time, greater exposure to ambient dissolved oxygen increases the degradation of the artefacts (weakening of artefacts' structure and development of concretions). This is due to the combined effects of water and erosion by sand carried by the waves. Finally, the greater the depth of salt penetration into the objects, the longer it will take to treat them.

as possible, every picture or drawing should be linked to the file and all this information should be retrievable for future research.

Minimalist interventions: The conservator should first establish the necessity of each intervention and measure the degree of intervention necessary to minimize impact on the artefact also in the long-term, and to intervene to the least possible degree.

Reversibility of the interventions: As far as possible, every intervention should be reversible, i.e. any modification made to an artefact should be able to be undone or removed without adverse affect.

Visibility of the interventions: The goal of the interventions is not to create a "new" artefact but to reveal its shape and the archaeological information without losing the history engraved on it by the degradation process. All the interventions undertaken on the artefact must seek to restore the original surface of the object, so that at a glance, the public can easily understand its function.

Fundamental to the notion of archaeological study, the original surface of the artefact corresponds to the surface of the object at the time of its immersion. This surface is not only the area carrying all the ornamentation, manufacturing marks and traces of

◀ © National Museum of Underwater Archaeology. ARQUA. Conservation and restauration laboratory facilities ARQUATEC, National Museum of Underwater Archaeology. ARQUA, Cartagena, Spain. Artefacts recovered from underwater environments are in a particularly unstable condition and require special treatment i.e. the cleaning and stabilization of waterlogged and salt contaminated artefacts. Detailed records are maintained throughout the conservation and restoration process. The facilities of a conservation laboratory treating artefacts recovered from the underwater environment certainly vary. A conservation laboratory should however be able to accommodate large and small collections of artefacts of a variety of materials, including metals, glass, ceramics, stone, wood, fabrics, and other organic materials. It should provide the following services: artefact conservation, stabilization and consolidation; microscopy and microanalysis; super-cold conductivity research; industrial radiography of marine concretions and artefacts; electrolytic, mechanical, and chemical cleaning of artefacts; removal of salts and other chlorides from marine artefacts; artefact casting, restoration and reconstruction; new polymer processing technology; artefact presentation and display; photography and illustration; artefact documentation, identification, and research; condition assessment and collection management.

use relative to where the artefact came from and how it was made and used. It is also that which has been highly exposed to seawater aggression and, later, to excavation operations, removal and studies.

The conservation programme

The scheduling of a conservation programme is a priority in any underwater cultural heritage project. It must ensure long-term preservation of the site and the artefacts, whether the decision is taken to keep them *in situ* or to extract them. The programme needs to plan well-ahead of the start of the project for the idial actions that occur throughout its duration.

The conservation programme thus sets out the guiding principles but also plans the following activities in every detail:

- Documentation - design of finds records, registration, condition report, monitoring systems and site inventory (see *Rule 26*);
- Underwater archaeological prospection and preparation work (see *Rule 16*) – design of the methodologies and techniques applied (*see Rule 16*);
- Recovery and transport of the artefacts from the archaeological site to the on-site workshop, if artefacts are not preserved *in situ*

▶ © J. Carpenter / Western Australian Museum. Divers are preparing to acquire corrosion data on the corroding mooring point on the *Gosei Maru*, Chuuk Lagoon, Federated Sates of Micronesia.
Corrosion data should be acquired as part of the site prospection. The information obtained will allow for the estimation of the artefacts' conservation needs and thus for the preparation of the conservation programme.

▲ © Parks Canada. Labelling of structural elements, Red Bay, Canada. Negligence in labelling, recording and documentation may result in the loss of important contextual information of the archaeological site. Finds shall carry their specific label constantly throughout the project in order to allow for consistent identification.

An underwater excavation should not start until a storage place and the budget for conservation have been decided and secured.

(*see Rule 24*), and the transport from the on-site workshop to the conservation laboratory.

- Artefact treatment, preventive conservation of artefacts and intermediary storage – design of the methodologies and techniques applied (*see Rule 24*);
- Long-term storage – long-term archival deposit of find archives (see *Rules 32 - 34*)
- Curative conservation and restoration treatment (*see Rule 24*)
- Transport from the laboratory to the exhibition site (museum)

The budget is established based on the conservation programme and the necessary equipment is acquired.

The conservation process

Before intervention

(a) **Prospection and documentation:** During prospection, underwater archaeologists generally undertake some preparatory dives and sampling to confirm the archaeological importance of the site. This first prospection allows archaeologists and conservators to obtain a sound understanding of the nature, number and type of artefacts that are likely to be discovered. At the same time, they also obtain a good understanding of the whole site and all of its parameters (type of substrate, seawater parameters, hydrodynamic currents, tides, etc). This data will allow them to prepare the excavation project under the best conditions and fully aware of all the likely circumstances.

(b) Preparative work: Documentation at the preliminary stage will allow conservators to organize the adequate material needed to take care of the artefacts that are expected to be excavated (including materials for marking, recovering, conditioning, transporting and storing the artefacts). Usually, conservators will propose an on-site intervention kit and a list of materials that underwater archaeologists might need during their work.

These two preparative steps are important in regard to the security of artefacts and those working on the site. They also provide information that is valuable for accurate budgeting of the excavation. Conservation can be time consuming and costly, and must be properly considered prior to the excavation and recovery of archaeological material from a site.

The conservation programme should be integrated into the budget and the costs related to the preventive

▼ © Archivo IAPH – CAS. Removal of concretions *in situ*, Cádiz, Spain.
Most objects, after long years of being buried in a marine environment, emerge covered in calcium concretions. Concretions are stone-like encrusted conglomerates created by grains of sand, shell particles, coral and sea plants around an artefact. These natural elements begin to build up on objects beneath the sea as they start to rust and corrode. After a while concretion covers the object, preserving it in a hard protective shell. The hardness, thickness and porosity of the concretions will depend on the burial environment (location and duration of exposure).
Following analysis, minor concretions can be carefully removed *in situ* in order to allow for the identification of the artefacts and if this is necessary for a scientific purpose.
However, solid concretions should never be removed or cracked *in situ*, just documented because without the protective concretion, the exposed artefact is exposed to further erosion or rusting.
If a decision is made to recover the object and to remove the concretions, post-excavation conservation is very important.
The 5 major stages of the post-excavation conservation-restoration procedure are 1) preventive conservation, 2) diagnosis, 3) cleaning concretions, 4) extracting salts or chlorides and 5) finishing.
Before cleaning concretions, conservators shall first X-ray the artefact in order to determine the exact shape and the fragility of the object underneath the tough outer casing. Using special mechanical tools to free the artefact from the concretion the artefact shall be quickly treated for corrosion, pending further investigation. →

→ The degree of hardness and the nature of the object will determine which cleaning methods will be used: mechanical (micro-sandblaster, micro-chisel, scalpel), chemical (immersion), a combination of the two or electrochemical. Electrochemical cleaning treatments involve cathodic polarization for metal (conductive) objects and electrophoresis for organic and other non-conductive materials. Electrolysis is used to remove chlorides and surface corrosion from non-conductive organic materials and occasionally ceramics, cannons, anchors and other large archaeological objects. Sometimes a concretion contains only a hollow space, which once contained an object that has rusted away. Thus it is important not to crack it. Such a hollow can be cast by filling it with epoxy, recalling and 'saving' the object's original form.

conservation should be distinguished from those related to curative conservation and restoration.

During intervention

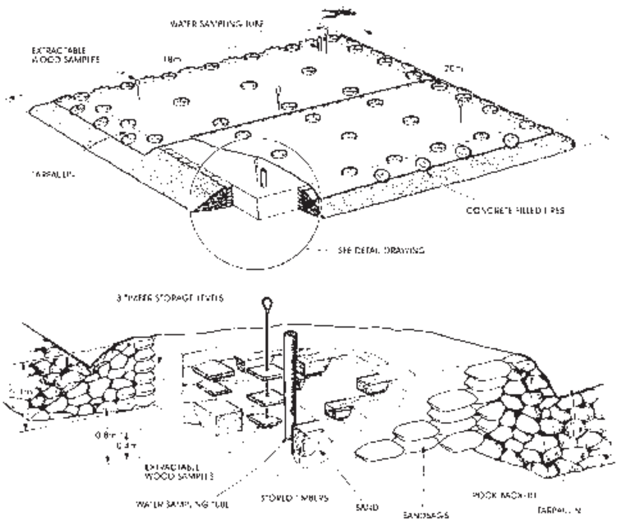
- Preventive conservation on site

During archaeological work, as soon as sand and/or silt is removed from the site, the natural physical and chemical equilibrium between the artefacts and the bed in which they lie is changed and the degradation process (re)starts. Therefore, objects should not be removed until secure arrangements are made to conserve them properly, especially if objects are taken out of the water.

The first steps of preventive conservation are emergency measures, like the first aid that a soldier receives from a doctor on a battlefield. It is about insuring perpetuity and integrity to the collection, but also about guaranteeing accessibility. At this stage, all artefacts need to be given the same attention. Limitation to only valuable artefacts based on the quality of the material or the good condition of conservation, increases the serious risk of neglecting other items that do not originally seem important, but may later reveal essential information following proper conservation and restoration.

Preventive conservation work has to be framed within the same professional standards that are applied in full conservation and restoration. Interventions

© Ships of Discovery. Prospecting during the Slave Ship Trouvadore Project: James Hunter examining the hull remains of the *Black Rock Wreck* (the so-called slave ship *Trouvadore*) sunk in 1841 in the Turks & Caicos Islands, British Overeas Territories, United Kingdom. The conservation process starts well before intervention with prospection and preparative work. During prospection, underwater archaeologists undertake some preparatory dives and sampling to obtain a good understanding of the nature, number and type of artefacts that are likely to be discovered and that will thus need to be conserved. This data will allow them to prepare the conservation programme as part of the project design. ▶



◀ © Parks Canada. Scheme for the reburying of structural elements on a Basque whaling vessel, Red Bay, Canada.
The issue of reburial as a long-term preservation strategy and its effectiveness is of utmost importance to the field of maritime archaeology. Reburial involves the deposition of archaeological materials beneath sediments in a marine or wet environment in an effort to create anaerobic or anoxic conditions that inhibit the growth of bacteria and limit other harmful organisms. Systematic monitoring of reburial sites is of the highest importance for all *in situ* preservation treatments because the archaeologist or conservator cannot fully predict the long-term suitability of the reburial context. Practical and experimental studies of reburial have been undertaken in several different contexts involving various species of wood, different types of sediments, and varying depths.
A major reburial experiment using archaeological and modern wood was conducted by Parks Canada on a Basque whaling vessel in Red Bay, Labrador.
Here, archaeologists disassembled and documented more than 3,000 timbers and fragments from a fully excavated wreck, after which reburial was carried out in the excavation pit. Timbers were stacked in 3 layers with 20 cm of sand above each layer. The researchers surrounded the timber and sand mound with 36 metric tons of sand contained within 1,200 recycled plastic salt bags. Rock fill was placed outside of the sandbag circle, and a 3.6 mm Hypalon tarpaulin was positioned over the mound and held down by 60 concrete-filled tires. Water-sampling tubes were installed so that water chemistry could be tested inside →

should be immediate and minimal. They should be stable, reversible and recorded.

- Preserving *in situ* versus recovering objects

The reasons for the recovery of artefacts must be well defined prior to the commencement of any excavation project. The scientific reason for the project should outweigh the damages caused by the artefact extraction to the integrity of the site. In addition to the financial support for conservation, storage or exposition has to be assured. Months and often even years can elapse between the discovery of an underwater site and initial probes, actual excavation and the raising of objects.

Leaving artefacts on site

- Displacing an artefact from a site changes its integrity, as the site is no longer complete. It also extracts the object from its authentic context, so that a very comprehensive documentation is needed to avoid depriving it of its historic sense. It is therefore often wise to leave sites intact for the scrutiny of future generations, in abidance of the principle in *Rule 1*. There is also the issue of the financial burden posed by excavation and the ensuing need for conservation and storage. These considerations have led to the gradual

→ the mound without disturbing the fill strata. Researchers also used frozen samples of wood and wood suspended in the open water column as control groups. One year after sealing the mound, the dissolved oxygen level fell to 1 mg/liter and has held constant. The dissolved oxygen of the water around the mound has tested from 9 to 10 mg/liter consistently. Other chemical properties tested include sulfide, alkalinity, pH, nitrate, ammonia, nitrite, total phosphorous, silicate, and iron. These tests have illustrated that the reburial environment is a reducing one.

emergence of preventive *in situ* conservation. Nevertheless, if the decision is taken to leave artefacts on site, some precautions must be taken regarding the further degradation of the artefacts as well as the risk of looting.

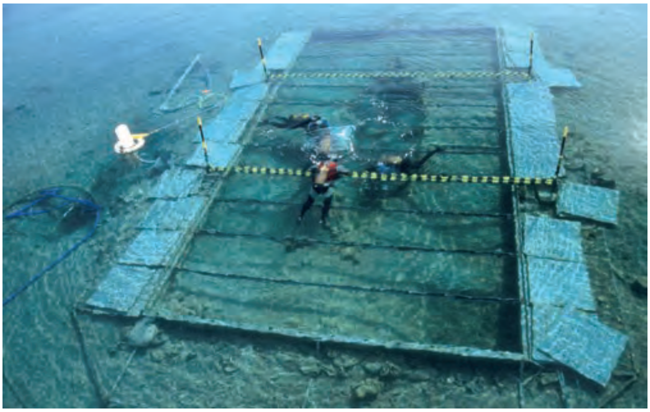
▪ Three major approaches for *in situ* treatment are viable, which may be classed according to the materials being protected:

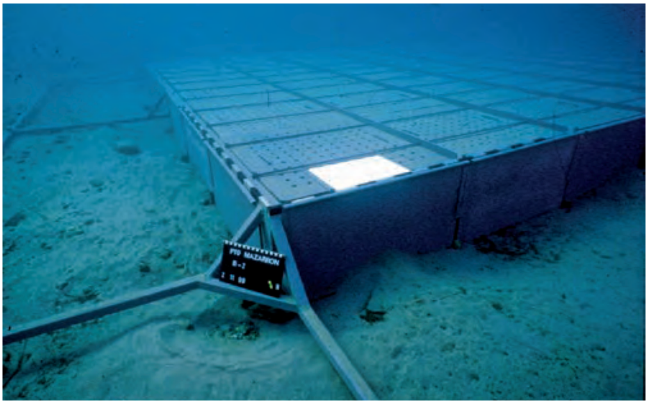
1. an organic heritage approach favouring reburial of a site and follow-up over time consisting of probing, studying and excavating followed by reburial and subsequent monitoring of the remaining site;
2. the built heritage approach, which first engages in preventive conservation and restoration work, but ultimately focuses on the creation of underwater archaeological parks;

Immediately after recovery, finds shall be kept:

- waterlogged : fragile objects shall preferably be kept in water from the original location while more robust objects can gradually undergo freshwater baths in order to start the desalination process
- cold
- in the dark
- in inert containers
- labelled
- separated according to materials of composition
- with great safety : weapons and potentially explosive materials should be handled with considerable caution and according to safety regulations

▶ © PROAS - INAPL. An unidentified shipwreck, Chubut, Patagonia, Argentina. An unidentified wooden shipwreck (known as *Bahía Galenses II*) attributed to the second half of the 19th century, located in the intertidal zone of Puerto Madryn (Chubut, Patagonia, Argentina), was covered with sand bags for *in situ* protection. Members of the local community participated in this task.





◄ ▼ © National Museum of Underwater Archaeology. ARQUA. Top: Protection cage for the *Mazarrón II*, Spain.
Bottom: Construction of the protective cage for the *Mazarrón II*, Spain.
In order to preserve the wreck of a Phoenician ship of the 7th century BC, discovered in the Bay of Mazarrón near Cartagena, a protection cage was constructed and solidly fixed over the hull remains preserved *in situ*.
The *Mazarrón I*, a Phoenician wreck discovered in the Bay of Mazarrón has been excavated and is now on display in the ARQUA Museum in Cartagena.
These two wrecks have provided important information about how the Phoenicians constructed their ships.

3. the metallic heritage approach, whereby preventive conservation prepares for excavation (extraction of wrecks and artefacts) or long-term conservation, including, for instance, cathodic protection.

Recovering objects

▪ Recovering objects of underwater cultural heritage is a very difficult operation, which requires continuous attention and meticulous planning. It must enable a quick break in the equilibrium between the materials and the environment. Some specific precautions are therefore required to ensure a good recovery. During this operation, the security of divers is always paramount to the security of artefacts. When undertaking artefact recovery, it is important to keep in mind that water and silt offer a natural support for the artefacts. The

▲ © Archivo del Centre d'Arqueologia Subaquàtica de Catalunya. Extraction of a Haltern 70 amphora from the site of the *Culip VIII* (1st century BC) Cadaqués, Girona, Spain. Recovering objects of underwater cultural heritage is a very difficult operation and it is thus important to ensure effective and efficient support for fragile artefacts, in particular when lifting, handling and transporting objects.

artefacts can collapse during the recovery if they are not effectively and efficiently supported. Support is even more cri-tical for organic materials or glass. It is thus of primary importance to create and bring an adapted support for each fragile artefact to be recovered.

• Lifting, handling and transporting recovered objects

The lifting, handling and transportation of artefacts is very sensitive and it requires careful pre-planning and adaptation to suit the specific needs of individual projects, depending on the fragility, significance, location, size and mass of objects, as well as project objectives and available resources.

Prior to lifting artefacts from the seafloor, all finds should be completely uncovered from the context (unless the retention of the surrounding context is important). It is important to move the objects very slowly under the water in order to keep the physical pressure exerted on them to a minimum. There are a number of methods to support finds during lifting, such as flat sheets, self-seal plastic bags, bubble wrap, plastic strings, cotton ties, pallets, large trays, block lifts and purpose-built devices. In any case, it is advisable to allow for decompression stops during lifting. If decompression occurs too quickly, the object may explode or break. The transmission of objects from the divers to the platform/boat staff should occur slowly and gently. Storage bins or containers should be readily available. Particular attention should be paid to large and fragile objects. The exposure of all finds to air and light should be kept to a minimum.

Underwater artefacts should benefit during their transport (in the water, from the site to the workshop or from the workshop to the conservation laboratories) from special protection measures.

◀ © P. Larue / FMC. Divers of the national marine remove a pounder canon from the wreck of the *Astrolabe* that sunk during the famous La Pérouse expedition in 1788 off the Island of Vanikoro, Solomon Islands.
The lifting of artefacts is very sensitive and it requires careful pre-planning and adaptation to suit the specific needs of individual projects, depending on the fragility, significance, location, size and mass of objects as well as project objectives and available resources.

- **Artefacts must be maintained in a humid state during the duration of transport,** as far as possible regarding their dimensions and weight. Artefacts do not always have to remain immerged during transport. However, if they do remain immerged, they have to be properly secured to avoid contact with each other, which can cause damage. Also, the movement of a splashing water mass inside a plastic sheet or a container can be very destructive and should be avoided.
- **Artefacts must be correctly wrapped in order to avoid being subjected to shocks during transit.** The receptacle or tank in which they are placed must be hermetic, airtight and rigid enough to support their weight. A thin layer of

◀ © UNESCO. Remains of a byzantine ship excavated of the commercial harbour of Theodosius, Yenikapi-Istanbul, Turkey.
While investigating the site of the ancient harbour of Theodosius, archaeologists found the remains of 34 ships that were temporarily stored in a humidified tent.

▶ © UNESCO. Amphora fragments, bones and other remains of the commercial harbour of Theodosius, Yenikapi-Istanbul, Turkey.
During the archaeological excavation undertaken in the harbour of Theodosius (5th - 10th century AD), 34 ships were excavated. While investigating the site of the ancient harbour of Theodosius, archaeologists found Numerous debris objects, bones and small artefacts which had to be sorted, stored and identified with tags. A diligent documentation is essential, as it is key to preserving information on the location of artefacts on the site and for obtaining scientifically valid information.

water in the bottom of the tank must ensure 100% humidity during the transit.

- **Storing recovered objects**

Immediately after the transit, artefacts must be re-immerged in a receptacle or a tank in an environment identical or as close as possible to that in which they were discovered. If this is not possible, then storage in a 100% humidity atmosphere is acceptable. The aim is to anticipate, restrict or halt any acceleration in the degradation of objects after their discovery and excavation. An appropriate storage must be envisaged in the interest of long-term conservation: every storage action must be planned considering that the storage can last weeks, or even years.
Moreover, the solutions adopted for individual objects must be simple and easily renewable.

Each artefact should be wrapped in a specific material (conditioning material and conservation-grade inert material), which avoids shocks while favouring the rinsing procedure. All finds should be stored separately and according to constitutive material as each particular archaeological material is subject to specific degradation. The subsequent work led by the conservator will usually allow the original surface to be 'revealed'.

▼ © National Museum of Underwater Archaeology. ARQUA. Control of the process of lyophilization at the conservation laboratory of the ARQUA Museum, Cartagena, Spain.
Freeze-drying is a dehydration process used to preserve a perishable material. By freezing the material, then reducing the surrounding pressure and adding enough heat, it allows the frozen water in the material to sublime directly from the solid phase to the gas phase.

After intervention

Every project manager must plan all actions to which finds are exposed, from the initial handling in the excavation all the way through to the conservation laboratory in order to ensure an accurate traceability for each artefact. Any loss of material constitutes a loss of information. That is why it is necessary to properly preserve and stabilize the objects on site, or in the laboratory, before any further physical intervention takes place.

▲ © National Museum of Underwater Archaeology. ARQUA. Mechanical cleaning of a bronze figurine at the conservation laboratory of the ARQUA Museum, Cartagena, Spain.
Mechanical cleaning using micro-sandblaster, micro-chisel, and micro-scalpel is part of the curative conservation procedure that comprises several stages of cleaning of calcareous concretions, stabilisation and rinsing. These procedures help to render the object more comprehensible and allow later for risk-free restoration work.

It would be presumptuous to try to present the state-of-the-art of conservation and restoration in a few lines but the major stages in post-excavation procedures and methods can be highlighted.

The overall conservation-restoration procedure proposed by conservation laboratories for treating underwater archaeological artefacts can be viewed in four key stages which follow each other chronologically:

- Preventive conservation and storage: begin as soon as the artefacts break the surface of the water. When the collection enters the conservation laboratory, it is usually stored preventively in the same tank that is used on site, in order to avoid another brutal change in the environment.
- Condition report and diagnosis: upon arrival at the conservation laboratory, every artefact must be precisely marked, identified and described in order to record it and its condition. The condition report, also containing a diagnosis, will ensure proper transmission from hand to hand in the conservation laboratory and allows conservators to decide if complementary diagnoses are necessary (material chemical analysis, radiography, tomography, endoscopy,...). The condition report and the complementary analyses will then allow conservators to decide what kind of treatment will be the most relevant for the materials and the conservation state of the artefact.

▶ © UNESCO. A scientist recording with a FARO Arm the structural elements of the hull of a Byzantine ship excavated from the commercial harbour of Theodosius, Yenikapi-Istanbul, Turkey.
Using a special computer aided design programme a 3D model can be established on the basis of these recordings. The number of ships excavated during the archaeological operation posed an immense conservational challenge.

▼ © National Museum of Underwater Archaeology. ARQUA. Lyophilization in the wood laboratory of the ARQUA museum in Cartagena, Spain.
A process of simply drying by evaporation can have catastrophic results on archeological leathers and woods saturated with water. Instead, a combination of chemical treatment and controlled drying or lyophilization is applied. Lyophilization is an efficient and gentle method of drying ancient woods and leathers. Still, to assure freezing without damage to the pieces, they must be protected by a low-temperature agent, which is introduced in impregnation baths.

o Curative conservation: once in the conservation laboratory, the objects need to undergo a "curative conservation" procedure that comprises several stages of cleaning of concretions, stabilization and rinsing. Cleaning the concretions and stabilizing the degradation, two closely interrelated procedures, help to render the object more comprehensible and allow for later risk-free restoration work. Most objects, especially if they have been buried in a seawater environment for many years, emerge covered by calcareous concretions. Their hardness, thickness and porosity depend on the characteristics of the sedimentary environment. That and the nature of the object itself will determine which cleaning, stabilizing and rinsing methods are most

◀ © Parks Canada. Reassembling the bones of a whale fin, Red Bay, Canada.
After recovery and conservation of artefacts and whale bones from wrecks in the framework of the Red Bay Project it was important to store them appropriatly, protecting them from damaging influence and above all identifying them and their provenance correctly. Only a well ordered and documented project archive guarantees the maximum preservation of scientifical data. The bones found during excavation and depicted here stem from right and bowhead whales. Once plentiful in the waters of coastal Labrador, these attracted whalers from the Basque country during the 16th century. A thriving industry based on the production of whale oil developed along the Labrador coast during the mid to late 1500s. The busiest port for this historic enterprise was the sheltered harbour of Red Bay.

relevant to utilize, whether mechanical (micro-sandblaster, micro-chisel, and scalpel), chemical (immersion), electrochemical (electrolysis) or a combination of methods.

- Restoration (finishing and long-term conservation): following cleaning, stabilization is essential, especially when objects come from a marine environment. It is above all based on the swift extraction of salts, especially those based on chlorides and sulphate ions. Some new technologies have been developed to accelerate the salt extraction and reduce the stabilization time, which includes techniques such as subcritical and supercritical fluids and computer controlled electrolysis.

Once stabilized, the objects are submitted to a controlled drying process. The dual finishing phase then begins: restoring their original surface so as to make them "readable" at a glance, and long-term conservation. This step generally consists of a gentle cleaning with vegetable or mineral abrasive, with a view to revealing the original surface of an object with its ornamentation, its designs and/or its inscriptions. The choice of abrasive depends on the hardness of the material.

Sometimes, it is necessary to consolidate the original surface through a specific consolidation and/or filling treatment, using reversible varnish, resins and so on. Decisions on such treatment should be taken in coordination with the curator

▲ © Swedish Maritime Museum. Conservation of the Vasa, Sweden.
The *Vasa's* conservation began as a huge experiment but the pioneering research by the conservators of the shipwreck has paved the way for numerous other shipwreck projects around the world.
After examining a number of possible methods and materials, the synthetic polymer polyethylene glycol (PEG) was chosen to treat the Vasa's wood from drying out.
PEG spraying began in April 1962. The PEG concentration was gradually increased from a low concentration of 5 % and ending with a 40 % solution. Boron salts were added to prevent microorganism growth and neutralize acids.
Various types of PEG were tested on the wreck over the years, and PEG 4000, 1500 and 600 have all been used. The PEG ran over the hull's surface, was collected in tanks and re-used. The spray treatment lasted for 17 years, from April 1962 to January 1979, followed by another 9 years slow air-drying. To strengthen the surface of the wood a final surface layer of PEG 4000 was applied.

▲ © U. Guérin / UNESCO. Long bows preserved in the *Mary Rose* storage room.
The bows have been stored on a dry and smooth surface and are kept in a drawer, which is well identified and safe from unauthorized outside access.

▲ © T. Maarleveld. Storage area of the Zuid-Holland repository, Netherlands.
Repositories for long-term storage of archaeological finds can become quite extensive. They need to be organized in the form of true archive or library with a systematic catalogue referring to each object in the collection and its location on the shelves. Standard boxes of appropriate material are used for storage of most objects in the Zuid-Holland repository.

responsible for the collection. Finally, application of a protective coating (of wax, varnish or resin) suited to the future exhibition site – interior or exterior – will help preserve the objects for the foreseeable future.

Conservation and restoration treatments are carried out using both traditional and technically advanced technologies. They are often long-term, ranging from several months to several years. This is particularly true for the processes related to the stabilization.

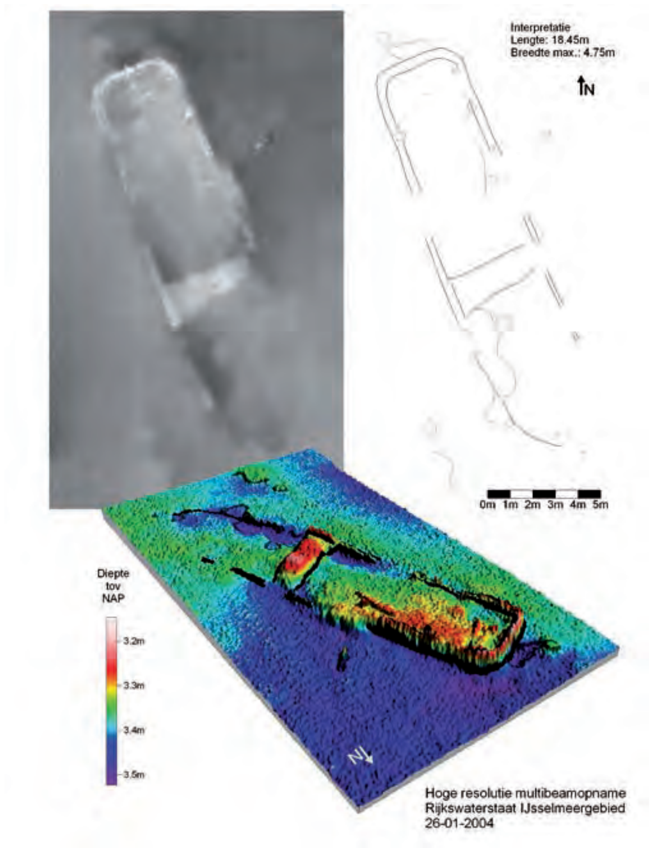
Metals: Treatments focus mainly on stabilizing corrosion by removing the chloride ions. For larger or more chloride-contaminated objects, the most effective means of achieving that end is through electrochemical treatment by chemical solutions. Electrolysis is used to clean concretions on cannon, anchors and other large metallic objects. Electric current from the power supply will either help remove concretions by causing hydrogen micro bubbling on the object's original surface, or will spark chemical changes in corrosion products (reduction) that speed up the removal of chloride ions. Electrolysis also helps remove chlorides and surface corrosion products from non-conductive organic materials, ceramics, etc.

Mineral objects: Controlled air-drying or a consolidation treatment, depending on their conservation condition, follows salt removal which begins by simple immersion in fresh water. Consolidation treatments entail a number of immersions in specific chemicals followed by gradual, controlled drying.

Organic materials: Stabilization treatments seek to prevent any sudden drying of the object or contact with air that might cause shrinkage or deformation. Two types of treatment are known to stabilize organic objects: gradually replacing water in the pores with various concentrations of polyethylene glycol (PEG) followed by natural smooth drying or freeze-drying, or the ARC-Nucléart method which consists of rinsing the objects in an acetone solution, impregnating wood with a polyester-styrene resin and polymerizing the resin by exposing it to gamma radiation.

Lithic materials: Stabilization treatment mainly consists of simple rinsing procedures by immersing the artefacts in fresh water.

▶ © T. Maarleveld / RWS. Side scan and multibeam sonar images of the *Hoornse Hop II wrecksite*, Zuiderzee, Netherlands.
A concise illustration of a site's extension is essential when elaborating a management plan. In the case of the 18th century wreck with cargo at the site *Hoornse Hop 2* the image obtained from side scans and multibeam sonar have been crucial in delimitating the site's extension. Initially this site was discovered by the water authority responsible for the area in December 2002 due to the sea bottom-anomaly at the location. It was then truthed by divers in December 2003. The first management measure was to declare an area around the wreck as no-anchor zone while informing the associations of fishermen, sailors and recreationists frequenting the area about the location of this archaeological site.



Site Management

Site management and preservation are related. Just as one should not remove underwater cultural heritage without considering its preservation, the same considerations apply to the site and to the *in situ* remains. As a general rule, every site deserves its own management plan, even if many countries, especially developing ones, do not yet dispose of such plans for their submerged cultural sites.

An adequate management programme and a long-term management plan can be of great assistance to reduce the risks for underwater cultural heritage, including deterioration, looting, or even destruction. They are important tools in optimizing the enjoyment of the heritage concerned, for the greatest number possible, in setting the conditions for access, information, consolidation, and maintenance. Thus, they enable the realization of the benefits and obligations for society.

General policies that deploy a management plan for all sites according to significance are rare. However, once an action directed at underwater cultural heritage is undertaken, especially when it is intrusive, consideration should be given to establishing a programme on how to manage the changes that occur. *Rule 10* therefore lists both *a conservation programme* and *a site management and maintenance policy for the whole duration of the project* as one of the aspects to be integrated in the project design. *Rule 24* elaborates conservation issues and *Rule 25* further elaborates the necessity to develop a programme of management of the site during and in the aftermath of the phases of intervention.

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

Management generally consists of deploying and coordinating resources most effectively and efficiently in order to accomplish a range of objectives and ultimately the protection of a given archaeological site. To that end, a written plan is devised describing the overall guidelines within which all activity directed at the heritage *in situ* is organized to ensure that agreed project objectives are achieved in a timely manner with due consideration for potentially conflicting interests. According to *Rule 25* a management programme must provide for the protection and management *in situ* of heritage, during and after fieldwork. The management plan also includes considerations on public information, site stabilization, monitoring, and protection against interference.

▲ © PROAS-INAPL. Members of the team who participated in the protection of the *Bahia Galenses II* wreck, Chubut, Patagonia, Argentina.
As a method of *in situ* preservation, sandbags proved to be an excellent short-term solution for reburial of the 19th century wreck known as the *Bahía Galenses 2.* It is equally a common practise after excavation, to backfill exposed areas and to place sandbags on top to ensure the site remained covered.
Sandbags are also commonly used as filler between survey seasons, and are often used in conjunction with other methods of reburial.
In some circumstances, sandbags can be used as an emergency tool until a more efficient, long-term solution can be determined However one has to bear in mind that the material of the bags has a finite life and that the bags themselves change water movement over the site, causing what is called toe scour.

Site management during fieldwork

In the context of an activity directed at a heritage site, public information, site stabilization, monitoring and protection against interference are specifically highlighted as relevant, but are also at risk of being neglected during the course of activities.

Site stabilization

This is a major aspect that risks being neglected in the course of activities that originate in investigative enthusiasm. It therefore needs to be addressed in the management plan. Not all archaeological interventions aim at full excavation. But even if this is the case, the site will not be cleared without delay and it needs to be stabilized. Archaeology is a meticulous process which progresses step by step. During the research process and as soon as the site is disturbed, it is much more vulnerable to erosion and destruction. Measures for site stabilization can imply sandbagging or covering of areas not under excavation. However, it can also be limited to the covering of the actual excavation area overnight or between shifts, in order to ensure that currents will not unguardedly wash away the sediment under excavation. The site stabilization programme should take account of weather and notoriously capricious sea conditions. Otherwise equipment or archaeological deposits may be lost if a storm comes up inadvertently.

▼ © E. Khalil. The ruins of the Pharos lighthouse, Alexandria, Egypt. Over 5,000 huge granite blocks lie under 8 m of water near the entrance of the eastern harbour of Alexandria. All of the remains have been recorded and are inspected every year in order to monitor the site.

Monitoring

Monitoring of a site's condition during the period of intervention is the logical condition for adequate measures to counter erosion and damage. Monitoring involves the periodic observation, collection and analysis of information on the site's condition, in order to detect signs of both short and long-term changes. Monitoring of a site over longer periods of time

▲ © NOAA. Complete profile mosaic of the *Defiance*, sunk in Lake Huron, United States. On 20 October 1884, the Defiance and the *John J. Audubon* sunk after a collision on Lake Huron. A NOAA-led research expedition in June 2010 in Thunder Bay National Marine Sanctuary has documented the sites with carefully drawn survey maps, individual and panoramic photographs, and video. The research has not only revealed the stories preserved in these nationally-significant shipwrecks, but it will be critical in their long term preservation. The sanctuary will use this baseline analysis to monitor future changes to the shipwrecks.

is an important element in a management plan. It allows understanding the processes affecting the site (including biological surveys on the impact of micro and macro organisms) and thereby facilitates the design of protection measures. Monitoring schemes are particularly important for instable sites and sites of great significance. They are implemented following a bench-mark or reference investigation of the site with regards to its composition, distribution and biology, seabed, current and water characteristics, and extend to factors such as human interference.

Protection against interference

This aspect should be considered for the long-term as well as in the course of fieldwork. A site that is under excavation is particularly vulnerable to interference. In preventing the interference of others, secrecy is not an option. It is hardly possible to secretly operate at the same underwater spot for any length of time. This will attract attention, even in the open sea. At sea, any continued presence on a spot without explication is suspect. Moreover, buoys and shot lines are the obvious corollaries of any underwater operation and as such, they attract attention and interference if unexplained.

Through proper public information, the prolonged and repeated presence of a team can be well-explained

▲ © INAH / SAS. Underwater archaeologist collects a Mayan skull from cenote Calaveras. The cenote 15 m deep and contains more than 120 Mayan skulls. Divers visiting a site should leave no trace of their presence, neither in the short- nor long-term. Similarly nothing should be broken, returned or recovered, neither voluntarily nor involuntarily. Human remains should be handled with respect and should not be disturbed unnecessarily.
Certain forms of behaviour such as scraping the bottom with a control valve or monitoring instrument, giving blows with swim fins, bumping or colliding with obstacles etc. are not admissible. Trampling should be avoided, particularly in areas with coral, grasses and algae. Stones must not be turned over. Finally, the divers, including scientist-divers, must collect all waste they come across while diving.
Other than human interventions such as treasure hunting, sports diving, fishing, dredging, infrastructural or development works, pollution, ship movements, archaeology, oil drilling and pipeline-laying underwater archaeological heritage is also exposed to physical-mechanical, biological and chemical threats. The site management plan needs to account of these threats and provide measures to protect the site against interference.

and as a consequence, interference is prevented. That is to say, unconscious and unintentional interference will be avoided, whereas intentional interference is of course another matter. Public information also creates consciousness about the site and the valuable work, and people can become involved in keeping a protective watch. Consequently, the on site presence of unidentified individuals in the absence of the project-team will attract suspicion from official radar posts, patrol vessels, local fishermen, and professional or recreational seafarers, who will be proud to defend their heritage. All these stakeholders should be encouraged to act as allies in protection, and to report if anything suspicious or out of the ordinary occurs, just like they would in the event of an accident or a fire. Nevertheless, it may be necessary to keep watch and ensure that the interruptions of onsite presence for night rest and rest days are as short as possible. Holidays can mean a rest day for a team, but will generally also release many others from their duties, creating extra time and opportunity for intentional or partially intentional mischief.

Informing the public

The public should be informed about an investigation. This should not be postponed until results have become clear. Public information needs to be addressed from the very beginning and during every activity, pointing to the (potential) significance of the site, the character of the work to be carried out, the vulnerability of the remains, and the whereabouts of recovered artefacts. This is a matter of the public having the right to know and of justifying the effort and funding invested in an activity. After all, it is vital for protecting the site and the activities. Public support and consideration can for instance ensure that speed of navigation is reduced in the area or that pillaging is prevented. In total contrast, silence results in indifference. Moreover, silence about activities invites suspicion, especially when artefacts are recovered. The lack of publicly accessible information, as well as missing contact with local sailors, politicians and authorities, consequently alienates these stakeholder groups from archaeology, as does the exclusion of local divers from participation and the lack of technical publications. Unless archaeologists invest in educating the public, the media and politicians they will not gain their support. Treasure hunting could then seem more appealing and politicians could refrain from supporting the cause of archaeologists against the long-term interest of the population.

Site management upon termination of fieldwork

Site management shall also provide for protection and management upon termination of fieldwork. The activities during fieldwork described above -informing the public, monitoring and site stabilization- are certainly still relevant upon termination of fieldwork.

In addition, properly winding up a project directed at underwater cultural heritage is a major concern of site management once the fieldwork has been completed. In any project directed at a site, the fieldwork should be properly terminated: no excavation trenches should remain open; no debris should be left behind. A management plan should ensure that the site and any remains that are left *in situ* are as stable as possible. This is less an issue in operations where excavation of underwater cultural heritage is undertaken in advance of a development project and if the site is completely cleared. However, even in development-led fieldwork, a site may not be cleared of everything, let alone its meaning. The development project may still be in a phase of planning, and the heritage investigated may be an inspiration for the way this planning is finalized. Even in such cases, the archaeological work should therefore be properly finished and it should be ensured that the site is stable and protected, so that it can best 'survive' the development project.

Simple technical and practical measures are a necessary condition for any long-term protection and management. Dependent on the significance of what remains *in situ* or on the significance attributed to the location, the site can also be recommended for a specific protection scheme, for controlled access, or for wider exposure in the media. The management plan that was part of the project then develops into a programme with long-term sustainability as its aim.

Site management programmes

A site management programme is a tool to structure long-term concern for a site. It should define the reason for concern and the purpose of engagement. Research and enjoyment by the public at large constitute the principal purposes. A management programme should then elaborate the way in which these purposes are best served while keeping the site authentic. Authenticity is best experienced *in situ* and it is one of the reasons why the UNESCO Convention and its Annex put emphasis on protection *in situ*. An authentic site is a joy forever, as a monument for those associating themselves with its history, or its environment, as well as for the local economics of recreational and touristic visits. It is also a joy for researchers, who inform other users, but who also may want to extend and critically assess common knowledge by means of excavation, a process that is both destructive and innovatively creative.

Active management cannot do without research, monitoring and protection. Usually, the three will be combined. Unless a site is threatened to the degree that full excavation is the only option, a site will usually be investigated several times over a longer period of time. Investigation and monitoring can then be combined with other forms of access.

When elaborating a management programme, many factors have to be taken into consideration,

▼ © UNESCO. Management plan of the *Mannok* Shipwreck site in the Klaeng District, Rayong Province, Thailand.
This management plan was prepared during the first Foundation Training Course on Underwater Cultural Heritage in Asia-Pacific in December 2009. It combines general strategies and policies with specific goals that relate to the significance and setting of the *Mannok* shipwreck site.

for example, the site's characteristics and needs, as well as the impact of activities and the natural resources, which may share the same context as the archaeological remains. Underwater archaeologists should ensure that guidelines are respected. How to deal with actions which might have an effect on the archaeological remains (underwater and in the nearby terrestrial areas, if applicable) is to be equally addressed in the management programme. The relevant conventions, national laws, recommendations and guidelines should similarly be consulted in compiling a management programme.

In the creation of a management programme, many different groups and entities may participate or contribute, for example:

- the official agencies in charge of protecting the national cultural heritage (on land and under water);
- the official agencies in charge of protecting the environment and natural resources;
- the official agencies responsible for safe navigation;
- universities and research institutions;
- groups and stakeholders that identify with underwater cultural heritage;
- groups and stakeholders that are likely to profit from the proper management of the underwater cultural heritage; and
- groups and stakeholders that are likely to affect underwater cultural heritage and its management through their regular activities.

◀ © Landesamt für Denkmalpflege im Regierungspräsidium Stuttgart. The site management plan of these shallow prehistoric sites on the shores of lake Konstanz, Germany includes the regular monitoring of the protective cover of gravel. Where necessary the gravel is redistributed with a gardening rake.

Not all of these stakeholder groups may have a positive attitude towards the heritage from the start, but they all have a stake and an interest that should be taken seriously. By taking an inclusive approach, involving all these parties in the formulation of a management programme, all interests can be considered and integrated and the chances of forgetting any relevant aspects are drastically diminished. Evidently, several goals can and should be combined in a management plan in such a way as to take other interests into account. These interests may have to give way to the interest of protection, but in other instances they may come first. Monitoring at set intervals is the way to check whether the management plan works. It can be done by direct or indirect information gathering. An integral approach is thus a way to ensure that the plan will be supported by all stakeholders in its implementation.

The site management plan

The site management programme translates into a concrete management plan that combines general strategies and policies with specific goals that relate to the significance and setting of the site. The general goals of a policy of cultural heritage management, also indicated as cultural resource management include:

- mitigating impacts on endangered sites;
- preventing destruction of sites and dispersal of artefacts by denying permits to exploiters seeking private financial gain;
- creating local, national, and international inventories of sites;
- protecting and interpreting sites *in situ* whenever possible;
- excavating sites only when there are scientific objectives or interests for public enjoyment, adequate funding, professional staff, and provisions for documentation, conservation, curation, reporting and publication;
- involving the public so that people can become the guardians of their underwater cultural heritage; and
- bringing the excitement of underwater cultural sites to the public in reputable museum exhibitions, media presentations, and publications.

Such general goals are to be combined with more specific goals for a region, which may include the targets of regional development or rehabilitation. They need to be specifically applied to the site, considering its challenges and opportunities. The management plan is also formulated to reconcile management goals at different levels. In many ways it is easier to elaborate, implement and apply a strong management plan for sites in zones or areas that have already been declared as protected areas, natural sanctuaries, or reef parks, than it is in the areas of large industrial harbours. In a marine park there are generally more options than in an area with lots of competing spatial interests. Complete, permanent site protection and management *in situ* is therefore not always the preferred or best option for a number of different reasons. For one thing, there are other interests that need to be accommodated, as for instance those of archaeological study that often requires the taking of a significant amount of samples, removing artefacts or structures and/or excavation. A management plan is obviously targeted at managing over the long-term a site that remains entirely *in situ*, but also partially excavated sites and what remains thereof, as well as the removed artefacts.

Content of a site management plan

Management of the underwater cultural resource can be defined as taking action to ensure that underwater cultural heritage is dealt with responsibly. This includes responsible action in survey and research, complemented by management at site level.

A management plan for a specific site can take different forms. Nevertheless, if a standardized approach is chosen for the format of such plans, it becomes easy to compare different sites, both within the same management region and across national borders. Due to the often very international significance of underwater cultural heritage, such possibilities are of great value for common understanding. Therefore efforts are being undertaken to structure the way to look at, assess and manage archaeological sites on a global scale. In this way, information gathered will be made available, understandable and of use for all researchers and policy makers, regardless of their location.

A management plan is always formulated on the basis of preliminary research. It defines what should and should not happen in the future, taking account of possible future contingencies. If a standardized form is pursued, it is important for the management plan to combine all data and assess its relative importance and specific opportunities in a transparent and understandable way. In the management plan, the results of assessment are simply reiterated. In a second part of the plan, policies and management objectives can then be formulated, whereas a third part defines actions and restrictions, and so defines the actual management. A standardized format can be used as a checklist, both in drafting an individual management plan and for the cumulative inventory of which it is a part.

Management as such is a dynamic process and that means that a management plan is a dynamic document as well. It is bound to change and will absorb new information as this becomes available. In this sense, a management plan starts very simply. An initial entry in the inventory, with a recommendation to complete certain information is a management plan in an embryonic state. It becomes more encompassing as soon as more is known and as soon as decisions have been taken about specific protective measures, or about allowing specific research. Over time, the file will grow. The structure discussed below is therefore equally relevant for the establishment of an inventory as it is for each individual management plan.

A site management plan should contain the definition of the site, the administrative details, the relevant organizational structure of who is responsible for what, and most importantly, a discussion of the site, including an assessment of its significance, a report on its status, its potential and any relevant threats and opportunities.

Structure of the management plan

Executive summary

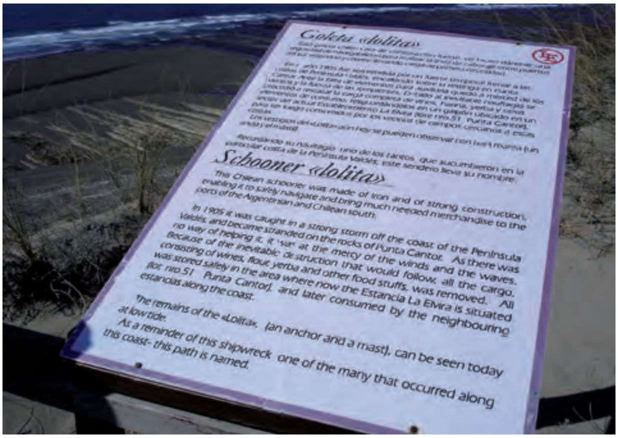
As in a project design, an *executive summary* is useful for a management plan as it summarizes the main points of the in-depth report and allows the audience to become quickly acquainted with a large body of material.

Site definition

a. Description and significance

However important the administrative details or the description of the management structure may be, it is the description of the site itself and the ensuing discussion of its significance that drive the management plan. It is because of its significance that the site is managed in the first place. The plan should therefore begin with the description of the site's character and its extent, especially if that is different from the later administrative delimitation of the management plan. Just like a project design for an 'activity directed at a site', a management plan should refer to all previous studies of the site. They form the basis on which the plan is developed and are preliminary to the plan's development in that sense.

Most of all, previous studies and preliminary work form the basis for a discussion of a site's significance. Here, it suffices to reiterate that significance is subject to change. It develops as more information becomes available, and as more people learn about the site, nationally and internationally. In a way, significance can also be created. The more media coverage it obtains or the more attention it attracts, the more significance is attributed to the site. Significance needs to be assessed anew whenever new developments take place, such as the drafting of a management plan. Of course it should also build upon earlier information and assessments, but it should be up-to-date. New stakeholders may be identified or may have identified themselves, through the many 'verifiable links' that the site might gradually reveal.



▲ © PROAS - INAPL.
Information plaque about the *Lolita* wreck, Chubut, Patagonia, Argentina.
The local ranch La Elvira, frequently visited by tourists, took the initative of installing a sign on top of a cliff referring to the nearby shipwreck of the schooner Lolita that sank in 1904.

b. Delimitation
   The precise position and delimitation of a site are important. They define where and to what extent actions and restrictions that are part of the management programme will be applicable and facilitated.

c. Ownership structure and responsible bodies
   Sites' ownership conditions can be simple but also complex. They, as well as the conditions of jurisdiction, should be stated in the management plan. Their organizational form must also be explained, e.g. the duties and responsibilities of an operating agency with respect to proprietors and users. If a site is located in a marine park, a nature reserve or an otherwise reserved area, this should also be mentioned.

d. Inventories
   The management plan should also contain information on the whereabouts of all items, artefacts and research samples collected on the site, as well as indications of the location of all documentation assembled in the course of the project. This information should be kept in the form of inventories that are regularly updated. Ideally – and according to *Rule 33* – all documentation and find material should be kept together, but in practice this is not always the case. Due to changing views on heritage significance, a site may not have been recognized as such, whereas data and material have nevertheless been collected.

e. Access
   Access to the site is a central issue that cannot just be reduced to a matter of allowing or prohibiting access. Managing access to significant heritage sites may imply costs, but it may also provide substantial benefits. These include understanding and support for heritage protection, but also

imply an economic perspective in terms of direct or indirect income obtained from a sought after experience. Managing access in the context of regional and touristic development is therefore a central issue to the management plan.

Factors such as economy, tourism and leisure diving could have a positive impact on a site, but also present a possible risk for its management. Some underwater archaeological sites, especially those in coastal waters, can be preserved *in situ* as underwater museums. This can result in great benefits in terms of education, recreation and income. In such cases, special guidelines should be included in a site's management plan.

Access to a site is partly a matter of how to get there, but for the management plan it is more important to note what access restrictions should be put in place. The issues to be considered are: Is there an owner of the site that needs to give permission? Is the site located in a park, a nature reserve or a military area, with special rules? Are there limits on motorized navigation, or its speed? Is anchoring allowed? Is access limited to certain hours of the day or certain periods of the year? Or is access subject to other limitations? All facilities and obstructions for access are relevant to the management plan. The plan itself may contain the objective to facilitate access or to implement access restrictions. However, every site should be managed for the best benefit of society.

Accessible sites strongly require periodical monitoring of their conditions. The site should be well-maintained, for example, by checking on site stabilization, corrosion progression, pollution by oil or rubbish, signs of looting, and control of biofouling adherences. This can be done by an underwater archaeologist or by members of an interested community, as for instance diving instructors, local guides, volunteer associations, or fishermen. Under the guidance of professionals and the competent authorities these can become guardians of the cultural heritage with which they associate. Coastguards can become a supportive element as well, especially for notifying relevant authorities regarding suspicious ships or boats around sites.

Management structure

a. Legal status of the bodies
   The legal status of the different individuals and entities that are mentioned in the management plan, and especially those that figure under 'administrative details and management structure' is an aspect that needs to be listed, as it has a bearing on the way their different interests and policy objectives can be addressed. The entities involved can be:
   - professional organizations,
   - governments and government departments,
   - academic institutions,
   - non-profit organizations,
   - museums,
   - vocational groups,
   - individuals, and/or
   - partnerships of the above.

   The legal status of such entities is closely related to their competences and responsibilities.

b. Competences and responsibilities
   The management plan for a cultural heritage site will not change the general competences and responsibilities of agencies and authorities involved. When a site is in a military area, for instance, the plan will not change the competences of the military. Nor will it change the competences of the heritage authority (the competent authority according to Article 22 of the Convention). But the management plan can address the specific way these competences will be used to realize the objectives of the plan. In other words, specific responsibilities can be agreed upon in the context of the specific management plan, for the purpose of its objectives. The site management plan should contain a description of all these entities as well as a binding agreement of their competences and responsibilities in the context of the plan.

The relevant demands on qualifications of staff come into view as well.

c. Coordination mechanism between bodies
As a site management plan always involves different bodies, with different interests and missions, it is essential that it specify modalities of coordination. There may be one leading party that commits itself to inform the others and coordinate with them bilaterally as appropriate. Or, it can be agreed to have coordination meetings at regular intervals, during which the realization of the plan is evaluated on the basis of monitoring reports and during which the contribution of all partners is critically assessed. It is important to agree on coordination schemes from the very start. The coordination mechanism should include a system of informing and involving stakeholder groups, nationally and internationally, as they may arise. It may be appropriate to give this role to an experienced public archaeologist.

Principles for planning and actions

a. Objectives, targets, strategies
The objectives of a site management plan are anchored in general strategies and policies, such as a general commitment to protect the underwater cultural heritage according to the 2001 Convention. Other strategies and policies, however, such as culture in development, urban and regional planning, recreation and tourism are at stake as well. Such policies will all have their specific targets, which the management plan for an individual site can help to meet. Note, however, that the site itself is the main ‘object’. Deciding what is best for that particular site, considering its specific significance and opportunities is the main ‘objective’ of the site management plan. Several aspects, such as preservation, access, provisions for science and research should be integrated with this objective, as well as a vision for the future and sustainable use.

b. Masterplan of action
All actions that have been undertaken or

are planned for a site should be listed in the management programme and in relation to the long-term objectives. This should be done in an action plan in the form of annual short-term (2 to 5 years) and long-term work plans (5 to 30 years) to guide the decisions of the competent authority.

When drafting the outline of the plan, it is important to involve all competent authorities and institutions responsible for conserving the site. It is imperative that the outline of the plan be continually updated to make it possible to react to changes and developments. In addition to mentioning needs for restoration and current construction, questions of security, fire safety, use, stationary and flowing traffic as well as protection of the environment should be addressed.

The masterplan should be accompanied by a catalogue of measures and a time schedule listing interventions and monitoring times to guarantee follow up.

Provisions for science and research

Protection of heritage builds on scientific evaluation through research. In archaeology, research often implies excavation or intrusive sampling, which compromises the integrity of the site that the management plan tries to preserve. Nevertheless, it would be counterproductive not to make provisions for research in a management plan. These can be extensive, but can also be highly restrictive and subject to very stringent considerations. An example could be the limitation of access to timber to parts of the year when tunnelling organisms such as *Teredo Navalis* are least active, or when other environmental threats are least. Though some restrictions are appropriate, research is necessary for proper site management and monitoring. Other research may have wider implications. Research must always be accommodated for and provisions facilitating research must be in place. It is important to remember that one of the functions of remains of the past, is that they offer the source material for writing and rewriting history. This cannot be done without research.

Preservation mechanism

Preservation or protection is the broadest objective of the management plan that also encompasses other aspects. However, management is certainly more than preservation as such. Preservation and protection are, after all, carried out for a specific purpose, that is the use, research and enjoyment of the cultural heritage by present and future generations. In other words, a management plan will aim at balancing benefits with acceptable levels of degradation, in view of the available possibilities. The two questions that need to be addressed are: how can the continued existence of the most vulnerable parts of the site (or the most significant ones) be warranted, and how can the most be made of opportunities.

a. Status report

The site's condition needs to be monitored and a status account should regularly report on the following aspects: Are conditions deteriorating since the site was first discovered? Is the site stable? If assumptions are made, they need to be substantiated. Some additional research or monitoring may be necessary to draw up the actual status. The status report is important because it provides the base-line from which the effectiveness of measures in the management plan can be measured.

b. Current and possible threats

Along with the status report, it is essential to assess threats and opportunities. They can relate to archaeological interventions, commercial exploitation, development pressure, climate change, natural disasters, tourism, and population development, among many others. Obviously, many threats will – if handled well – create opportunities, while thoughtlessly seizing opportunities may pose serious threats. This applies to archaeological research and excavation as much as it does to tourism and public access. A management plan aims at balancing threats and opportunities, and aims to ensure that threats become opportunities. Threats and opportunities can be related to:

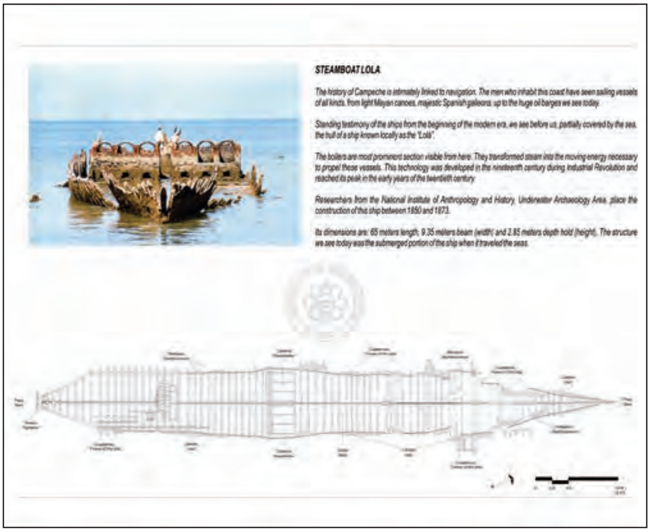
i. Archaeological interventions
ii. Commercial exploitation
iii. Development pressure
iv. Climate change
v. Natural disasters
vi. Tourism
vii. Regional development
viii. Demographic development

c. Preventive protection

Characteristics of underwater sites like depth, currents, visibility, accessibility and most of all, the fact that it is an environment where external breathing support is needed, make protection against interferences complex and sometimes impossible.

Many preventive measures can be taken. Some are purely administrative, but have important implications all the same. The site can be excluded from the planning of other developments, or from fisheries' permits. It can be included in the patrol routes of government vessels, whose primary functions are navigation safety or border control, or in operational permits for recreational diving schools and tour operators on the condition that they keep a close watch.

Furthermore, ranges of less costly and more expensive techniques to protectively cover the most vulnerable parts, and to prevent degradation of certain materials, have been developed over the last decades, as was touched upon earlier in this chapter. Every underwater archaeologist should be aware of the possibilities. Note that a management plan aims at improving the conditions for preservation; it does not need to instantly implement every possible measure. Rather, it should envisage regularly monitoring the effect of measures taken and fine-tuning accordingly.



◀ © INAH / SAS. Information chart about the wreck of the French steam boat *Lolá*, Campeche, Mexico.
This chart, posted at Campeche's sea drive, describes everything related to the remains of the French steam boat *Lolá*, located in coastal waters of the port of Campeche, Mexico.

d. Monitoring: planned control action
   A management plan should never be static. It is generally conceived of in terms of a cycle. Measures are taken, evaluated, fine-tuned, altered or withdrawn. Monitoring and evaluation are therefore part of a management process and should be included in a management plan. It can take different forms, targeting specific issues, measuring specific parameters of change or reacting to specific events. However, periodic monitoring should also address the overall condition of a site. It should do this in relation to the 'base-line-study' and to the periodic status-report.

   Different types of monitoring can be:

   i. Periodic reporting
   ii. Reactive monitoring
   iii. Preventive monitoring

Awareness

Education, information and public awareness building are important aspects.
The divulgation of information and the creation of awareness should be addressed in a management plan. Heritage protection has come into existence due to the awareness of the

public. There is a strong appetite to learn more about history and archaeology. Underwater archaeology projects can spark an individual's imagination and these opportunities can be seized to gain understanding and support. This is even more the case if a site is also a renowned touristic attraction. In addition it is indispensable to publicize any project or project developments among the research community, funding bodies, sponsors and heritage agencies. The public and in particular divers should also be informed when a site is covered, or access is restricted or made impossible, also explaining the reasons for these measures. This often helps to gain their understanding and support.

A site management plan should therefore include the public information strategy and set the frame for keeping the public informed about a site. It is advisable to diffuse information and to create awareness locally, regionally, nationally and internationally as underwater cultural heritage and maritime remains are international in nature, with stakeholders and verifiable links far afield. Means of communications will vary considerably in function of the audience addressed, from mass media, the Internet, brochures, videos and exhibitions, to workshops and signs. Nonetheless, they should include information about the site's importance and how communities, divers and the public at large can help to protect it. The impact of networks and international collaboration should not be underestimated.

If this is appropriate in the context of the concerned site, it might also be an option to organize archaeologist guided tours, specific events and festivities, including commemorative days.

Resources

A management plan should contain a section on the resources needed for its implementation. Part of this could be secured from commitments by the entities that back up the management objectives. Other parts, such as basic research and monitoring, will need dedicated budget and staff from other sources. Costs and benefits should be balanced. Integration with policies of regional development, public order, navigation safety or border control, and involving the leisure industry in the plan, can show that proper management does not have to be expensive. If done well, it will not only produce cultural benefits in the long-term but also financial benefits.

a. Staff
Reference should be made to the availability and the qualification of staff for all measures planned for in the management plan.

b. Budget
A budget or funding plan should be included in the site management plan.

Sustainable use and vision for the future

A management plan is generally conceived for a specific period, after which it can be evaluated and adapted. In the formulation of its objectives, it will benefit from developing a vision for the future in a longer perspective. Such a vision would inform how to balance present and future use with sustainability. This is not the same as preservation, as sustainability implies the economic balancing of costs and benefits for society.

IX. Documentation

▶ © Z.Morsy. Members of the team putting together the site plans of the reefs of Fury Shoals during the Red Sea Survey 2010.

The knowledge of underwater cultural heritage exists and persists because of documentation. In order for current and future generations to learn from archaeology, the information gained in the course of an archaeological project must be documented and made available in an organized form.

Archaeological documentation thus gathers information on prehistoric and historic sites in a systematic, professional way. The destruction of submerged archaeological sites through salvage, fishing, pipe laying and other activities has heightened the need for documenting. Two rules of the Annex are devoted to documentation, *Rule 26* and *Rule 27*.

As it has already been stated, the production of archaeological knowledge and understanding is an iterative process. Field-data from earlier work will be reconsidered in preliminary studies for future projects or management plans. This data is also, however, the primary source to refer to if new interpretations of the past produce new scientific questions that were not answered at the time, simply because they were not yet formulated or asked. It is for this reason that documentation aims at objectively recording all observations, findings and activities as accurately and completely as possible.

The nature and level of documentation is dictated by the specific circumstances of a site and is guided by the objectives and methods employed. It is thus consistent with planning decisions.

Documentation programme

Rule 26. The documentation programme shall set out thorough documentation including a progress report of activities directed at underwater cultural heritage, in accordance with current professional standards of archaeological documentation.

Rule 27. Documentation shall include, at a minimum, a comprehensive record of the site, including the provenance of underwater cultural heritage moved or removed in the course of the activities directed at underwater cultural heritage, field notes, plans, drawings, sections, and photographs or recording in other media.

The documentation programme is part of the project design. It sets out the strategy for thorough documentation throughout the project and needs to be drafted before any intervention takes place. It explains the scientific rationale behind the research effort; defines the scope of the investigation; identifies the methods, techniques, and procedures to be used; provides a schedule for progress reports and site

◀ © MMARP. Two students training in documentation methods, bay of Bigovica, Montenegro.
During the Montenegrin Maritime Archaeology Research Project (MMARP) in August-September 2010, an international group of students were trained in various documentation methods. Here, Ania Kotarba-Morley (from Poland, left) and Quinn Saint-Amand (from the US, right), record the scantlings of a modern hull exposed in the small bay of Bigovica, Montenegro.

reports; and permits comparison of the proposed research with the results. It equally specifies the selection of methods and techniques of study and provides a comparative framework for evaluating and deciding the relative efficiency of alternatives. Last but not least, it specifies how the information is made available to others, to other professionals and the public.

Standards of archaeological documentation

The documentation programme must follow the acknowledged standards of archaeological documentation. Moreover, it should be tailored to the specific project objectives. All observations that are relevant for the site's interpretation or future management should be documented and archived. The following guidelines apply:

- the goals of the documentation shall correspond to the goals of the project specified in the project design and to the needs identified for the relevant historic or prehistoric contexts;
- the selection of methods of documentation shall be coherent with the information sought;
- the possible results of documentation shall be assessed against the objectives and this analysis shall be integrated into the planning process;
- the results of documentation shall be reported and disseminated to the public and necessary measures shall be taken accordingly; and
- the documentation shall be conducted under the supervision of qualified professionals in the disciplines appropriate to the data that are to be recovered. When non-professionals are involved in documenting activities (for instance volunteers), provisions should be made for training and supervision by qualified professionals.

The documentation programme must take specific data needs into account, as well as the time and funds available to secure the data and the relative cost efficiency of various strategies. However, in any intrusive action, it is better to economize on the action as such than on its documentation, since documentation is all that remains and since documentation can never be repeated if what is to be documented has been destroyed.

Progress reports

Rule 26 specifically requires progress reports of activities directed at underwater cultural heritage. This means progress reports of all stages of archaeological projects. It includes planning, survey, identification, evaluation, excavation and treatment, as appropriate. Progress reports provide the basis for evaluation of the project's development, they inform the project's sponsors and they help the project-director to fine-tune strategies, and, if necessary, to adapt the project design. Status or progress reports shall always include a description of the current phase of activities, methodology, results, and preliminary assessment of the archaeological materials recovered thus far. They shall also include reports on any accidents and major problems encountered during the course of the excavation. Progress reports are also a basis to keep the public informed and involved. In terms of documentation, the progress report stands halfway between the primary data collected and the final report, or perhaps it stands a bit on the sideline, as the final report needs to build on the primary data as well.

The breadth of archaeological documentation

Archaeological investigations are seldom able to collect and record all possible data. It is therefore essential to determine in advance the point at which further data recovery and documentation will fail to improve the usefulness of the archaeological information to be recovered.

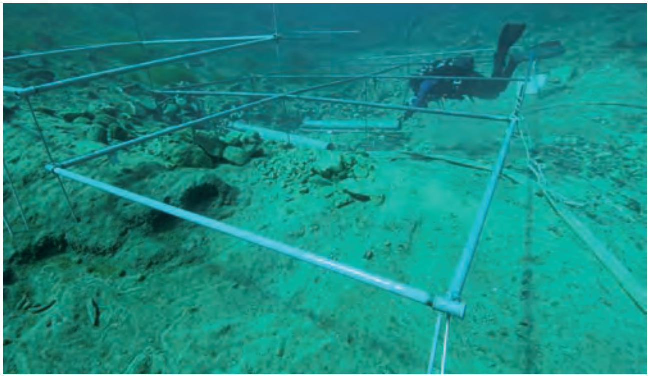
Conversely, the research design should also be flexible enough to allow for examination of unanticipated, but important research opportunities that arise during the investigation. Moreover, it is important to guarantee responsiveness to the concerns of possible stakeholders (local groups, environmental protection groups, religious entities, etc.) since an archaeological intervention usually involves site disturbance and it is essential to address concerns or wishes of stakeholders appropriately with documentation.

The process of archaeological documentation

The documentation process of an underwater cultural site starts as soon as an object of archaeological nature is found. In terms of inventory and management, it will continually accumulate from that point onwards, but it will not necessarily include a comprehensive record of the site. That is to say, it should be comprehensive to the level of what is known. More documentation will ensue from background research for the development of a management plan, for impact studies of other developments or when an archaeological intervention is planned, such as an assessment of the site for which a project design is prepared.

However, the situation is different as soon as a survey is actually undertaken. The first thing it should do is comprehensively document the site as it appears, without any interference. It is in relationship to that overview that further decisions for management

© Parks Canada. Vertical documentation, Red Bay, Canada. Documentation of the vertical and horizontal directions of features of a site and its immediate surroundings are the basis of all site surveys. The site is recorded horizontally in plans and vertically in sections, giving an overview of the site and its features.
This equally allows establishing a topographic model for which sufficient points and lines must be recorded to allow a complete computer simulation of the ground surface.
Horizontal and vertical recording also allows observing complex changes of texture, colour and content of layers during excavation. By detecting cuts and fills, superimposition and episodes of soil removal and re-deposition, the order in which the deposits were laid down (i.e. the sequence) can be understood. The sequence helps to establish the chronology of activity on the site by allowing dating evidence such as artefacts or scientific dating samples to be related to the build-up of layers across the area being investigated.
▶



◀ © Robert Mosković. Fotodocumentation of the Croatian Conservation Institute. Test pitting with the aid of firm grid at Lake Hutovo blato near Capljina, Croatia.
A prospection technique which can be used on large area projects is that of test pitting. Ideally this will consist of the excavation of trial pits (This may for instance in 1.5 x 1.5 m) on a regular pattern which may be a 50 m grid. Full details will however vary from site to site and must be agreed in detail with the planning archaeologist. The general standards and methods of work should conform to those for trial excavation as outlined above.
This site has been known since the 1970s, but intensive and systematic rescue archaeology has only been carried out recently. Tons of amphora sherds (Lamboglia 2 type amphora, 1st century BC) have been found, a prehistoric bronze axe and over 200 amphora plugs. It is not known for now whether these are from a shipwreck or a port at the site. Lake Hutovo blat was, namely, joined to the Neretva River navigation route in Roman times, and thereby with the Roman commercial centre of Narona.
A prehistoric layer with Cetin culture pottery from the early Bronze Age was found under the Roman period cultural layer during the excavation.

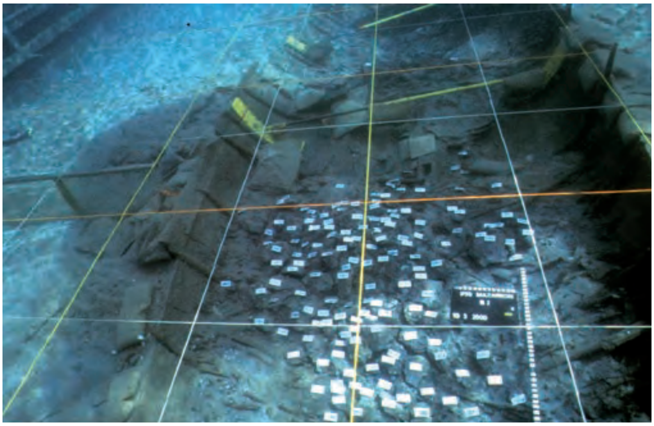
or intervention are to be taken. It is on the basis of that overview that information on the site can understandably be communicated. This is the message that *Rule 27* wants to convey. The rule is very clear on the fact that the original position of items that are moved or removed should be documented in relation to the site-plan or overview. Furthermore, it mentions the importance of field notes, plans, drawings, sections, and photographs or recording in other media. All phases of planning, implementation and evaluation should be documented and evaluated to assess significance and effectiveness. The importance of well-documenting all project information is accordingly emphasized.

Documentation techniques

Once the compilation and documentation of background information is complete, and following the decision to undertake an archaeological intervention

▶ © A. Rey / UNESCO. Students of the UNESCO Training Course in Advance Recording Techniques for the Underwater Cultural Heritage, in Guanabo, Cuba, 2012. This programme aimed the provision of the necessary skills to help in the protection and recording of the underwater cultural heritage in Latin America and the Caribbean Region. Here two students are practicing mapping sites with direct survey measurement before applying the methods under water.

▶ © National Museum of Underwater Archaeology. ARQUA. Observation grid during the excavation of lead ingots from the wreck *Mazarron II*, Spain. Large or smaller grids are often placed over a wrecksite to map and measure the site, and to position individual finds. Such a grid can be made of aluminium framing or other material.

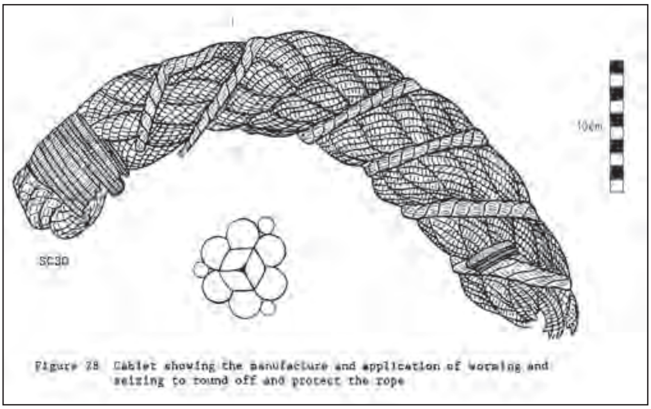


according to the project design, archaeologists begin with the fieldwork. Many types of equipment and technology will be used at this stage.

The central objective of documentation at the start of fieldwork is to ensure a full, clear, and accurate description of the site, and of all field operations and observations, including excavation and recording techniques. A phased documentation programme in accordance with a phased project design is often the most efficient and cost-effective. It allows for winding up the project after each phase and for reconsidering the feasibility and usefulness of the next, as well as a fine-tuning of methods.

The techniques chosen for archaeological documentation should be the most effective, least destructive, most efficient and most economical means of obtaining the needed information. This seems to be a platitude, but in underwater archaeological work this

▶ © Tasmanian Parks and Wildlife Service. Drawing of a piece of rope and its construction from a wreck.



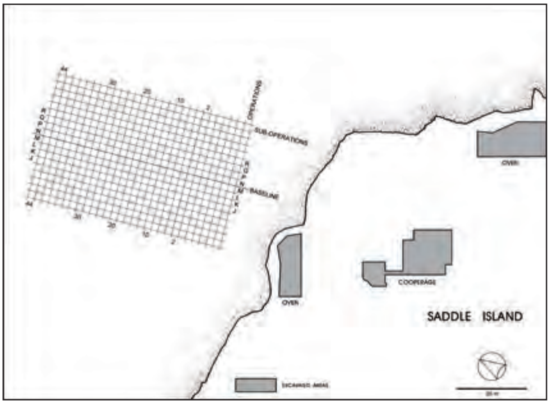
Murphy's law

Archaeological operations are amongst the most labour intensive underwater operations. Much needs to be done by hand. In planning efficiency one should counter the unfortunate 'Murphy's law' that everything that can go wrong will go wrong.
Technical devices, whether they are pumps, engines, cameras or surveying and measuring equipment other than rulers and tape-measures, need careful treatment and maintenance and have a tendency to malfunction at inappropriate times. To compensate for this, one should be able to deploy back-ups at short notice. As a result, there is a strong tendency to keep to simple and infallible devices: pencils, frosted plastic boards, tapes, strings, rulers and the like: the so-called KISS-method: 'Keep it Simple Stupid!' In many ways this is a sound approach. And in remote but shallow sites, underwater archaeologists should definitely be proficient in getting results, while using very simple means.

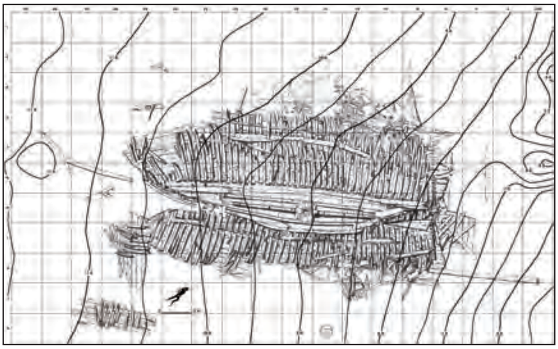
Sometimes, however, this reaction has developed too much into a creed. In operations with mixed teams of professionals and volunteers, there is an understandable tendency to volunteer for the diving rather than for the maintenance of non-personal equipment. For many, diving is the motivation to volunteer in the first place, which takes away all stimuli to improve efficiency and cut down on the hours spent under water. Unnecessarily prolonged operations are the result. In some respects this can still be relatively efficient, but in other ways it is a waste. For instance, the directing archaeologists cannot be deployed else-where.

Clear assignments are therefore essential. Another option is to take turns for diving, equipment maintenance and all other activities.

◀ © J. Auer. Archaeologist Thijs Maarleveld recording data on a computer.
Manipulating data in computers may pose problems in small boats or with wet fingers. Frosted paper and a pencil provide the simplest and most secure (intermediate) recording medium in more difficult conditions.



◀ © Parks Canada. Observation grid, Red Bay, Canada.
Underwater research in the harbour led to the discovery of 3 Basque galleons and several small boats, superbly preserved examples of 16th century shipbuilding.
The documentation techniques applied in Red bay where exemplary and allowed the construction of a replica of one of the wrecks as well as the elaboration of a 5 volume report.



◀ © Parks Canada. Bathymetric map of the site 24M, Red Bay, Canada.
Bathymetric survey is one of the marine geophysical techniques most widely applied to marine archaeology. This technique, primarily developed for military and commercial purposes, is now being used in reconnaissance and site-specific underwater archaeological surveys.
The results of this type of grid survey can be contoured and presented as 2-dimensional plots and surfaces, i.e. the results of a bathymetric survey can be contoured to provide a bathymetric chart of the topography of a seafloor and a Basque 16th century whaling vessel, using contour lines to indicate depth.

▲ © Wessex Archaeology. Archaeological recording on-board a support vessel.
The team is tracking a diver who is surveying a wreck on the seabed. The diver's helmet is also sending live video footage to the support team so they can see what he is looking at.

▲ © INAH / SAS. Archaeologists from INAH's Vice-Directorate of Underwater Archaeology of Mexico recording a part of a shipwreck, near the coast of Ciudad del Carmen, Campeche, Mexico.

principle needs careful consideration. To document excavation effectively, it is essential to record sites, features and finds accurately and comprehensively. All artefacts should be given equal weight whether they are wooden wreck parts, gold coins or antique amphorae, since they provide equal information about the past, and since it is their spatial interrelationship that counts. That, and the careful dissection and preparation of excavation plans and sections, is very labour intensive.

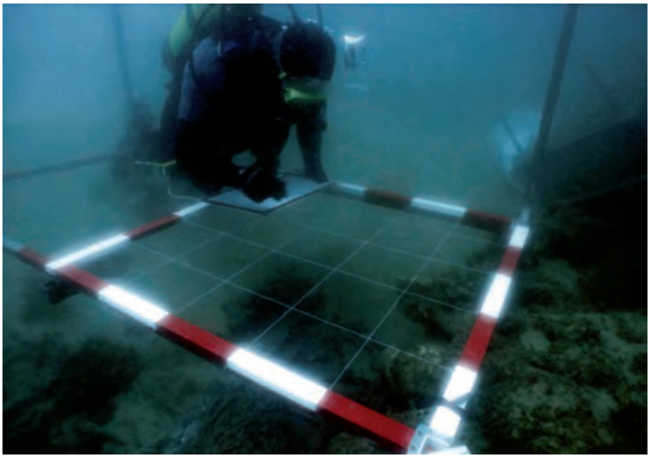
Whatever the documentation methods chosen, the actual documentation will consist of computer-data sets, plans and sections, as well as photographs, drawings and illustrations, recording forms, log-books, site notebooks, diaries, dive logs, etc. Original data and field records should be maintained in a manner that permits independent interpretation insofar as possible. This means that the archive should be structured in such a way that the results are verifiable, for the principal researcher as well as for others. Record-keeping other than field notes should therefore be standardized in format and level of detail. Choices for certain methodologies must be explained, both for independent interpretation and for the periodical progress of the project. Obviously, that explanation will include a discussion of cost-effectiveness relative to other methods.

Onsite observations

Primary observations and data are very important. It is good practice in archaeology to keep field-notes and diaries. Systematic field notes in small

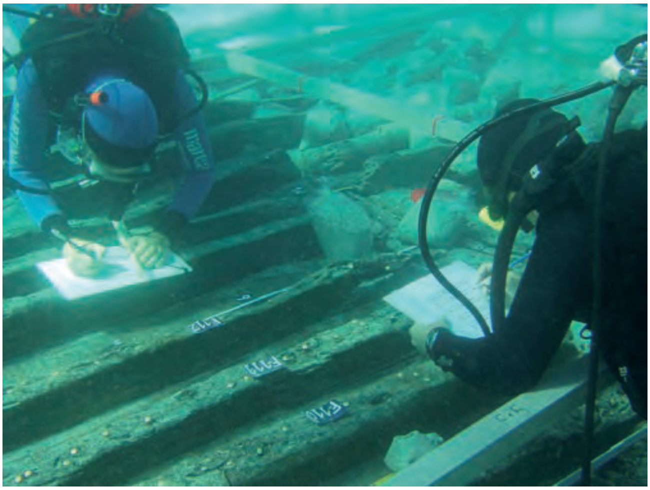
▼ © Ships of Discovery. Diver photographing a Japanese Jake seaplane in Saipan Commonwealth of Northern Mariana Islands.
When taking photographs, divers should be careful to avoid contact with the wreck or ruin site as many objects are fragile regardless of their size. Improper techniques while taking photos under water can damage sensitive site elements and harm fragile objects with the bump of a camera or tank, swipe of a fin or even the touch of a hand. As camera systems add weight and are buoyant, divers should make sure that their equipment is secured and properly weighted to avoid contact damage.

▶ © Archivo IAPH – CAS. Measurements and documentation of a 19th century wreck at Camposoto, Cádiz, Spain



hardbound notebooks and written in pencil rather than ink, for readability after having been left out in the rain or splash-water, used to be the norm. The entries are both the basis and a check for analysis. As they also contain notes on weather conditions and sea state, headaches, emotions and seasickness, they provide a useful background to assess the accuracy and reliability of the observations made on a particular day. No archaeologist is infallible. Keeping such field notes in the project-archive is not a sign of weakness or doubt concerning one's final analysis or interpretation. In fact, it is a sign of professional strength. The simple method, including notebook and pencil, is still useful today, especially in small operations with small teams, or in operations involving much improvisation. Generally, however, 'current professional standards of archaeological documentation' include a formalized system of registering data and observations. Standardized forms have become the norm. There will be a range of these forms in a larger operation. Each form will contain information on a particular aspect. Some are oriented to control the operation, others are meant for description of the drawings, photographs, or measurements that have been collected, still others will be designed for the documentation of specific types of features in a standardized way.

Documentation can hardly be thorough enough. This is especially true for the documentation of onsite observations. Many archaeological observations,



◀ © I. Radić Rossi. Fotodocumentation of the Croatian Conservation Institute. Documentation of a late Roman shipwreck at Pakoštane, Croatia. Primary observations are very important. It is good practice in archaeology to keep systematic field-notes in project diaries and documentation forms. Diary entries covering all aspects of the project and external conditions serve both as the basis and as a check for analysis and should be part of the project archive.

especially those that relate to stratigraphy and spatial relationships in deposits that are unravelled in excavation, are of a one-off nature. It is good practice to have another member of the team corroborate those observations, even if that is not always possible. In low visibility and highly dynamic underwater sites, for instance, every single observation may turn out to be important. This is to say, it can be important for the purposes of the project at hand, but it can also prove important at a much later stage.

The documentation by the diving supervisor is aimed at safety and management of potentially dangerous situations and accidents. It should always be kept in real-time and hard copy. Individual dive sheets may also contain information that is important for evaluation of safety issues. Archaeologically, however, it is more important that they serve the same purpose as the hardbound notebook referred to above, commenting primary observations as well as remarks on general well-being and the conditions of the dive. Such sheets should also refer to any other documentation that results from that same individual dive, such as drawings, sketches, photos, video or measuring sheets.

Due to underwater psychology and the workings of the human mind, it is essential that the delay between the dive and the writing of the individual dive report is as short as possible. Sometimes this implies that they need to be written in hard-copy as well, although the project-director may want them to be entered into a computer at the end of the day. Other forms, such as drawing-sheets, photo-sheets, measuring sheets, feature-sheets, find- and sample-lists, artefact-sheets or timber-sheets, as the case may be, may directly be entered into a computer, for ease of backup and cross-referencing. But that, of course, depends very much on the situation. Backups only work if several computers or a connection to the internet are available on the working platform or at base. Computers do not do well in small boats or with wet fingers, and are even less useful when they fall overboard.

It is not only computers that risk getting wet and washed out. Underwater operations as a whole are particularly prone to all sorts of mishaps and interruptions and to the vagaries of weather and sea state. Documentation should be organized accordingly. An experienced underwater archaeologist is known for his dictum 'each day one should document as if there is no other day'. It can be very tempting to postpone finishing after a busy shift. However, it is good practice to round off all documentation, including a daily summary before finishing the day, even if that means working late at night.

Technological advances

In the diving industry other than recreational diving, there is a tendency to limit the amount of time spent under water to an absolute minimum, whatever the depth may be. Remotely Operated Vehicles with cameras and documenting equipment, and tracking devices for adequate measuring have replaced divers in many construction jobs, reducing their presence to assessments and complicated operations where their intelligence is needed, or to simple tasks where the diver is nevertheless more efficient. The technology employed generally calls for extensive investments or high leasing rates. But if a few days of expensive equipment rental can win several months of toiling by inefficient scuba – divers it is still the more efficient option. Miniaturization of

◀ © National Museum of Underwater Archaeology. ARQUA. A Remotely Operated Vehicle (ROV), Spain.
The ROV is part of the remote-sensing equipment that can be employed to help uncover hidden archaeological sites and artefacts. The term ROV stands for Remotely Operated Vehicle and designates an underwater robot that is used in underwater environments too dangerous or deep for human divers to operate within. This makes them a useful tool in the field of Maritime Archaeology when surveying wrecks and other underwater archaeological sites.
The ROV can vary in size from small vehicles with TVs for simple observation up to complex work systems, which can have several manipulators, TVs, video cameras, robotic grips, tools and other equipment. The vehicle is powered and operated from the surface through an umbilical line that runs out the back of the robot. Depending on the size of the ROV the working depth may reach a maximum of 7,000 m.
There are many examples of ROVs being used in Maritime Archaeology. The *Mary Rose* fieldwork in 2003 included using an excavation ROV to remove the top layer of silt that had covered the wreck leaving the delicate excavation to be done by divers with airlifts.

offshore technology has the dual effect of reducing rental, shipment and purchase rates with technology becoming more versatile for some of the tasks related to archaeological documentation.

In choosing efficient documentation techniques, one should be prepared to combine different systems. It is quite clear that simple offset measurements and sketches are the most efficient in limited excavation trenches. In setting up a grid for measurements, a Direct Survey Method including computer-processing of simply measured direct distances is to be preferred. There are several simple and readily available computer programmes that can process such data with the help of non-parametric statistics. In documenting complex structures, long periods of underwater work can be avoided by combining simple triangulation with voice-recording of the measurements and processing in the dry. Direct distances, measured with tape measures, should not as a rule exceed 20 or 30 meters, especially not if visibility is low. Therefore, if measurements need to be taken over larger distances, the tracking devices of the offshore industry might be an efficient answer, especially if their deployment can be focused and concentrated on a few days. For shallow sites, GPS–positioning with the antenna on a long pole may be an answer for the reference grid, and if close to land a traditional surveyor's Total Station can do the trick. Another step is to integrate the local grid into the land- or sea-bottom-scape, for instance, in a detailed bathymetry image.

Consideration for future research

The chosen documentation methodologies and techniques should take into account that future researchers will need to use the data to address problems not recognized at the time that the data was collected. This means that a record of primary observations and raw data should be kept alongside with the processed data. Spatial relationships between different layers and their interfaces can, for instance, profitably be analysed with the help of the so-called Harris-Matrix, but the documentation should allow reconstructing what the interpretations are based on.

It also means that destructive methods of data-gathering should not be applied to portions or elements of the site if non-destructive methods are possible. In those cases, however, where it is known that the site will be destroyed anyway, for example, when industrial construction will follow the investigation, this is not an issue. It may be far more practical and efficient to gather the needed data in the most direct manner, even though this may involve the use of destructive techniques. This is also one of the reasons why destructive archaeological research should preferably target those sites that will meet this kind of fate.

Alongside the primary aims of the documentation programme, it is quite likely that the field operation will collect data that is not fully analysed in the context of the project. Just like the raw data that is actually analysed, this additional data should also be recorded and preserved in a way to facilitate future research.

Similarly, project documentation needs to be recorded in a certain way, and order, and on media that will be equally available and comprehensible for future researchers. Nowadays, digital recording and storage is particularly recommendable, but it has its specific problems and issues. Attention needs to be paid to saving back-up copies in different data formats and places. Also, it should still be contemplated to deposit full paper copies in a safe place elsewhere.

X. Safety

▶ © P. Larue / FMC. A diver carefully excavating a Nankin porcelain plate from the wreck of *La Boussole*, that sunk during the *La Pérouse* expedition in 1788 off the Island of Vanikoro, Solomon Islands.
In all diving activity, safety needs to come first. One should not be carried away by the task at hand but keep strictly to the dive plan and the instructions of the diving supervisor. Hazards of the environment should equally be kept in mind. While most diving systems provide for a tether or another means of communication with the surface, free diving scuba is sometimes preferred. For safety scuba depends on diving together and in focused activities individual divers may lose contact with their diving partner which is an extra risk.

No project, professional or otherwise can do without devoting proper attention to the health and safety of all individuals involved in the project. This applies to everyone on the team and in particular it is the organizers, sponsoring entities and competent authorities of activities that need to reinforce safety measures. They should withhold their backing if this is not the case. Although all participants must be qualified, competent and have appropriate training for the task, responsibility for safe practice ultimately rests with the project director. Water, boats, ships and diving all have their specific safety requirements that need to be considered. Invariably, project organizers will have obligations under the relevant occupational health and safety legislation in their home country, and that of the country where the project is operating. Professional bodies and insurance arrangements may impose additional safety requirements.

Work in marine environments requires high levels of precaution to guarantee the health and safety of the project participants both in and out of the water. Therefore, one of the items that is included under Rule 10, the project design, is (k), a safety policy. A safety policy is applicable to all maritime archaeological operations, whether they include terrestrial-based shoreline activities, such as walkover low-tide surveys, or include diving that takes place from the shore or from an offshore dive platform. Similar levels of precaution will apply in relation to inland waters. The specific safety requirements will vary with the type of operation and the equipment involved. This section focuses specifically on dive safety.

▲ © AAO. Open bell diving during a research project in the Netherlands North Sea sector. The aims of the project and its location define the type of diving. Open bell diving from a dynamically positioned vessel in the open sea calls for other procedures than a shallow project inshore. Nevertheless, the same principles apply and in each case a diving supervisor should take the lead.

The project dive plan

Rule 28. A safety policy shall be prepared that is adequate to ensure the safety and health of the project team and third parties and that is in conformity with any applicable statutory and professional requirements.

The part of the safety policy that addresses diving is, in effect, established within the project dive plan, and should be formulated before the start of a project. Regardless of whether the project is an assessment, survey, excavation or monitoring activity, if diving is involved, a project dive plan needs to be in place. The plan will be compiled by the person(s) responsible for dive activities for the project, normally the dive supervisor (see *roles and chain of command* and *qualification of personnel*, below).

The project dive plan is a comprehensive document and should include, at the very least, the following sections, which are described below:

- a review of the aims of the project
- activities/working methods that will be undertaken to achieve these aims
- the logistical aspects of the diving operations
- roles and outline of the chain of command
- necessary documentation and record-keeping tasks
- the applicable diving legislation that will be adhered to on the project
- a site-specific risk assessment
- emergency procedures and contacts

As with the project design of any archaeological undertaking, planning is an integral part. In regards to diving operations where technical equipment is operated in different environments, this is of the utmost importance. In order to help formulate the plan and assist in the overall operations of a project, reconnaissance of dive sites and other working areas such as moorings, harbours and marinas where vessels will be operating from, prior to the start of a project, is strongly advised. In addition, visits to emergency treatment facilities in order to establish prior contact is encouraged, especially if the area where the activities are taking place is not normally frequented by divers.

Before work commences on a project, the dive plan should be read by all project participants, who should acknowledge that they understand the document. Emergency procedures should be clear and reviewed with all participants, and the location and operation of first-aid and communication equipment and transport options should be made known.

The aims of the project

The aims of the project should already be clearly stated in the project design (see *Chapter II Project design*). In this introductory section of the dive plan, however, these aims should be briefly revisited with a clear indication of how the diving activities will assist in achieving the project's objectives.

Activities/ working methods

This section of the dive plan should provide a description and the dates and times of the planned diving activities during the project.

Depending on the type of project (assessment, survey, excavation, consolidation or monitoring activities), tasks could vary from simple visual SCUBA diver reconnaissance to the extensive shifting of sediment using a dredge, an airlift or other earthmoving equipment, and the recovery of small artefacts or items of considerable size. This section of the dive plan should clearly state what types of diving will be done and the equipment to be used: for example, SCUBA diving or surface-supply diving, as well as

◄ © MMARP. Dr. Athena Trakadas recording in real-time the diving operations in Bar, Montenegro.
Diving and safety are subject to regulations that may vary from country to country and from organization to organization. The safety instruction for each project should include a risk assessment, a statement of the rules that apply and a definition of roles as well as responsibilities, such as dive-supervisor, time-keeper, standby-diver, tender etc. Safety instructions for mixed teams of professionals and avocationals are a particular challenge. In view of liability and insurance, all qualifications and medical certificates should be documented in the project archive before starting.
During the Montenegrin Maritime Archaeology Research Project (MMARP) in August 2010, diving operations were recorded in real-time by both the project Dive Supervisor, Dr. Athena Trakadas (shown here), and the time keeper. Time keeping was a task that was rotated amongst student participants. The diving for the project took place from Downunder, a 25 m dive boat operated by a local recreational dive shop based in Bar, Montenegro.

the type of breathing gas: air or a specific mixture, diving with dry suits, diving with full-face masks or helmets, diver-to-surface communication, etc.

The choice of an appropriate diving system depends on environmental conditions, accessibility and size of the diving platform and ultimately the type of work to be undertaken. The experience and qualifications of the team should be in accordance with the chosen system.

Increasingly more complex diving systems are becoming popular in recreational diving, particularly enriched air (nitrox), trimix and rebreathers. While for some projects the use of such tech-diving equipment can be appropriate, one must be aware that a diving system which requires the diver's constant attention just to stay safe is not acceptable if any work is to be done. An acceptably safe and sound back-up is hard to organize and if the project involves extensive operations at great depth it is more appropriate to choose a diving system that is well-proven in the offshore industry.

The dive tables that are being followed for the project should be listed here and included in the documentation. The tables most commonly referred to are those formulated by the US Navy, and updated versions of these are available on the internet (as part of the US Navy Diving Manual). Depending on the country of operation or applicable legislation, however, other tables might be required or preferred (see *Applicable Legislation*, below). As a general rule on archaeological projects using SCUBA, decompression diving should be avoided, but it is possible to make allowances for the use of enriched air or NITROX to extend no decompression limits.

In addition to their presentation in the dive plan, specific underwater tasks should be discussed on a regular basis as part of the daily briefings of the project. No diver should undertake a task that is beyond their capability or level of competency, and no diver should be pressured to do a task if uncomfortable. If there are tasks which require a particular skill set, it is recommended that the project provide additional training for this, if possible.

Logistical aspects

This section of the dive plan should provide a description of the location or locations of diving, the facilities from which diving will take place (boats, platforms, shore) and the type of transportation to and from these. The means of getting in and out of the water, such as solid and safe ladders clearly need specific attention. Detailed instructions regarding the operation of equipment and tools should also be described. Dredges and airlifts, for instance, are frequently used on underwater excavations. Their deployment creates specific hazards that should be addressed, in rapport with the diving equipment used. When the lower end of an airlift becomes blocked, it rapidly becomes buoyant and will suddenly rush to the surface if not tethered. No extraneous pieces

© MMARP. A local dive operator, *Scubaquest*, Montenegro, was hired to provide dive support during the Montenegrin Maritime Archaeology Research Project (MMARP) survey of the bays of Maljevik and Bigovica, Montenegro, in August-September 2010. The vessel *Downunder* served as the dive platform for the project, and its crew participated in survey dives and offered valuable information on submerged archaeological sites in southern Montenegro. Here, archaeologists and the *Downunder* crew work together in Maljevik Bay. ▶

of equipment, such as free dangling gauges or secondary breathing sources, should risk getting entangled. If a secondary breathing source gets sucked into a dredge or airlift, the breathing supply will rapidly be emptied. Incidents of this nature have led to fatalities. A means of quickly shutting off the supply to the excavation equipment must be within easy reach of the diver operating it.

A work place, below as well as above water, needs to be kept well-organized and its layout described and understood. Guiding lines, ropes and reference spikes, power-supplies, such as compressed air or water-hoses for the airlift, water-dredge or other tools need to be mapped and all underwater workers should help the dive supervisor and the project director to rationalise the way that equipment lines and hoses are placed on the site to reduce the potential dangers associated with snags.

If working at several sites during the course of a project, each site should be described separately.

Additionally, the working environment (depths, water temperature and conditions, currents, visibility), and weather conditions (temperature, precipitation, winds) should be presented in this section. These will be further addressed in the risk assessment (see *risk assessment*, below), in order to mitigate any hazards these might cause to diving operations.

Roles and chain of command
In order to ensure fulfilment of tasks and a functioning chain of command during a project, specific roles must be assigned during diving operations.

Project director: this person is responsible for the overall running and daily organization of the project and leads the daily briefings. This person is also ultimately responsible for maintaining safety standards, maintaining the chain of command, and ensuring that project participants follow operating procedures.

Dive supervisor (or diving safety officer): this person is a qualified individual responsible for the organization and directs the diving aspects of the project. Prior to the start of the project, the Dive Supervisor conducts reconnaissance of the site, operating facilities and emergency facilities, as well as draws up the project dive plan. They are also responsible for checking diver qualifications and medical qualifications, collating paperwork associated with the diving aspects of the project, and assembling the equipment to be used and the initial safety checks. During diving operations, the dive supervisor is responsible for the health and safety of the divers and leads the safety briefings. The supervisor conducts safety checks on equipment and divers. She or he delineates all other roles of the diving operations and determines if a diver is fit to dive or other persons are able to carry out their roles, and the supervisor can cancel diving. In addition, the dive supervisor can control boat traffic or designate someone to do this.

Diver: this person undertakes a task on a project following the techniques required for the activity at hand. If diving is self-contained, it should be organized following the buddy system, and no diver should be left alone unless a system is used that allows for this, such as diver-to-surface communication. Under certain conditions, especially when heavy equipment is deployed or the work is integrated with ongoing dredging and construction, diver-to-surface communication is an absolute requirement. SCUBA may then not be the right choice of diving system.

Safety/standby diver: during diving operations, this diver is fully kitted up. A safety/standby diver only enters the water in case of emergency to assist divers and/or recover divers.

Roles on a project can be further diversified depending on the dive system used. For example, using surface-supply equipment (SSE) and/or diver-to-surface communication, a *tender* will be used to assist in kitting up the diver and to hold the lines and communicate with the diver throughout the duration of their dive. The tender has no other responsibilities whilst fulfilling this role. In projects where a decompression or treatment chamber is present, a *chamber operator* will also be an assigned role. In addition, some projects might be organized in such a way as to include a *timekeeper* who oversees the dive schedule, records the entry and exit times of divers and their maximum depths, keeps an eye on basic dive operations and may assist the dive supervisor with the direction of boat traffic. These additional roles follow simple diving operations, which are based on the buddy system of diving. In all instances, clarity of communication, language, and agreement upon signals used is important.

The chain of command of the diving operations begins with the dive supervisor, who is the authority regarding safety and procedure. The dive supervisor confers with the project director on the tasks of the project and daily operations. The dive supervisor instructs the divers, safety/ standby diver, chamber operator, timekeeper and tender, and should not dive while fulfilling this role. If present, a tender will serve as the communication link between the dive supervisor (and perhaps project director) and the diver. A timekeeper, if present, will receive instruction from the dive supervisor and then communicate directly with the divers before and after they are in the water.

Documentation and record-keeping

Every aspect of the diving operations needs to be documented as the diving operations record, and this paperwork should be kept separate from other documentation of the project.

Prior to the beginning of the diving operations, the equipment to be used and its status, including last service and approval, need to be recorded. The qualifications of the divers and other relevant personnel also need to be on record (see q*ualification of personnel*, below), as well as the divers' medical paperwork indicating that they are approved for diving and have obtained the necessary first-aid training. The risk assessment, safety procedures and emergency contact information also need to be formulated at this time (see *risk assessment* and *emergency procedures and contacts*, below).

During dive operations, the status of the equipment should be recorded (for example, if repairs and/or replacements have been made). Documentation also includes the records kept in real time of the daily dive operations (kept by the dive supervisor and if present, timekeeper) and the changes made to any procedures. It is also strongly encouraged that divers complete their own log books for their personal documentation. Moreover, it is strongly recommended that divers fill out individual reports after each dive to describe the task that took place. This record not only helps in reconstructing the course of any mishap or miscommunication, and to gauge the project's progress, it will also support and reinforce the archaeological documentation considerably. Records also need to be kept by the dive supervisor of any injuries or illnesses that occur during a project.

Applicable legislation

The legislation and codes of practice that regulate diving operations differ in each country. The relevant legislation should be understood by the dive supervisor and be available to all project participants. Legislation does not only influence diving as such, it also qualifies responsibilities, liabilities and the way in which insurance can or should be organized. Archaeological operations are more than just diving. Liability waivers that are sometimes used in outdoor sports, including diving, are often illegal as soon as specific tasks are assigned. If there is no applicable legislation in the country of operation, the dive supervisor should select a set of regulations to follow, and agree upon it with the project director, prior to the project's commencement.

Examples of some of the most widely-used regulations include the British Health and Safety and Diving at Work Regulations issued by HSE (Health, Safety and Environment), the Norwegian Diving Regulations, and the Australian Occupational Health & Safety Regulation. For diving at work in a commercial or professional setting, these outline the legal responsibilities, minimum number of participants on a dive team, the health requirements of crew

SAFE WORK METHOD STATEMENT (SWMS)

Organisation Details			
Organisation Name:		**Contact Name:**	
ABN:		**Contact Position:**	
Address:		**Contact Phone No.:**	

Project Details			
Project:		**Area:**	
Activity:		**Client:**	
SWMS prepared by:	**Name** **Signature** **Date**	**This SWMS makes mandatory:**	• The use of UV protection, including long pants, long sleeve shirts, wide brim sun hat and sunscreen while working under exposed sunlight; • Seat belts to be worn when operating all vehicles; • Prohibition of alcohol/non-prescription drug use at work site; •

Hazard identification and risk assessment:	• **Class 1 (high risk):** the hazard has the potential to kill or disable permanently; • **Class 2 (medium risk):** the hazard has the potential to cause serious injury or illness, which will temporarily cause a disability; • **Class 3 (low risk):** the hazard has the potential to cause a minor injury which will not cause a disability.
Resources/Trades involved:	
Plant and equipment used:	
Maintenance checks:	

Occupational Health and Safety or Environmental Legislation:	•	**Codes or Standards Applicable to the Works:**	•

Safe Work Methods Statement (SWMS) 1

▲ © Comber Consultants. Examples of Risk Assessment used at Comber Consultants, Australia.

members, required diver qualifications and diver's rights. Legislation might also specify what type of equipment can be used. In many countries the work that archaeologists perform under water is subject to the same regulations as work that is carried out for other reasons. In other countries, there are specific regulations or exemptions for diving at work with a scientific purpose.

The British Diving at Work Regulations 1997, for instance, include exemptions and codes of practice specific to scientific and archaeological diving projects. A code of practice is a set of recommended or preferred processes, actions or organizational structures to be applied in a given setting. These can provide practical information and outline safety procedures for team welfare. They are general as a rule, but can serve as a guideline to a project and can be annotated to fit a project more accurately. Codes of practice are also useful for projects with mixed teams, in which people with professional and recreational qualifications operate in tandem (discussed in *qualification of personnel*, below).

Risk assessment

Once the project's activities and logistics have been described in the project dive plan, then the principle hazards of these and of working in a marine environment, and the mitigation measures taken to avoid them, should be outlined. This assessment helps to identify and assess hazards systematically, to include control measures in the planning stage and to communicate safety information to all project members.

The risk assessment is probably best set out both in table format and in expanded descriptions. In table format, the hazards can be listed first, the likelihood of the incident occurring, the risks from those hazards described, the severity of the resulting injuries, the persons affected, and the mitigating measures. In some instances, the level of risk can be designated using a numerical scale (1 being the lowest risk and 5 being the highest risk, for example). It is considered best practice for diving supervisors to prepare a risk assessment for each part of the diving operation.

Examples of hazards usually included in a risk assessment are:

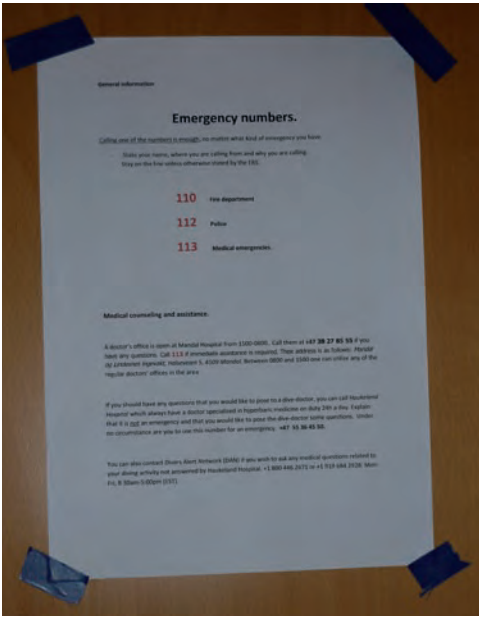
- Environment: weather conditions, currents, tides, winds, cold, heat, marine life, working in contaminated waters;
- Physical exertion: lifting of equipment, swimming, associated outdoor activities, general fatigue and lack of concentration;
- Dive equipment: malfunctions, use of compressor, communication lines, damaged dive equipment;
- Boat safety: ships in the area, transfer between vessels, divers in water around boats;
- Diving-related events: the character of the work such as surveying and sampling; the wielding of tools; sharp or rusted metal, entrapment due to collapsing structures or sediments, lines or equipment; lost diver; diver not fit to dive (fitness of diver); nitrogen narcosis; decompression illness.

▼ © Wessex Archaeology. Diver Supervision on board a research vessel of Wessex Archaeology, United Kingdom.
During the execution of the project, the diving safety officer is responsible for the health and safety of the divers, leads the safety briefings, conducts safety checks on equipment and divers.

The assessment of hazards, their risks, and mitigation procedures should be addressed in the orientation briefing at the start of the project; additionally, specific safety briefings should be given on a daily basis, before work commences. Once the project is under way, the risk assessment should be reviewed frequently because as conditions change, different control measures may be triggered.

Emergency procedures and contacts

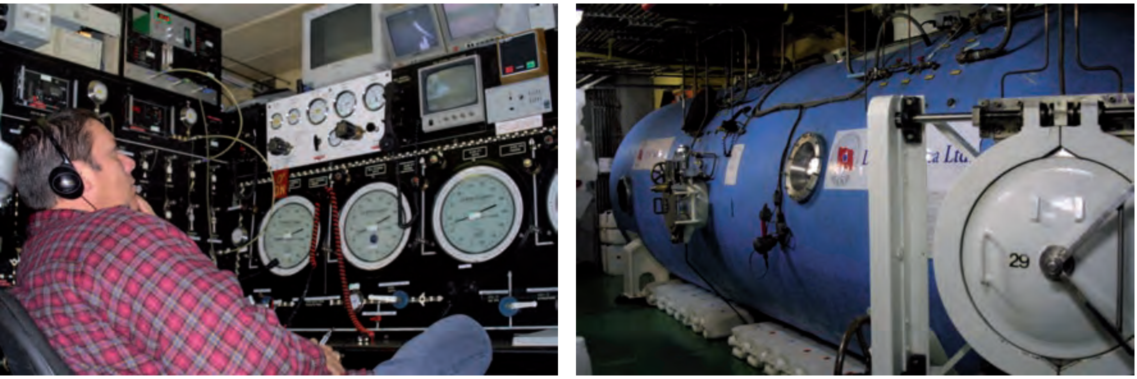
Following closely upon the mitigating measures set out in the risk assessment, the emergency procedures section details what should happen in case of an accident or illness and the chain of command in these instances. This includes prehospital care relating to different scenarios (such as cuts, extreme seasickness, or decompression illness, for example). For clarity, the major or most serious life-threatening scenarios (such as an unconscious diver, burst lung or suspected decompression illness) and their treatment are best laid out in a flow chart. These scenarios should be reviewed prior to the beginning of diving operations.



▲ © T. Maarleveld. List of emergency procedures on site. Without instruction not all project participants may be aware of the local emergency procedures and contacts. As these instructions will not be memorized it is a very good idea to simply place a list of emergency numbers in appropriate places on site, at base, in the kitchen or the mess. Contacts for local doctors and contacts for individual project participants and their relatives can be added.

To initiate emergency procedures, contact information of emergency transport services, hospitals, and decompression/treatment chambers should be listed. These should include the contacts for a search and rescue helicopter, the police, coastguard, fireservice or military, as appropriate. For best practice, all project participants should know where this contact information is kept on site every day. All medical paperwork of project participants should be on site during the diving operations, so that pre-existing conditions and personal contact information are known to emergency personnel.

Ideally, all crew members should be qualified first-aiders or should be certified in basic first-aid treatment as well as the operation of communication equipment. If not everyone is trained in these,



▲ ©T. Maarleveld / Smit Internationale. Diving supervisor and chamber operator.
In saturation diving that allows divers to work at great depth for long periods of time the roles of diving supervisor, chamber operator and others are very strictly reparted.

however, those that are should be identified. Information in the emergency procedures section should also identify the locations of first-aid kit(s), O_2 kits, and communication equipment (radios, walkie-talkies, mobile phones) and their operation should be demonstrated prior to the beginning of diving operations.

Qualification of personnel

Participants on a maritime archaeological project will have to be qualified and competent in different skills and professional ethics and demonstrate that they have knowledge of the tasks to be undertaken (see *Rules 22 & 23* in *Chapter VII Competence and qualifications*). These skills are varied, and can include historical expertise, technical knowledge of equipment used during diving operations, or first-aid care.

The minimum qualifications for an archaeologist to work on a project are usually set by the relevant authority overseeing the project. These might include an academic degree or similar certification, practical experience, demonstrated research in the chosen field or area of speciality, and knowledge of the historical period or archaeological site under investigation. The person overseeing the diving operations and divers participating on the project will also have to have qualifications accepted by the relevant authority overseeing the diving and safety aspects of the project. At a minimum, the dive supervisor should have obtained an elevated certification from a recognized dive training institution.

Different organizations exist world-wide. For SCUBA operations, the qualifications of the World Underwater Federation, CMAS, are accepted in several countries. For professionals working in the recreational diving industry, the instructor certificates from the Professional Association of Diving Instructors, PADI, are a common norm. However, in many countries where diving at work is regulated, qualifications need to be obtained from a training institution that is recognized for diving at work, for instance a school that is recognized by the International Diving Schools Association, IDSA. Specific first-aid or paramedic training is often included.

Divers in the project should also have obtained at least a primary level of certification from such an institution. If no relevant authorities addressing diving issues or such regulation exist in the country of operation, acceptable or comparable qualifications will have to be determined by the overseer of the project. These definitions are explained further in *Chapter VII Competence and qualifications*. It is important that all participants are determined to have the appropriate qualifications prior to the start of the project; not only is this best practice, but in many cases not following these guidelines can have legal ramifications (see *applicable legislation*, above).

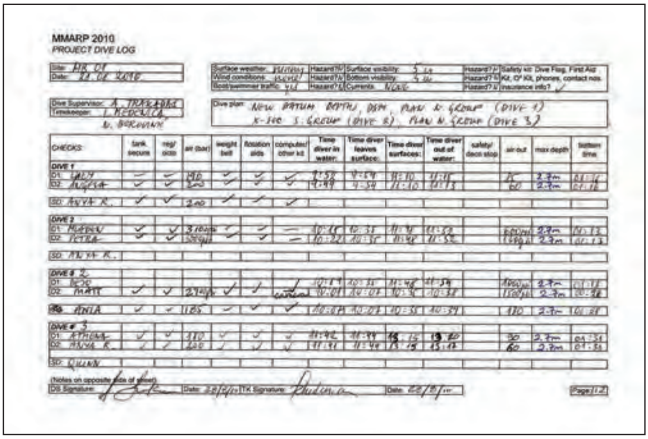
Prior to the beginning of a project, all qualifications and competences should be verified.

Academic degrees, diving and boat operator licences and first-aid certifications are easily checked with the issuing institutions.

Mixed diving teams

As noted in *Chapter VII Competence and qualifications*, it is very likely that some projects will actively seek to include the participation of non-archaeologists ('avocationals') in order to encourage local involvement in underwater heritage management, capacity building, or provide technical training to interested parties. In development-led archaeology this may not be appropriate, especially not if archaeological services are tendered out, or where developers pay for specified archaeological research. Professional

▶ © MMARP. A completed diving operations record from the Montenegrin Maritime Archaeology Research Project (MMARP), documenting the dives and tasks that took place on MR 01 site on 28 August 2010, in Maljevik Bay, Montenegro.



relationships should then be the norm. However, in exploratory archaeology and research projects that are funded independently, there can be great advantages in including interested avocationals.

Avocationals usually do not work in the field of archaeology, but choose to explore or to participate in archaeological work in their free time. In fact, avocationals often are the first to identify sites and report them. They may explore areas where archaeologists who are professionally employed will not have looked. If this leads to further assessment and research, it is often a matter of courtesy to include the interested discoverer in the project. Avocationals are also available to participate in other ways. This can be very fortunate, as in archaeological projects one needs many skills besides strict scientific expertise and a variety of skills and qualifications are available in the non-professional community.

Sometimes avocationals have the same diving qualifications as the archaeologists. It is then relatively straight-forward to develop a consistent safety policy, along the lines described above, that will cover the whole operation. It is a bit more complicated if the qualifications vary and are different for the volunteers and those who are employed professionally, especially where legal requirements differ for diving at work and recreational diving. Under some codes of practice (see *applicable legislation*, above) it is then still possible to integrate the team. As always, specific tasks, such as wielding heavy equipment, being supervisor or standby diver, will only be allotted to those who have the competence and necessary qualifications for that task.

In other instances, regulations can be prohibitive for integration of those 'at work' and those who one would like to integrate for their recreation. It is then often possible to have two separate procedures for two separate teams, operating under different regulations and different chains of command, but, for instance, still referring to the same safety backup. Preparing a safety policy for such a situation is a somewhat more daunting task, in which employer responsibility, liability and insurance need to get as much extra attention as the division of tasks and the avoidance of interference of one team with the other.

Mixed-team diving can thus be complicated due to different organizational embedding of the participants, and different levels of expertise or standards of training received by team members in a country with varying requirements for recreational and professional divers. In some settings, this might even be further complicated if the project has a team comprised of international members. Nevertheless, international cooperation is very desirable (see *Chapter I, Rule 8),* and so is the involvement of local and recreational divers (*Chapter XIV*).

The inclusion and basic requirements of non-archaeologists will vary from country to country, and be determined by the regulating authority or those overseeing the project or dive operations. In order for the non-archaeologists to be included in a form of 'responsible participation', their skills and level of technical expertise must be taken into consideration. This is best facilitated by establishing their participation in the project dive plan, which should be specific to mixed teams. In all instances, communication procedures and agreement upon signals used should be clear, and operating and safety standards must be maintained at the same level for all participants. In some instances, particular codes of practice can offer a basic set of standards that guides the participants or projects with mixed teams (see a*pplicable legislation*).

Record keeping and logs

Records of the project diving operations are essential for documenting the flow of activities, and in many countries are also required by law. Records are necessary to demonstrate to the relevant overseeing authority that the technical requirements, as well as the health and safety concerns of the crew, were met during the course of the project. All paperwork associated with diving, the diving operations record, should be kept separate from other paperwork related to the project.

The records can be separated into two types: those collated *prior* to and those filled out *during* dive operations. The records that should be collated prior to the start of diving operations include:

- applicable legislation
- procedures, dive plan and risk assessment
- copies of qualifications of divers (diving and first-aid certifications)
- medical records of divers
- list of diving and associated technical equipment to be used on the project
- list of first-aid equipment

Records that should be kept in 'real time', whilst the project is taking place, include:

- timekeeping logs (dive times, maximum depths, surface intervals)
- equipment safety logs (if there is a problem with equipment, and the resolution)
- illness or injury records (what happened, to whom, and the treatment)
- daily confirmation check of diving equipment and safety equipment
- individual diver logs
- change record (a document that outlines the changes made to any part of the diving plan and operations during the course of the project)

These records should initially be assembled by the dive supervisor of the project (see *roles and chain of command*, above). However, the 'real time' records, such as the timekeeping log, can also be filled out by the timekeeper, and the individual diver logs should be completed by the divers and signed off by the dive supervisor or other responsible authority.

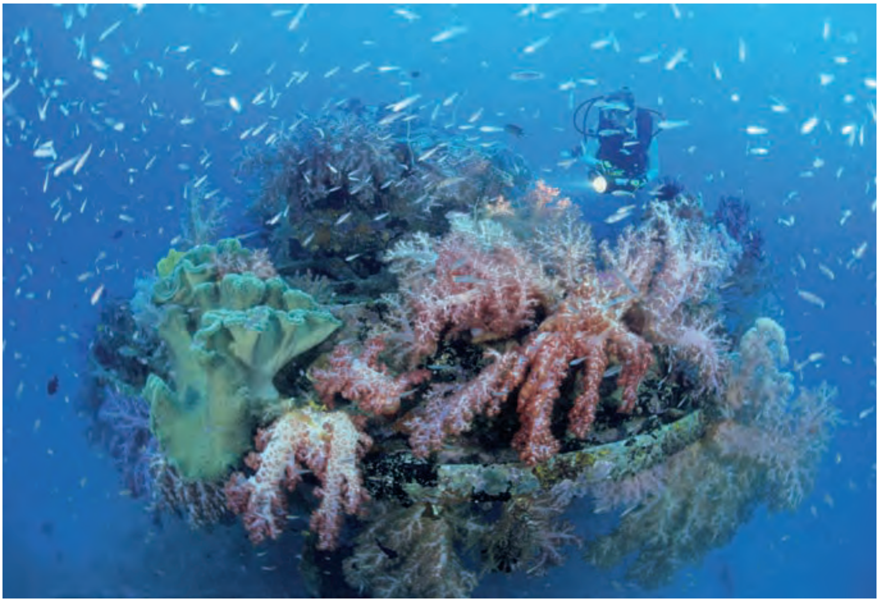
The purpose of these records is not to complicate diving operations; rather, they are intended to provide a transparent and easy-to-follow record of operations that is accessible to project participants, directors, and supervisory authorities.

The diving operations record should as a minimum include:

- The name of the responsible organization or diving contractor
- The date or dates
- The location
- The nature of the diving operation
- The name of the diving platform or vessel if applicable
- The risk assessment
- The procedures followed in the course of the diving operation including reference to the decompression tables used
- Arrangements for emergency support (including contact-details by phone or VHF)
- The name of the diving supervisor
- The names of on-site first-aid staff
- The names of all other persons engaged in the diving operation and their respective roles
- The type of breathing apparatus and mixture used
- A list of on-site first-aid equipment
- Particulars on sea state, visibility, temperature and weather
- Confirmation of daily check of safety and first-aid equipment
- Confirmation that diving equipment has been checked on proper maintenance and proper functioning immediately prior to each individual dive
- The time that each individual diver leaves the surface, starts to ascend and reaches the surface
- The maximum depth of each individual dive
- Any defects that are discovered in any plant or equipment used in the diving operations.
- Any decompression sickness, other illness, discomfort or injury suffered by any of the divers. Particulars of any emergency which occurred during the diving operation and any action taken
- Any other factors relevant to the safety or health of persons engaged in the operation

It is highly advisable to use standardized forms, including checklists, for the diving operations record.

XI. Environment



▲ © M. Spencer. Coral encrusted stern of a shipwreck of World War II off Madang, Papa New Guinea.
Time has changed the wreck into a large artificial reef, providing home for an abundance of marine life and many species of scorpion fish, which can be found camouflaged against the hulls.

One of the pillars of the management of underwater cultural heritage is the integrationtion of heritage protection in spatial planning and in marine policies. This integration ensures that the cultural environment is respected whenever developments with a great impact take place. Conversely, archaeological policies should also respect other interests. For these reasons, the Rules concerning activities directed at underwater cultural heritage explicitly mention respect for the environment in any action that is undertaken.

Environmental policy

Rule 29. An environmental policy shall be prepared that is adequate to ensure that the seabed and marine life are not unduly disturbed.

Underwater archaeologists, like others, must comply with the existing regulations of the country in questions on archaeology and protection of the environment. Their operations must also respect the environment in which they operate. To ensure they do so, *Rule 10 (l)* states that any Project design for an activity directed at underwater cultural heritage, should include an environmental policy. This is reiterated in *Rule 29*. It does not, however, give detailed instructions on how to do this. It just recalls the reasons, and specifically refers to '*the seabed*' and to '*marine life*', neither of which should be '*unduly disturbed*'. 'Unduly' is an important qualifier. It stresses the importance of balancing interests with due consideration given to their relative importance. Of course, aspects other than the seabed or marine life should also be respected. *Rule 29* also applies when work is to be carried out in inland waters, and, for instance, to birdlife if the project is carried out in a sensitive wetland area.

Balancing policies

Integration and balancing of different interests is a characteristic trait of environmental policies. Consciousness and awareness of the different aspects are central to their success. Policies that address the protection of marine life or the protection of underwater cultural heritage can be harmonized. This is further confirmed by the observation that it is easier to apply a management programme for an archaeological site in areas that have been declared protected areas, natural sanctuaries, or reef parks, than it is to do so elsewhere. In any case, environmental policies should take the presence of archaeological sites into account and cultural heritage management should integrate environmental policies.

For natural and heritage protection to agree, the issues central to the different objectives need to be understood. It takes different specialists to assess relative significance in the field of monuments and sites, and in the field of nature conservation. It takes different specialists to assess the seriousness of potential impact on cultural and natural heritage. It is only through mutual respect that sensible policies can be developed and sensible decisions can be made.

▲ © A.Vanzo. Shipwreck in the Golf of Sagone, France. The site has become a haven for marine life, attracting leisure divers as well as fishermen to its surroundings.

Marine life, archaeological sites, site management and environmental policies

Underwater archaeological sites as specific biotopes

Underwater cultural heritage sites tend to automatically develop into a sensitive ecological niche, within the wider area. Many algae and sessile animals need hard substrate to hold onto. They will colonize 'foreign bodies' and foreign materials extensively, including artefacts. In turn, this plant and animal cover will attract sedentary fish and predators that stand higher in the food chain. Isolated spots of foreign materials at the bottom surface therefore automatically tend to create a rich biotope. It is also for this reason that many initiatives around the world seek to intensify bioproduction by creating artificial reefs. Car tyres have been dumped for the purpose and worn out ship's hulks have been scuttled. Sometimes such efforts have been integrated with the creation of an underwater park for recreational divers; sometimes the purpose is purely ecological, although mostly with the expectation of economic spin-off for fisheries.

The described process does not apply for sites that are deeply buried, but it does for sites that occur at the bottom surface of a body of water. Their specific ecological qualities derive from the fact that their substance is alien to the environment. This brings positive effects in that it allows for colonising by other species and creating biotopes that allow more biodiversity. This may be considered of great significance for conservation of nature in a wider area. As in many 'life cycles', these positive effects may be of a temporary nature. Wooden structures, for instance, are attacked by animals and wood-eating micro-organisms. Mechanical resistance decreases and eventually the structures collapse. Although the biotopical advantages may disappear when what finally remains is covered in sand and silt, such processes are not in themselves negative for the environment. This may be different with the degradation of other materials that may have a negative impact on the environment.

Heritage with a negative impact on the environment

Stones and ceramics are relatively inert and harmless, but other materials are not. Metal ships from the last century have formed wreck sites of huge size. Iron or steel is their main component and in the long run that is not resistant to (sea) water. Depending on their specific character, such wrecks will tend to continuously produce iron oxides. This is not generally considered a menace for the environment. Heavy metals and alloys that are also present are another matter. Sometimes their corrosion will come to a balanced standstill when a protective layer has formed. But if several metals are present, electrolytic processes will continue to produce materials in solution that are called minerals if they have a positive effect on bio production, and contaminants if their effect is assessed negatively.

For the sake of cultural heritage protection, sacrificial anodes have occasionally been mounted to stop corrosion processes. In such cases, the argument for cultural significance had better be very strong, because environmentally speaking, it is just replacing one contaminant with another. Management strategies that isolate archaeological materials from the environment by covering or packing them will not suffer from such critique, but will on the other hand allow for a lesser experience during recreational visits.

Many wrecks are likely to induce oil spills that are certainly hazardous. But due to gradual corrosion of tanks such a spill may also occur after many years. The wreck in question may however still be considered significant heritage. An example of a high-risk wreck is the *USS Neosho*, which lies off the Great Barrier Reef, off Australia, and still holds four million gallons of fuel oil.

▶ © C. Lambert. *USS Mississinewa* sunk in 1944, Federated States of Micronesia.
One example of a historic wreck posing a high-risk for the environment is the wreck of the *USS Mississinewa*, an oil tanker originally supposed to supply aviation fuel and heavy marine fuel oil to the US Pacific Fleet anchored off Ulithi Atoll in the Federated States of Micronesia. On 20 November 1944 it had been attacked by a Japanese torpedo and sank, hitting the seabed at a depth of 40 m of water. A tropical storm disturbed the 57-year old wreck in July 2001, causing the oil cargo to spill. It polluted the area and was not contained until more than a month later releasing in the meantime between 68,000 to 91,000 litres of oil. This incident led to the establishment of the regional PACPOL programme. The aims of the PACPOL are to prevent or minimise damage to marine and coastal environments and resources as a result of marine spills from World War II wrecks and to ensure that any action taken will respect the character of these sites as war memorials and grave sites.

An even more problematic issue is formed by the presence of containers with toxic or explosive content. It is obvious that such substances have been transported in ever greater quantities since early times and at least since the industrial revolution. Unfortunately, they have also been lost at sea. Even worse, they have been dumped in great quantities in the context of armed conflict or clearance actions that followed. Such objects evidently pose a serious problem, the more so since they are encountered by fishermen and recreationists. They may be intertwined with other objects or may be part of an unfortunate, but often important cultural heritage. In any case, they do not contribute to a pleasant experience when encountered in isolation or as part of a heritage site. They are environmentally dangerous if touched or unstable. Archaeologists that are charged with heritage assessment and the preparation of heritage decisions are constantly reminded of this, both in relation to impact studies, to inventory and to regular management.

Nevertheless, heavy metals and toxic substances are not just characteristic of relatively modern wrecks. Cargoes of ingots, raw materials and chemical ingredients are as old as seafaring itself. Such cargoes would have been processed had they arrived at their final destination. It is for this reason that they offer exceptional opportunities for research. There is no other source that allows for any quantitative analysis of these materials, and consequently, some such cargo deposits are considered to be among the

- Archaeological objects are alien to the natural environment.
- Archaeological sites are often special biotopes.
- Environmentally suspect substances may present a hazard, but can also be important for research.

most significant underwater cultural heritage that we know of. Such sites should therefore be managed and addressed in conformity with environmental policies, but also with due respect to the concerned heritage.

Archaeological interventions and the environment

Site formation processes are such that over time a site achieves a state of relative stability and equilibrium. More often than not, this stabilization process is interrupted by the event that leads to its discovery. That applies both to the physical and chemical condition of the artefacts it contains and to the resilience of the local ecosystem. The ecosystem derives its strength from the presence of its flora and fauna. Removing growth may disrupt this fragile balance. For proper assessment of the archaeological significance, this may nevertheless be necessary. Stabilization and consolidation measures will equally impact both the seabed and marine life. For excavations, this is even more evident.

The environmental policy that is put in place to ensure that the seabed and marine life are not unduly disturbed, should balance the scale of the operation with the resilience of the ecosystem in question. Generally, this can easily be done. Archaeological interventions are small scale as compared to many of the impacts an ecosystem stands to survive. They may also be small scale as compared to the spatial extent of the specific biotope. On the other hand, there may be situations in which the ecosystem is already under great stress, and in which it should not be disturbed during critical phases of breeding or blooming. Such seasonal phases can easily be avoided to diminish negative impact. This example shows that in integrating an environmental policy in the project design for an archaeological intervention, local environmental and ecological knowledge is essential.

Other aspects of the policy are general. One should act in compliance with the laws and rules governing environmental issues of the location, and one should

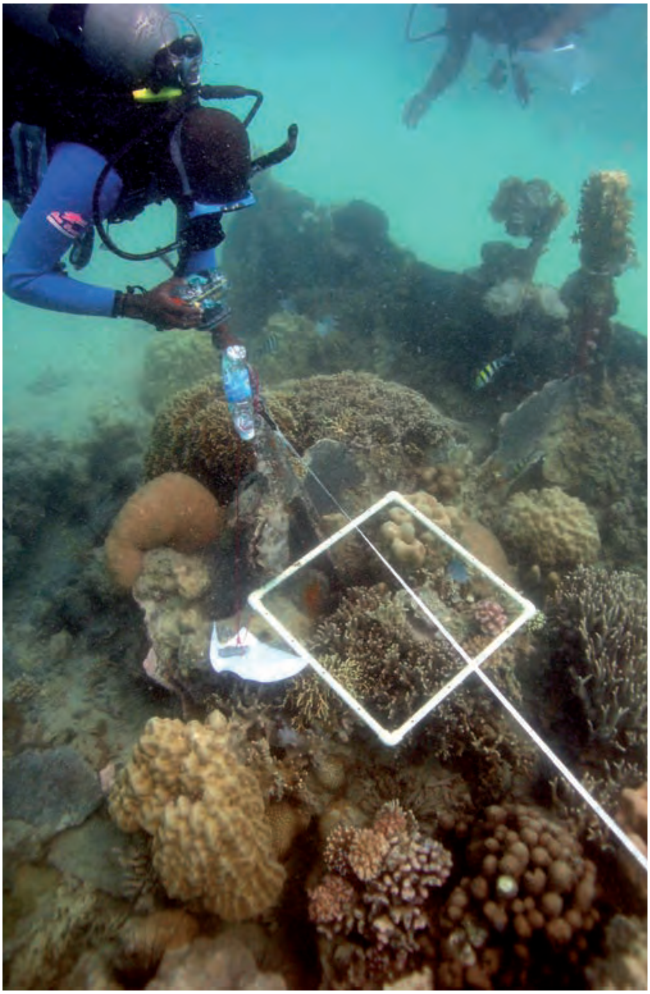
▶ © G. Adams. *Fujikawa Maru, Chuuk Lagoon,* Federated Sates of Micronesia.

handle equipment, engines and fuel as well as food, garbage and the like in the same responsible way as one would do at home. No litter or waste should be discarded from vessels into the sea, including cigarettes, tissues and paper towels, bottles, cans and batteries. Ashtrays and rubbish bins must be provided on board for sorting waste. This also applies to biodegradable waste, especially leftover food. Animals must not be fed either directly or indirectly. Waste collection, management and disposal are compulsory.

Such rules and policies apply for the whole du-ration of the project. They will not extend beyond the scope of the project design.

A different situation occurs if the intervention aims to facilitate access to the site. Impact is then not only a one-off, from which site and ecosystem can recover, but it will be sustained over longer periods of time. The project therefore needs to take the consequences of an intensified human presence into consideration. Integrated site management addresses whether the ecosystem can bear this.

In all cases, the human factor is the key. If one behaves responsibly, impacts are significantly reduced. In contrast, if this aspect is neglected, the impact can be considerable. Underwater archaeologists must be responsible diver-scientists who respect the environment in which they operate. Site workers must be aware of any specific or fragile areas and these should, if necessary, be clearly indicated. If operations include many people, the environmental policy should formulate clear directives to which all the team members must subscribe. This can include, for example, the commitment not to waste fresh water, which is a major issue in many places, including areas of scarcity. Water should be used sparingly and wisely. Rinsing sieves and cleaning objects can use huge amounts. Recycling and treatment of waste water should be considered before the water is released into the environment. Likewise, domestic use of water for individual needs such as washing and the toilet must be kept in check. Boats and equipment should be rinsed with water management in mind.



◀ © B. Jeffery. The *Great Northern* shipwreck, Zanzibar, Tanzania. This shipwreck referred to as the *Great Northern* shipwreck off Zanzibar (Tanzania) was scientifically investigated. During the research work the corals were carefully preserved from destruction.

▶ © B. Jeffery. The *Dock Boat* shipwreck, Chuuk Lagoon, Federated Sates of Micronesia. Underwater archaeological heritage is greatly exposed to physical-mechanical threats such as erosion or deterioration caused by dredging, fishing, and anchoring. This deterioration can equally be due to tidal movementsts or changes in water circulation. Many of the threats to archaeological sites pose also threats to the natural environment of such sites. This concerns especially construction projects and pollution issues. A site management plan should always look at a site as a whole and not only consider one side of its nature.
This shipwreck referred to as the *Dock Boat* (Chuuk Lagoon) was the object of scientific investigation during which great effort was undertaken to maintain the coral in its pristine state, in addition to documenting the amount of benthos covering the shipwreck.

Site management and the environment

Long-term management of an archaeological site should take account of environmental issues, at least as much as a single intervention would. Human presence will be a key factor in sustainable development and protection. This is true both for the cultural heritage at the underwater site and for the ecosystem. The protection of fauna and flora and their environment is necessary, as they are important to human life. Protection means in this regard protecting habitats and interchanges rather than preserving the life of every entity.

Visitor impact

The degree of attention paid to environmental issues in a site management plan depends on the stability of the situation and on the number of expected visitors. Visitors should leave no trace of their presence, neither in the short- nor long-term. This certainly also applies to diving, during which nothing should be broken, overturned or uncovered, either voluntarily or involuntarily.

Accordingly, certain forms of behaviour such as scraping the bottom with a control valve or monitoring instrument, giving blows with swim fins, bumping or colliding with obstacles etc. are not admissible. Similarly, trampling should be avoided,

◀ B. Jeffery. A mooring block dropped onto the Kitsugawa Maru, causing considerable damage, Guam United States. While this poses a threat to the archaeological site, the navigational or environmental hazard of a wreck should be taken into account in its protection. In the illustrated case a site management plan should try to find a non disturbing solution for flagging the archaeological site to passing ships.

particularly in areas with coral, grasses and algae. Stones must not be turned over. Finally, the divers, including scientist-divers, must collect all waste they come across while diving. On-site facilities must be proportional to the number of visitors. This is in no way different to the management of sites on land.

Boat and vehicle use

Site installations and the boats used should not cause the erosion or degradation of beaches, shorelines, wharves or working areas. The site, its accessibility and its enjoyment must not be detrimental to the immediate environment. Vehicles' use should also not contribute to weakening the substrate, as for instance with regards to coral, cliffs, and slopes. These are, of course, aspects that need to be integrated in the management plan. Other users in the area must not be exposed to any danger incurred from vehicles. The site can be provided with marked access routes avoiding particularly sensitive areas. These can be explicitly signposted to avoid degradation. It is advisable to involve marine biologists in the management process in order to conduct diagnostic assessments and monitoring.

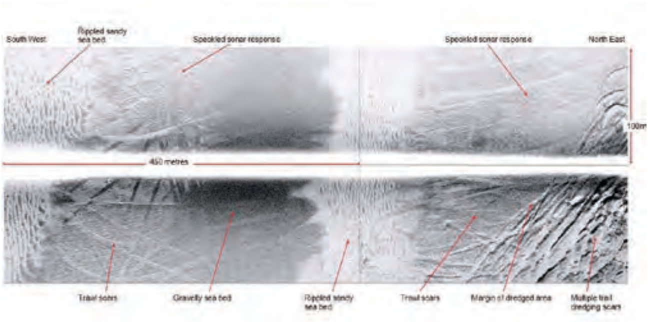
Boats, working and surface platforms must have fixed moorings, so that regular recasting of anchors is avoided. Even in sandy areas anchors have quite considerable impact, whereas mooring in sea grass or seaweed beds may destroy these. Of course one would not want to cast anchors on archaeological remains.

Introduction of species

In some areas, particular care must be taken to avoid the introduction or spread of invasive species. The seaweed *Caulerpa taxifolia*, though beautiful, is considered a disaster outside its original habitat. The same is true for several bivalve species, crustaceans and fish. Although ensuing ecological problems may be extensive, and although they are important in marine environmental policies that deal with the movement of ships and their operators, they are not typical for the management of archaeological sites. Let us not – although we could – count the visiting humans under this kind of invasive species. Public enjoyment is after all an important reason to devise a site management plan in the first place.

The impact of offshore activities and fishing on underwater cultural heritage

Discussions on the environmental impact of offshore operations, as for instance, drilling for oil-wells, pipe- or cable- laying, date way back. Impact studies and mitigation have been identified as the most adequate answer to the environmental impact of offshore operations. These impact studies address the potential presence of archaeological sites and heritage of significance with the same logic as other environmental factors. Although there is certainly room for improvement, this approach works



Line 19a. High resolution side scan sonar record of the sea bed immediately to the west of the Hastings Shingle Bank licence area

relatively well for heritage located at the bottom-surface, while deeply buried cultural heritage is difficult to detect and can only be predicted. Nevertheless, these development projects at sea and the associated impact studies have resulted in major development-led research projects and it is a great challenge for archaeologists to make the most of this development-led research, also in relation to the construction of offshore islands and the dredging for aggregates that make landfills and reclamation possible.

Fisheries are yet another matter. In contrast to offshore development projects, their impact is not negotiated on a project-to-project basis but general policies have and can be developed. In the past, the impact of fishing on the sea-bottom was not recognized as a problem. Ships engaging in seabed-impacting fishing used to be wind-propelled or had limited engine power, while larger industrial factory ships all use so-called benthic techniques, catching fish in the water column, rather than at the sea-bottom. With the increase in engine power, shallow water trawlers with ground-tackle have upgraded their equipment to 4000 hp and even double this in more specialized instances. The severe impact of this development has made it a major concern for environmentalists. As a consequence, many countries have devised policies to ban these fisheries, or limit them to less powerful ships. The fishing techniques themselves have also changed. Ground tackle that literally 'ploughs' through the bottom-surface with great energy and force is being gradually out-phased in favour of tackle of a more hovering kind. The main driving force is certainly to economise on fuel,

◄ © CEMEX UK Marine Ltd, Hanson Aggregates Marine Ltd & United Marine Dredging Ltd. Scars made by bottom trawling shown by a high resolution side scan sonar record of the sea bed immediately to the west of the Hastings Shingle Bank licence area, United Kingdom.
Sandy bottoms where bottom trawling is permitted show the impact and scars of this activity that impacts all cultural heritage on the bottom surface. The scars frequently extend beyond the fishing zones. The scars in the right corner derive from dredging. This image was taken in the framework of the detailed Environmental Impact Assessment for a marine aggregates extraction project in the UK. Marine aggregates play an important part in the provision of high-quality raw materials for both the construction industry and for coastal protection. In the UK permissions for aggregate dredging are given for 15 years only after a detailed Environmental Impact Assessment and stakeholder consultation process with 5 yearly reviews. Although this activity is strictly controlled, and relates to only a very small area of seabed, concerns have been raised that removal of dredged material may impact on environmental resources of conservation and economic significance.

▶ © C. Beltrame. The Mercurio shipwreck, a brig sunk in the 1812 during the battle of Grado. Discovered and damaged by fishing trawling activities. The impact of the fishing trawling activity on the sea floor of the Italian coasts of the North Adriatic sea is particularly devastating. It has been calculated that from the introduction of the fishing ships with engine every square meter of the sea bottom has been covered at least three times. The impact of the fishing activity on the shipwrecks is similar to the impact of the agriculture on the land archaeological sites. The "rapido" and the "turbossofiante" are the tools used by the Adriatic fishing fleets. The first one is composed of four rectangular metal boxes with iron teeth on the bottom which are the entrance of the nets. These boxes are towed with chains and they drag over the sea floor impacting the sand for at least some centimeters deep. They are able to damage the obstacles and they are able to move heavy objects.

but the reduction of impact on the sea-bottom is a welcome side effect.

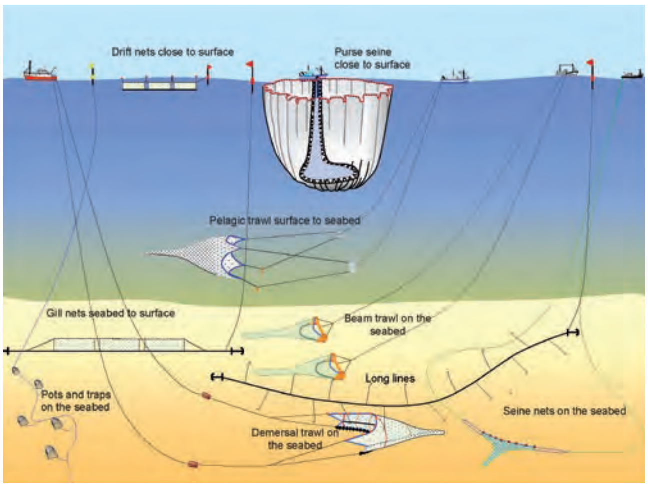
So far, concern about the impact of fisheries has focused on the ecosystem and neglected the underwater cultural heritage as illustrated by the UN General Assembly Resolution 61/105 of 8 December 2006 on sustainable fisheries.

The discussion on the impact of fisheries in the context of underwater cultural heritage has, however, begun. This crucial debate is marked by assumptions. Moreover, it is often diverted, leading at times even to a misuse of the threats posed by fisheries as an excuse for even more destructive activities. These complications are not very helpful for putting the real impact of fisheries into perspective.

Large-scale industrial fishing techniques are benthic and do not affect underwater cultural heritage. Stationary fishing techniques are not very intrusive either. It is, however, undeniable that fisheries using ground tackle have an impact on the sea-bed, all bottom life and by extension on those archaeological phenomena that occur right at the sea-bottom surface. Apart from the side effect of important discoveries through trawlers catching artefacts in their nets or by losing their nets after collision with a site, ground tackle has had effects on archaeological sites that have become ever more detrimental with increased engine power.

Litter deriving from fishing has systematically affected the bottom of large tracts of shallow seas and the heritage located there. Lost fish tackle, including hooks and small anchors, dating from all periods subsequent to the first formation of the site, are a standard feature of all archaeological sites at sea. Today's durable synthetic netting materials, which are not necessarily a sign of trawling, litter the sea bottom and tend to collect especially around surface irregularities such as archaeological sites at the bottom surface.

Most fisheries however, no longer use ground tackle at all. And for those that do, destroying archaeological sites is not the result of responsible and informed economic practice but rather due to negligence or bad information. Responsible local fishermen with detailed knowledge of sea bottom conditions try to avoid direct contact with sites that destroy their equipment as ground-tackle gear is expensive and sustains their livelihood. These fishermen will map with utmost accuracy anomalous bottom features such as archaeological sites or offshore installations but nonetheless trawl as closely to them as possible because they feature a different and richer marine life than elsewhere. Fishermen using more stationary non-intrusive tackle will even more purposefully seek out hotspots of stationary fish and bottom crawlers.



◀ © Seafish. Graphic of fishing gears in the water column. Ground trawling is a major concern for the preservation of submerged archaeological sites and the environment. Trawler now increasingly venture into deep waters and destroy the seabed with their heavy nets and wheels dragging along the seabed. Ground tackle and its residuals such as lost fishing tackle, including hooks and small anchors have equally affected the bottom of large tracts of shallow seas and the heritage located there. Today an ever increasing number of fisheries no longer use ground tackle at all.

Situations negatively impacting archaeological sites can be avoided through mutual dialogue and information. It is vital to consider fishermen as natural allies in heritage protection. Fishermen's interests are not – in principle – at odds with heritage protection. With their local knowledge they can be important informers on changing marine conditions and on discoveries of heritage. If sites are subject to a management plan, one should consider what fishing techniques, if any, one would want to allow on-site. Many techniques, however, are more harmful in combination with other uses, such as recreational diving, or functioning as a breeding ground for specific species, than they are for the physical properties of a site as such.

In many countries, fishermen are already important allies in the management of underwater cultural heritage. They are invited to share their information with the competent national authorities and thus contribute to the establishment of inventories. Archaeologists benefit from consulting them as much as possible, both on the general conditions of the marine environment and on the whereabouts of irregular features at the bottom surface. Conversely, they should inform them about areas that should be avoided, in order to prevent endangering submerged archaeological sites. If fishermen act as bad partners in heritage management, this is often due to negligence in communication with them. It is the responsibility of those who care for heritage to make sure that fishermen are well-informed and conscious of the importance of heritage protection. It is vital for all stakeholders to establish a mutual understanding between heritage managers and the fishing industry.

XII. Reporting

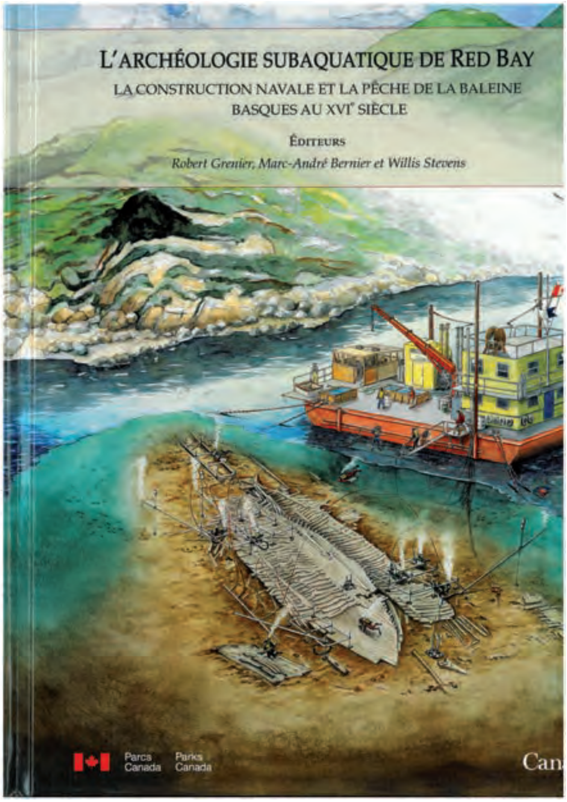
Reporting, the archiving of data and finds, and dissemination of search results are daily routines that begin with the first day of work in archaeology. Although the Annex only addresses these issues towards the end, reporting should be addressed from the very beginning of any archaeological project. *Rules 30* and *Rule 31* deal with reporting. *Rule 32*, *Rule 33* and *Rule 34* have the curation of archives as their theme. Finally, the publication and dissemination programme is addressed in *Rules 35* and *36*. Note that reporting, publication and dissemination are three different things.

General considerations on reports

Rule 30. **Interim and final reports shall be made available according to the timetable set out in the project design, and deposited in relevant public records.**

Written reports should present the outcome of underwater archaeological projects. They are the core of archaeological knowledge production and its consolidation. Reports assemble original observations and evidence together with analysis and interpretation of project results. Reports strictly differentiate between facts or observations, inference and analysis. They present evidence in a way that allows external researchers to draw their own conclusions. The quality of the report and its information value define the credibility of the project, the team and the discipline on the whole. This therefore also determines the future of maritime archaeology as successive projects need to be able to build on previous results.

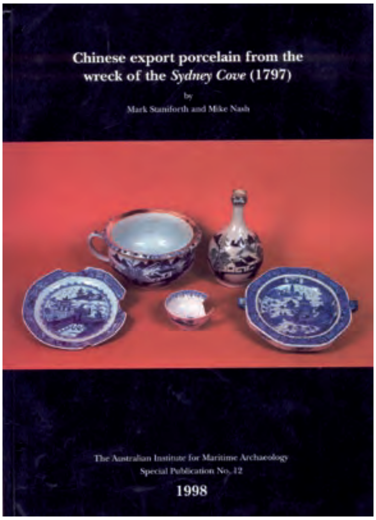
While this is obvious for larger projects and excavations that need to result in full publication, this



◀ © Parks Canada. Five volume report publication on the underwater archaeological excavation at Red Bay, Canada. In 1978 Parks Canada underwater archaeologists discovered the wreck of a 16th century Basque whaling vessel in Red Bay, Labrador, believed to be the *San Juan* (1565). This 5-volume publication is the culmination of over 25 years of research by associates and members of Parcs Canada's Underwater Archaeology Service. It describes not only the underwater archaeology as practiced at Red Bay but also 16th century ship construction, whaling and material cultural studies.

is equally important for smaller interventions. Reporting is integral to project management. This is one of the reasons for choosing a project management approach. Moreover, whether the objective of a project is significance assessment, promotion of access, or consolidation, projects or activities directed at underwater cultural heritage will always include original observations and research. These observations need to be traceable and reported.

Interim reports are to be drafted regularly throughout the research process, according to a set time schedule. Such reports should register all data, describe the course of activities, give an up-to-date account of all progress that is made and outline the results. Besides informing sponsors and funding bodies, the interim report also serves to inform other professionals on the progress. It enables peers to develop an informed opinion and offer assistance and advice. Given that it may take considerable time to publish the final report, dedicated efforts need to be made on issuing



▲ © Tasmanian Parks and Wildlife Service. Report entitled *Chinese export porcelain from the wreck of the Sydney Cove*, published by the Australian Institute for Maritime Archaeology.
This is an example of a report that focuses on a specific aspect of the excavation project and informs the scientific community and the interested public of the outcomes of the research project. The complete documentation of the research project has been compiled into a report of 15 hard cover volumes. In 2009, a book edition was published.
Wrecked in 1797 while on a journey from Calcutta to Port Jackson, the *Sydney Cove* was the first merchant vessel lost after the establishment of the colony of New South Wales. Since its rediscovery in Tasmanian waters by divers in 1977, the *Sydney Cove* site has been the subject of an extensive research project. While the *Sydney Cove* was a relatively small trading vessel of around 250 tons, carrying cargo composed primarily of alcohol, foodstuffs, textiles, luxury goods and livestock, the archaeological and historical significance of the wreck is considerable.

detailed interim and special reports as soon as possible and in advance of the final report.

The *final report* builds on all interim reports and contains an analytical summary and interpretation of the results.

Reports may vary in their purpose. There is, for instance, a difference between project reports informing the local community and financial reports. It follows that reports target different audiences, such as the scientific community, funding sources, authorities, or the general public. All reports, however, require a formal structure and careful planning. They should present their subject matter in a logical manner using clear and concise language. The manner of reporting, required content, and time schedule needs to be set out in the initial project design. It is important to remember that the process of data collection is shorter than the time needed for analysis. This problem can be overcome by allowing for reporting to take place in several stages. But reporting should be consistent throughout all stages of the process, and conducted in a way that is comprehensible for future users.

Results of underwater archaeological projects must be made available to the full range of potential users. Reports should therefore be elaborated and published within the shortest delay possible, following the completion of activities. Upon their completion, they must be submitted for archiving by the public institution indicated in the project design. Depositing of reports in a timely manner guarantees accessibility to important information and thereby allows for adequate future research to be carried out on the site in question. It is not for the archive only, however, that reports are produced. In addition, information can be publicized through a variety of means. These include publication of results in monographs and professional journals, and distribution of the report to libraries and technical clearinghouses. Reports can also be made available through the internet.

Report planning

Reports make the most important components, descriptions and results of a project accessible. Their elaboration requires time and effort. Their success and usefulness depend on their systematic, logical and appropriate format.

The form to be chosen for reporting must be precisely planned and defined prior to commencing any actual work. It should be set out in the project design. This guarantees that all vital information is registered according to a consistent method throughout all stages, and that professional standards are met. This means that the scope and form of reports need to be fixed, a schematic blueprint of the final report needs to be devised and decisions on how to archive and publish documentation need to be made.

The nature of data constituting the basis of a report depends on the site from which it comes. It depends also on the type of intervention undertaken. Non-intrusive interventions produce other information than excavations, and equally important reports deal with the accidental discovery of an artefact or site. In each case, the methods of documentation and representation need to satisfy professional standards. In cases of rescue excavations, it may be necessary to choose less labour- and time-intensive documentation techniques. The most important features would, however, still demand detailed descriptions. Under pressure, it is important to determine priorities and make the right professional choices. What is documented will in one way or another continue to exist whereas what is not documented can never become part of our common memory. In other words, the conditions of a rescue intervention do not reduce the responsibility for proper exploration and documentation of the site.

Stages of report writing

The following stages are involved in writing a report:

- Clarification of purpose, terms of reference, objectives and audience

- Defining structure and content
- Planning and division of labour (who does what when?)
- Collection (and safe storage) of information
- Organization and structuring of information
- Writing the first draft
- Checking and rewriting
- Finalisation of manuscript

In report writing, there is no escaping some repetition. Small or large inconsistencies that had escaped notice will become apparent, and will have to be addressed. They will need attention and resolving. Organizing the report writing process in a structured way will avoid problems among the numerous contributors.

Structure of a report

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.

The structure of the research report should mirror the course of the research process while illustrating its positive and negative effects, and end with recommendations for preservation and future research.

A good report begins by defining the research goals, the assumptions made, the methods and techniques applied. The next stage is a description of the results obtained. This constitutes the basis for planning of possible future interventions or additional, complementary research. A very important element of this part of the report is a description of mistakes and omissions. Everyone makes mistakes. It is only by specifying them that it will be possible to eliminate the same mistakes in the future, or to take them into account. In this way, the research process can undergo continual improvement.

The final report of an archaeological project should ideally follow the structure indicated in the text-box. Following such a template will help to include all the necessary information. The listed elements are different in character and will be briefly discussed.

An archaeological report should include

- Title page (and verso)
- Acknowledgements
- Table of Contents
- Abstract / Executive Summary
- Introduction
- Account of activities, responsibilities and personnel involved
- Results and findings
  - facts
  - interpretation
- Conclusions and recommendations
- Information on the project archive
- References
- Appendices

Title page (and verso)

The first page of the report should give its title (which should provide a precise indication of the subject matter), the authors, the archaeological site and the date of elaboration. The reverse of the title page is reserved for copyright information. Reports can be produced for a small, specific audience, but even so, one should include all the details that will allow bibliographic referencing, such as place and date. One should consider giving the report an International Standard Book Number (ISBN), which will greatly help future users to identify it. Each country has a national ISBN-office that assigns such numbers on demand. Even reports that will only be published digitally can now get an ISBN-number. If the report is part of a series, which will often be the case, there is also the International Standard Serial Number (ISSN). Periodicals will have an ISSN. Book-series will also have an ISSN, while individual books in the series have an ISBN in addition. The copyright page or verso of the title page includes a colophon, a list of key-words and these numbers.

Acknowledgements

The scientific or material support of partners or contributors should be acknowledged as well as sponsors or other partners and then, all individuals

▲ © UNESCO. Augustus Henry Lane Fox Pitt-Rivers, after 1880. The format of excavation reports dates back to the 19th century based on Pitt-Rivers' Cranborne Chase model. This generally comprises summary /abstract, introduction background, description of features, structures and stratigraphy, discussion, catalogues/specialist reports/appendices. In addition, the volumes on the Cranborne Chase excavation contain useful relic tables summarising context details including features, stratigraphy and finds. Now, in the 21st century excavation reports contain more data with more specialist reports, but follow the same basic format.

and institutions who have provided assistance in the fieldwork, analysis, report writing and other stages of the project. Many people will have worked hard to bring the project to completion and this public acknowledgement may often be the only reward they receive.

Table of Contents

The progressive numbering system and hierarchy of the report's layout should be incorporated into a Table of Contents. Considering that the accessibility of reports is greatly enhanced by putting them in digital collections or on the internet, it is wise to consider whether a digital link between titles and text would be practical. Such links can then be included from the very start. They are also an advantage if several persons work on the report simultaneously, which nowadays has become the rule, rather than the exception.

Abstract / Executive Summary

A short paragraph summarising the main contents of the report should be drafted if the report is longer than 10 pages. It should include a short statement of the goals of the project, the methods used, results obtained, conclusions reached and any recommendations made. The abstract should be concise, informative and independent from the report. It is advisable to draft this section after having written the report.

Introduction

The introduction should give the context and scope of the report and should include the terms of reference of the project that is reported on. It should include:

- Description of the site, including
  - location and environment,
  - contextual background,
  - historical background, and
  - its formal delimitation, as well as an indication of the surrounding space included in analysis.
- Description of the objectives of the project, including

  - research objectives, and
  - research design.
- Description of the project's organization and institutional affiliation.
- Enumeration of the people involved, including
  - the principal investigator, and
  - the other people in charge of different aspects of the project.
- Introduction to the structure of the report.

If the report deals with a particularly comprehensive project, it may be necessary to split the introduction into several chapters that together will constitute an introductory section. Its function and contents will nevertheless be more or less the same.

Account of activities

The account of what actually happened when the project was carried out is an essential part of the report. It should include a discussion of the circumstances and organization of the desk-based research and field work and the dates when it was undertaken. It should mention the identity of the individuals by whom the different tasks were undertaken as well as their institutional affiliation. The account should report on the methodology employed. It thus illustrates how activities and research were carried out and how data was collected. Although there can be merit in extensive narratives, this information should be presented logically and concisely. Omissions or possible problems of data collection, including any

◀ © J. Pinedo & D. Alonso. Excavation of a roman shipwreck off Escombreras Island, Cartagena, Spain.

deviation from the research design and the reason for the changes, should be clearly indicated.

Results and findings

The results of the project should be described and illustrated. These results often come in different forms. Practical results and scientific results go hand in hand. In this section, it is important to separate facts from analysis and to include conclusions.

Facts should be reflected in the text and should be illustrated, if necessary, in an annex, with drawings, or graphic and photographic documentation. These should include all stages of the activities and observations. In each case, the factual information should be clearly distinguishable from the analysis and interpretation. The section on results and findings will generally be composed of several chapters, each presenting the facts and analysis relating to a specific topic. All in all the results should include:

- A description of the location of the site, including a map and contour plans;
- a description and drawing of the object of research, including an outline of trenches and areas of archaeological research;
- a full artefact report with drawings and photographs of objects and materials;
- a comprehensive description of field observations;
- environmental and specialist scientific reports;
- reports on conservation work on the site and individual artefacts, including all changes such as excavation, back-fill, covering, or disassembling and re-assembling of artefacts, as the case may be;
- analysis and interpretation of the results.

Findings shall be presented in a simple way. Maps should include an overlay of the coordinate system used during the research, as well as compass directions and geographical coordinates. Statistics and measurements should be illustrated with tables, charts, graphs and photographs, as appropriate. Graphs, photographs and illustrations have to be labelled and easily interpretable. There must be a clear link between illustration and text. Captions must be accurate and comprehensive, including precise titles and references to the relevant find numbers and diary entries. Scales should be indicated, and axes in graphs should be well-explained. Copyrights need to be indicated, and whether use of material is restricted or not.

Analysis and interpretation of the results need to explain the significance of the site, the artefacts and the conclusions that can be drawn. They need to identify important issues and suggest explanations for the findings. Any problems encountered shall be outlined and an attempt shall be made to present a balanced view. An evaluation of the investigation in view of its objectives should follow. This evaluation should include a discussion of how well the needs dictated by the planning process were served. The analysis should also illustrate the significance of the findings for the archaeological discipline and the general public. At the end of the analysis, the main issues should be drawn together. All new factual information should have been presented earlier in the report. Possible future research can be briefly discussed.

Conclusions and recommendations

The analytical chapters on interpretation that have been discussed under the general heading of *Results and findings* will all include partial or far-reaching conclusions. At the end of a report, however, the conclusions should be combined and reiterated. It is useful to always combine this with recommendations. Such recommendations can include lessons learned on appropriate or failing methodology or equipment. They can address scientific questions that urgently need to be settled and they can and should include practical recommendations on the ongoing management of the site, the project archive and the collection of artefacts and samples that it may include.

In undertaking archaeological research, researchers assume responsibility for the preservation, curation and condition of a site and of any objects they remove. It should be remembered that preservation and securing actions should be planned with a view to the long-term, allowing research, understanding and enjoyment to progress, not only over a few years but over several decades. Recommendations should take the threats and opportunities of a site into account. Such threats may result from the natural environment, but may also include man-made ones. For this reason, it is very important to exchange information concerning threats for the underwater cultural heritage with the representatives of other sectors actively working in the environment.

In line with this responsibility, the recommendations could address storage and exhibition of artefacts removed from the site, and specific conditions that should be met. This could extend to the relative humidity, temperature, and lighting levels to be strived for, or specific instructions for transport. Recommendations could also relate to a future site management plan for the terrain where the excavation site is located, or relate to future activities or revised information needs.

Information on the project archive

The report should also contain a clear summary of the contents of the project archive, its location and conditions of access. The archive can be composed of very different components, including both documentation and finds, as discussed under *Rules 33* and *34*.

References

The last pages of the report should give details of all works by other authors, which have been referred to within the report. Details should include the author's name and initials, date of publication, title, publisher, place of publication, and page numbers. Details of website references should also be given, including the URL of the webpage, date of access, author and title. References should be listed in alphabetical order of the authors' names and in a consistent format, for which various standards exist. These may vary from country to country or from publishing house to publishing house. For internal reports, a research group will have to choose the format that is the most appropriate, considering local conventions. Referencing software is a useful tool available for quick and easy conversion between different systems.

Appendices

Additional information that derives from the project, but whose length would unbalance the report, should be annexed to the report in appendices. These could be lists, catalogues, tables, statistics, drawings or photographs. One could also decide to include specialist reports that support the project, such as the dendrochronological analysis of wood samples if such analysis took place. This is equally true for other types of research that have their own cumulative logic. Reproducing such reports *in extenso* as an appendix will not burden the flow of argument in the report, while still giving every opportunity to assess and compare specialist results. Such analyses can be central to the project, but equally importantly they provide their own body of knowledge. In the case of dendrochronology, this refers to climate and climate change as well as to forestry, timber-use and timber trade.

Other elements that can be considered for inclusion are an index and a glossary of terms. Technical terms are hard to avoid when dealing with technical subjects. Readers may not have the same specialize background and they have a right to understand what exactly one means in using a specific term. This is not a problem if a term is used only once, and can be defined in the text. If it is used repeatedly in a report that is to be consulted regularly, rather than reading from cover to cover as a novel, a glossary will be the only way to address the problem. Sometimes it is even necessary to include glossaries in more than one language, especially when dealing with phenomena that cross cultural and linguistic borders. An index, telling exactly on which page one will find discussion including a particular term, used to be a very practical addition to complicated reports and publications. Their preparation used to be tiresome. This has changed enormously since computers have replaced typewriters in word-processing. It is much easier now to prepare an index than it used to be. But the usefulness of an index has also decreased. If a report is accessible digitally, any word search is possible. A detailed Table of Contents is therefore usually good enough.

Sensitive information

Some information, such as specific GPS indications, may be highly sensitive to disclosure. This may particularly be true in the absence of a management plan that addresses threats of vandalism. Sometimes, it may therefore be appropriate to prepare a separate report for public distribution. However, this touches on a profound dilemma. Archaeology builds on spatial distributions. Moreover, it serves a public purpose. So, in many ways, the public has a right to know. Denying access and withholding information may have more negative impacts in the long run than engaging as many as possible in protection through extensive information. Nevertheless, it may be wise to consider some information sensitive when it is not backed up by a full information strategy. This argument should not be used, however, to withhold information that would otherwise lead to a better understanding of the significance of the underwater cultural heritage, or of the issues involved in its protection.

Report-writing guidelines

Every author has his or her own style. But there are guidelines that should be followed when writing a report. A report is not a novel, but just like a novel it needs to be readable. Readers will generally consult individual sections, rather than reading it cover to cover, which they might quickly do once. This needs to be accommodated. Each section should be more or less self-contained. A matter-of-fact style is the most practical. Complicated constructions, wordy clauses and passive voice should be avoided. A narrative on how things were done may include personal considerations. It should not be swamped with sophisticated, lengthy sentences. Factual descriptions should avoid adjectives that are subjective in nature. It is also more relevant to state actual size and condition than to state that something is big, overwhelming or beautiful. If such adjectives are used at all, they should be in comparison to something else. It is essential that the reader can quickly distinguish what is factual information, what – rightly or wrongly – are basic assumptions, and what are interpretations that follow from structured analysis. Personal opinions should therefore be recognizable as such. If they are given at all, they should be revealed in the interpretations. They should not be concealed in bluff like: “it is obvious that…”.

Usually, if the writing is selective, accurate, objective, concise, clear and consistent, it will also be simple. It is essential to keep the audience in mind and to keep asking whether they will be able to follow the logic of the report. All in all, the following recommendations should be kept in mind.

- Write clearly and concisely, and make appropriate, consistent, and economical use of other methods of data presentation such as tables, plans or photographs. Innovative presentation methods may increase publication costs, but improve comprehensiveness or attractiveness. The format should be adapted to the audience targeted with the report.
- Present information about what was found in a well-balanced, logical, accessible, and structured way. It should be immediately understandable to those who know nothing about the site. It should reflect the importance of the results of the project and deal adequately with the site’s social, political, and historical context.
- Specialist reports and their supporting data should be given proper place and value. Specialist contributors must be involved in or informed of editorial decisions affecting the presentation of their work in print.
- Deliver accurate and verifiable information. Justify the interpretation of the site with evidence. Ambiguities in the data should be discussed, and where more than one interpretation is possible, the alternatives should be presented.
- Explain the extent to which the objectives of the project have been fulfilled and evaluate the methodologies employed.

- Make sure that chapters, paragraphs, figures, photos, and specialist reports are adequately cross-referenced. Readers should be able to find their way through the report without difficulty.
- Draw attention to potential areas of future study that could not be fully explored in the context of the agreed project design.
- Standardize abbreviations and carefully choose expressions to convey subtleties of meaning.

For scientific reports, peer reviewing is recommended, to ensure state-of-the-art levels of quality.

Responsibility

Reporting must be carried out by a team of researchers composed of specialists representing various branches of science. It is important to ensure collaboration and exchange. The reporting must be performed by those who were directly involved in the collection of data. The final responsibility lies with the research director. It is a substantial responsibility. The history of archaeology has seen many instances of directors who deferred reporting until much more could be known, after many more years of excavation, with the aim of then writing the ultimate, authoritative publication. Unfortunately also, many died before this ever happened. Managing projects of limited scope to their completion has therefore become the norm. Follow-up projects can be planned later, but only after completion of earlier reports. It is therefore suggested that timely completion and submission of research reports should be a condition for future appointments as research director of a project.

XIII. Curation of project archives

Activities directed at underwater cultural heritage will produce documentation of observations, usually also samples and finds. Together, these collections of records and finds constitute the project archives. As heritage is a public interest, both documentation and find material are to be considered public as well. It is the responsibility of the project and its director to make sure that the archives can fulfil their public role after the project's termination. They should be kept together and not be dispersed. Moreover, it is important that the archives, both documentation and finds, are accessible for future research as this will allow reassessment of the evidence in the light of new techniques, additional contextual information or data gained from other sites. No material should be excluded from the archive as it may be important in the future. All these requirements are the same for underwater cultural heritage and for archaeological sites on land. Considerable experience exists with the management of archaeological collections. International standards have been developed and these should be adhered to. The curation of project archives is regulated by *Rule 32*, *Rule 33* and *Rule 34*.

General considerations on project archives

Rule 32. **Arrangements for curation of the project archives shall be agreed to before any activity commences, and shall be set out in the project design.**

The methodology for archiving project documentation and the structure of the archives must be set out in the project design. The project design needs to contain a schematic blueprint of what archives it will produce. Moreover, appropriate storage locations, curation, and the envisaged degree of public availability need to be determined prior to commencing fieldwork.

Arrangements should guarantee that all vital information is registered according to a consistent method throughout all stages, and that the systems chosen are compatible with archiving constraints that may exist.

▲© Hampshire and Wight Trust for Maritime Archaeology. Julie Satchell and Paul Donohue studying the archives of the protected wreck site of the warship *Hazardous*, United Kingdom. Archaeological archives of projects undertaken are a unique and vital source of information on the site concerned and often the only trace that remains of disturbed sites. For this reason the full documentation and results of the intervention must be deposited for posterity in the archives, reflecting every aspect of the project. They should contain the preliminary documentation, documentation on the aims and methods, collected information, objects and samples, results of analysis, research, interpretation and publication. The mass of collected paper, drawings, photographs, objects and digital data is a resource that enables the reinterpretation of original findings. But it also provides the raw material for further research and informs exhibits.

A central part of the project archives will contain documentation of archaeological research which will be substantial and composed of a great number of elements. In line with the experience of other projects and the way the archaeological profession has progressed, it is therefore not acceptable to postpone selecting the method of archiving until the process of research or excavation is underway. It is evident that sometimes new elements will be developed during the course of a project, as for instance, a backup for a system that is not completely reliable. However, improvisation should be limited to exceptional cases and should not become the rule. Drawing on previous knowledge and past experience, the choice of methodology must ensure that a project's stable, orderly and accessible archives can be assimilated easily into the collections of recognized repositories.

The need for project archives

Archaeological archives are an essential element of archaeological research. They represent a unique source of information on the site concerned. With regard to sites that have been disturbed or excavated, future generations are denied the opportunity to study the evidence *in situ* and therefore the archives are the only trace that remains. For this reason, the full results of the intervention must be deposited for posterity in the archives.

The documentation of an archaeological project can be very extensive. In an underwater project, the documentation should be more, rather than less, extensive than the documentation of an archaeological project on land. The risks of interruption because of bad weather and other causes are greater. As a consequence, it is better not to take any risk with documentation, but actually to document every day as if there were no other day.

The mass of collected paper, drawings, photographs, objects and digital data is a resource that enables the reinterpretation of original findings. It also provides, however, the raw material for further research. It informs museum displays and teaching collections and it gives the general public access to the evidence. Project archives are the basis for creating understanding.

The significance of archaeological archives is growing as their value is more widely recognized. At a time when many reports of archaeological projects appear as what is sometimes called 'grey literature', such reports are only barely available in the public domain. This is a problem, making reports available on the internet that may be solved by. It also means that the project archives have become an even more vital source of information. There is an increase in requests for consultation of archives, and it is important for archaeological archives to be accessible and comprehensible to all interested parties, archaeologists and others alike.

The archives should reflect every aspect of an archaeological project. They should contain the preliminary documentation, documentation on the aims and methods, collected information, objects and samples, results of analysis, research, interpretation and publication. As such, the archives must be as complete as possible, including all relevant documents, meeting reports, records, data and objects. Nevertheless, it is quite clear that archival collection must be subject to selection procedures. These are determined by the overall research aims of the project and by the requirements of the receiving repository. Selection should follow accepted practice, and aim at preserving a complete and comprehensible record of the project.

It is good practice to prepare and deposit archives efficiently, with the aim of quickly making them available to the widest possible audience. This should not cause a problem when transfer to the repository has been outlined in the project design, and when it is taken into account in daily procedures. To ensure the quality of the archives, it is important that members of the research team, who are knowledgeable about the adopted documentation and reporting systems, are involved in archiving activities. It should not be left completely to staff that has not participated in the research. However competent these may be, this might nevertheless lead to flawed systematisation of documentation and to overlooking some of its elements or characteristics.

All these considerations support the intent of *Rule 32*:

- arrangements for archiving should be made in advance;
- preparations for archiving should be part of the project's organization; in short:
- archiving should be dealt with in the project design.

Composition of project archives

Rule 33. The project archives, including any underwater cultural heritage removed and a copy of all supporting documentation shall, as far as possible, be kept together and intact as a collection in a manner that is available for professional and public access as well as for the curation of the archives. This should be done as rapidly as possible and in any case not later than ten years from the completion of the project, insofar as may be compatible with conservation of the underwater cultural heritage.

Rule 33 further elaborates some of the conditions for archaeological archive repository. Objects and documentation should be kept together. Archives should be accessible. Deposition should not be delayed.

Project archives are composed of the following three categories:

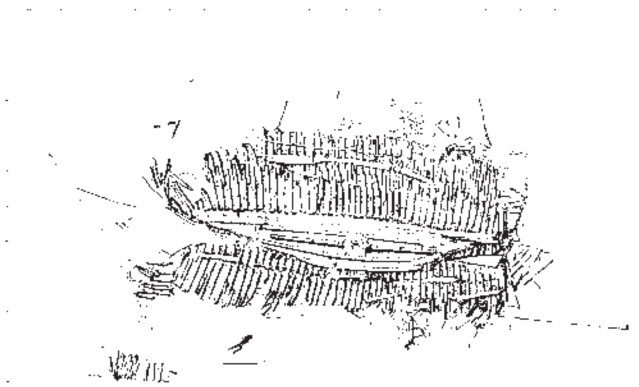
The documentation archive (hard copy / digital), which will contain
- context information and location map,
- site plans showing archaeological, topographic and environmental features, sections and profiles,
- the project design,
- details on methods and selection strategies,
- records of activities, progress reports, management reports,
- records of site and features,
- field-notes, sketches, plans and sections, stratigraphic drawings, structural plans, drawings and photographs,
- object drawings and photographs,
- find lists, sample lists, drawing lists and photographic catalogue,
- environmental records and reports,
- records of preliminary results and evaluation,
- preliminary reports, specialized reports and final reports,
- publications, catalogues and all other records.

The material archive, including
- objects, finds and samples,
- conservation records,
- object drawings, photographs, x-rays, etc.

Inventories and correlation lists, including
- a master inventory of the archive, listing all elements of documentation and reporting produced during and after research,
- a description of the method of archiving and inventory,
- an index, referring to the location where elements and copies of the archive are stored.

The composition of project archives that derive from activities directed at underwater cultural heritage is normally so varied as to require varied conditions for storage. This may lead to practical solutions in which different categories are kept in different spaces. That, however, does not change the principles. Nor should this prevent the management of the collection to be in the same hands or organization.

Along with the removed artefacts, all elements of documentation created in the course of an archaeological project are irreplaceable. As are the documents related to its preparation, such



◀ © Parks Canada. Final map of the structure, site 24M, Red Bay, Canada.

as the project design and background research. The documents relating to analysis and interpretation are also indispensable. Altogether these artefacts and documents constitute the project archive relating to the archaeological site.

The archive will be derived from activities during several phases: preliminary studies, project design, research, analysis, interpretation, conservation and curation. The archives will comprise two main categories, the documentary archive and the material archive, and as a third category, the necessary inventories and correlation lists.

The third category, the inventories and correlation lists are extremely important for future understanding. They can only be completed on completion of the archives. But correlation and concordance are already at issue from the very start of data collection and documentation. Unique find-, feature- and document-numbers facilitate this process. Each separate data group should be cross-referenced to related data groups, to the final report, and if necessary to a general context concordance. These should be supplemented with a table of contents or index for maximum accessibility. Relational databases are practical aids, allowing for daily back-up. Just like in any administrative process, precision and meticulousness are essential.

Delay of archiving

Archiving must be completed within the shortest delay possible. It is to be advised that preparation for archiving is included in all documentation and handling of documents and finds. Final archiving and repository should follow as quickly as possible the conclusion of research and conservation. Under no circumstances should this be later than ten years from the completion of the project, preferably much earlier.

A project has not been completed until the archive has been transferred successfully and is fully accessible for consultation. It is in the interests of all parties to facilitate the transfer of completed archives to recognized repositories as quickly as possible. It may therefore be appropriate for an archive to be deposited before the project has been fully published. In such instances, a copy of the publication must subsequently be added.

Archiving guidelines

Archives are part of any administration. A long history of archival traditions exists and archivists work according to standards that have been agreed upon internationally. The very special aspect of archaeological archives is, however, that finds, samples and artefacts are considered to be 'data carriers', just as documents or digital media are.

Rule 34. **The project archives shall be managed according to international professional standards, and subject to the authorization of the competent authorities.**

All archaeological projects must result in a stable, ordered, accessible archive. Archaeological practitioners must accept their responsibilities in this regard. Competent authorities should make sure that they do. Documents that set out requirements or standards for archaeological work, or that underlie archaeological permits, should therefore reflect this principle.
Standards for the preparation, creation and management of the archive must be understood and agreed upon at the beginning of any project. Lines of

SUMMARY OF TAGGED STRUCTURAL TIMBERS

TIMBER TAG	EXCAV. TAG	PROVENIENCE	REFERENCE(S)	DIMENSIONS (APP. CM)	DRAWING NO. & DATE	FIELD PHOTO	DESCRIPTION	REMARKS
1194		20Q	83-76-07 83-60-29,30 83-85-06,16	220x19x16	83-88-D81	3W, 83-509w	Second Futtock West end	Iron pin treenail
1195	32	20Q	83-76-07 83-60-29,30 83-85-07,16	244x17x14	84-93-D76	3W,	Second Futtock West end	
1196		20Q	83-76-07 83-85-07		83-83-D58	3W, 83-506w	Frame Spacer	
1197		20Q	83-76-07 83-85-06,16		83-83-D46	3W, 83-505w	Plank Frag.	
1198		20P	83-76-07 83-60-29	365x24x16	83-83-D86	3W, 83-547w	Waterway	
1199		20Q	83-76-07 83-85-06	67x20x3	83-83-D10	3W, 83-501w	Inner Hull Plank Frag.	
1200		20R	83-76-07,42 83-85-06,16,19	– x9x5cm.		3W,	Eroded Timbers extends into 18Q	
1201		10P	83-76-09,10	48x10x8	83-83-D18	83-503w	Small Knee, 25 cm below T.T.756	
1202		6N	83-76-09,10	46x7x7	83-83-D21	83-584w	Structural piece with L. shaped cross section	
1203		10P	83-76-09	50x12.5x4.5	83-83-D25	83-501w	Plank Frag.	Found free floating beneath 15.80m on datum 4
1204		20Q	83-76-09 83-60-29	29x25x4	83-83-D170	83-543w	Frame Spacer	Between T.T. 1192 & 1194
1205		18Q	83-76-09 83-60-29	25x34x5.5	83-87-D92	83-547w	Frame Spacer/Stopper	South of T.T. 417
1206		16Q	84-6-42 83-76-09	26x16x3.5	83-83-D17		Frame Spacer/Stopper	MATES W/ 2850?
1207		14Q	83-76-09	24x31x3.5	83-83-D12	83-501w	Frame Spacer/Stopper	Free floating
1208		16P	83-76-09 83-46-15	58x13x5	83-87-D67	83-539w 9N, 13T	Wedge	ass. T.T. 1274
1209		14L	83-76-09	42x21x6	83-83-D6	83-504w	Frame Spacer	Free floating
1210		14L	83-76-09,10	46x21x6.5	83-83-D5	83-504w	Frame Spacer	Free floating
1211	28	20Q	83-76-10	40x14x3	83-83-D20	83-505,506w	Shaped Plank	
1212	10,16	18Q-20Q	83-76-10 83-85-06,16	78x13x11	83-83-D29	83-501,502w	Timber Frag.	Probably moved
1213		20N	83-76-10	19x14x2.5	83-83-D7	500W	Small Plank	Free floating Orientation meaningless

▲ © Parks Canada. Page of the register of structural elements that have been deposited in the Red Bay project archives, Red Bay, Canada.

communication are vital in any project, and especially in the archiving process. The standards that are to be followed must be understood from the beginning, and regular communication between all participants in the process, as well as with the intended archive repository, will ensure that the archive meets all requirements. It must be understood that an archive repository can return a project archive if it fails to meet agreed standards.

The relation between recording and archiving

All aspects of the archaeological process affect the quality of the resulting archive. The archiving process begins with planning the creation of the first record. If proper systems of recording are not consistently applied, then the archive will not be orderly and accessible. If, for example, terminology for features or deposits is not applied consistently, it will hardly be possible later, to distinguish the records of post-holes from pits, or for a maritime example, to know to which deck a find should be attributed. It is advisable to use a standard *thesaurus* of terms throughout the project. Photographs of features that lack identifying labels will have little value, unless this is compensated by an extensive description of the individual shot. Extensive descriptions are to be the rule for underwater photographs that are taken under very variable circumstances.

Keeping the archives together

Archives must be kept together and intact as a collection and this creates very specific demands. It is a central point, both of the 2001 Convention and of the Rules of its Annex.

Archaeology and the understanding of a site are based on facts and interpretation. It is also a cumulative process. With new information becoming available, interpretation needs to be reviewed. This can be after many years. It will then again be important to know what the considerations were for an intervention and on what information and considerations the earlier interpretation was actually based.
Keeping the archives together facilitates their curation, and allows the cumulative information to be available for professionals and the public. This is why it is important for each new piece of information to be kept with all other information regarding a particular site. It is also the reason why *Rule 34* specifically indicates that the management of the archives should be subject to authorization by the 'competent authorities' defined in Article 22 of the Convention.

Ensuring the security of the archive

Ensuring the security and stability of the archive is a continuous process. It is a universal responsibility. All archaeologists need to recognize that they must manage archive material. Record sheets, drawings, and digital records should be created to preserve their content and to protect it from damage and loss. Such records should be treated accordingly. This is as relevant on site as it is in the laboratory or museum.

Archive curating guidelines

Since the documentation and material archive of archaeological research is an irreplaceable source of information, its curation should warrant its future existence. International standards have been developed to that end.

◀ ©T. Maarleveld. Archaeologist Chris Dobbs explaining archiving policies at the Mary Rose Musem to international students of the Maritime Archaeology Programme at the University of Southern Denmark. Archives of the *Mary Rose* in a climatised room, Portsmouth, United Kingdom. Project archives shall include all finds and samples. Archives should be deposited in a sustainable repository.
This picture shows the climatised archive room that holds the artifacts from the *Mary Rose* excavation that are not on display at the Mary Rose Museum.

Conditions during storage

The combination of documentation archives and material archives in archaeological repositories implies that professional standards apply for several different aspects. All different materials must be stored in accordance with professional standards of conservation. This applies to paper documents and digital media, but it also expressly applies to heritage items that have been removed from their location, the samples and finds. These can only be archived after having been cleaned, documented and analysed, and after stabilization.

In the curation of archaeological finds, there are two simple, very basic principles to follow according to professional standards of conservation:

- Finds that are not on exhibition must be stored in the dark.
- Finds must not be exposed to wide fluctuations in temperature or relative humidity.

These two basic principles imply that project archives should be stored in conditions that are not susceptible to high light levels or to wide fluctuations in temperature or relative humidity.

Many materials can stand low and high temperatures, and low and high relative humidity, but they must not be subjected to constant variations in either. For many artefact materials, the ideal storage is at low temperatures (around 15°C) and a relative humidity (RH) that lies between 35% to 70%. Metals should be stored in a range of 15° to 24°C, and below 35% RH. Organic finds, such as objects of leather, textile, wood or bone must be dried before deposition in the archive and stored at 18° to 22°C and 45% to 55% RH.

The drying process is where the challenges in conservation are the greatest. Material from a saline environment must be thoroughly desalinated, to keep it from attracting moisture. Some packing and storage materials are better than others. Acid-free packing materials are preferred in international standards.

An alternative solution is to conserve artefacts in submerged depots. In this form of wet storage that is sometimes chosen for big timber objects, the artefacts are conserved in a wet environment that is similar to their original site context or in freshwater tanks. Yet again, the depots need to be controlled for light, temperature and whether the water is infested by organisms that feed on the wood. Some repositories control the tank environment with carefully selected living fish. Other institutes include reburial below the groundwater table as part of their archiving policy.

Location

Appropriate documentation, archiving and storage are of fundamental importance. The project archives must be stored in a place that provides the best possible conditions to prevent degradation of materials it contains. Moreover, it should meet safety requirements, while at the same time assuring availability to the interested public. Finally, the storage location should meet the best possible conditions with respect to temperature, humidity, lighting and exposure to the risks of natural disasters. Specific environmental *desiderata* may vary for the different materials that the archive will contain, but all will profit from stability. While it may be necessary to apportion the archive to different rooms with different indoor climates, it is nevertheless preferable not to have these rooms too far apart.

Submission and transfer

Documentation and reports are submitted to the archive on the basis of an established protocol. Electronic submissions must always be supported by paper copies. The responsibility for correct submission to the archive lies with the member of the research team assigned to the task. Information forwarded to the archive should be arranged in such a way that the information can be integrated into the institution's inventory, as well as into an integrated IT system, if that is applicable.

Archives that specialise in digital information will have policies for that and may prefer certain formats over others. Imaging, drawing and mapping software often allows for saving in different formats, including very basic formats. These may not include all the processing information, but may be a wise backup all the same. Digital data that is not maintained in an active system risks getting lost. First of all, the magnetic or optical carrier on which it is kept may be subject to quality loss. Secondly, decoding software may not continue to be available over time. Readable formats may change.

In any case, research materials submitted to the archive must be systematically edited according to a pre-established and agreed upon methodology. This applies to digital archives and paper archives alike.

Ownership

Underwater cultural heritage is a matter of public interest, even when in some cases a private owner may still exist. As a consequence, archive repositories should also have a public responsibility and function. This implies some form of public control. There are different ways to organize this, and different models exist for different countries. Sometimes, the repository keeps collections on behalf of the national or regional government and in other cases, the State or municipality will be their owner. It is preferable for the repository to have ownership of any archive deposited with them. The repository should also have copyright, or shared copyright, over the documentary archive. This must be in line with existing legislation. Because of the legal complexities surrounding these issues, it is not possible to establish universal standards. However, general recommendations can be made. Regarding ownership and copyright, *pro forma* agreements and specific protocols should be subject to legal advice, while taking account of the public function of the collections as their most important characteristic.

Identification

All elements of the archive should be subject to a uniform identification system referring to the site number and numeration of individual artefacts and documents. In this respect, it is important to align the project design with the repository's organization. Changing the unique numbers on individual items, especially small ones, needs to be avoided by all means. Renumbering will always introduce untraceable mistakes. As archaeological projects produce large amounts of data, which is diverse and structured in a complex way, it is essential to pay great attention to a master inventory of the project archives, listing all elements of documentation and reporting produced during research. It is equally important to implement schemes for cross-referencing the unique identification numbers.

Copies and backups

Nowadays, all project archives contain both digital and paper-based elements. Celluloid negatives and colour slides, which continue to have their own problems in conservation and curation, have been replaced by ready at hand digital photography, with large digital archives as a consequence. Relational databases, digital plans, and raw measuring data are other types of 'files' that one can hardly imagine a project to do without. In archiving, these digital data need extra care. The repository should have a maintenance policy for digital data, including regular back-up. As a safety measure, raw data, and digitally produced documentation, can simultaneously be kept in the form of a complete set of printouts on materials resistant to degradation. Conversely, it is also recommended to scan the entire documentation. Such a policy will prevent irreparable loss if either the paper-based or the digital archives are damaged or otherwise inaccessible. Despite the wide spread of technological possibilities that allow for safe storage and back-up of digital materials, it is nonetheless recommended to make paper and digital copies of the entire documentation and store them in separate locations.

Professional and public access

Upon completion, project archives must be made available for research and public access to a feasible extent. Wide dissemination and publication of the research results constitutes the main purpose of the research process. To facilitate access, the project archives should be deposited at recognized archive repositories. Recognition or authorization of the repository by the competent authorities that are responsible for underwater cultural heritage is in this regard preferable. Any such recognition or authorization of a repository that accepts an archaeological archive must take into account its suitability for providing both long-term care and public access. Examples of repositories include accredited museums, local record offices and national monument archives. Specialized centres or institutes can also be accredited as such.

Regulations for access

A central reason for archiving the project archives with an appropriate repository is to make them available for professional and public access. As a consequence, the management or governing body should organize the best way to provide this service. Access to the documentary parts should conform to the official requirements that exist for public archive repositories. This equally applies to the material archive. Access to some items may be more cumbersome than to others, especially if their storage is away from the archival institution, or needs special preparation and overseeing by staff. Nevertheless, access needs to be organized and regulations should govern decisions relating to the following issues:

- Regulations for access to the archives should be made public.
- Any restrictions on access, if applicable, should be explained.
- Details of regular opening hours should be given.
- Conditions for consulting material should be clearly stated.

It may be wise to require written proof of identity from those consulting the material, before giving them access to unique pieces. Users of the archive should be made aware of rules, regulations and other codes of conduct which apply to the use of the archive service. Collection items should be protected from theft or damage during public inspection and unauthorized access to the records should be prevented. Obviously, the health and safety of the public should also be ensured.

In order to facilitate users' access to the service, several specific measures can be taken. These include:

- Providing a catalogue with a short description of all items held and available for consultation in publicly available finding aids, for instance through the internet.
- Providing a designated study area sufficient to satisfy normal demand for public access to the records; it should be suitable for inspection and easy to control.
- Providing technical facilities necessary for consulting the records that are appropriate for the type and quantity of archives, and ensuring proper maintenance of such equipment.
- Providing facilities for making photos or photocopies of records, with due regard to copyright restrictions.
- Taking reasonable measures to meet the special needs of disabled users.

International standards

Several international norms are relevant to the process of professional archiving:

- Norm ISO 63936 for identifying and describing the language of the document archives; this norm is also important for the international transmission of data over the internet.
- Norm ISO 5963 for examining documents, determining their subject, and selecting indexing terms.
- Norm ISO 2788 for establishing and developing monolingual thesauri.
- Norm ISO 999, which includes guidelines for the content, organization and presentation of indexes.
- ISAD(G) (www.ica.org/en/node/30000) General International Standard Archival Description (2nd ed.), adopted by the Committee on Descriptive Standards, Stockholm, Sweden, 19-22 September 1999.

XIV. Dissemination

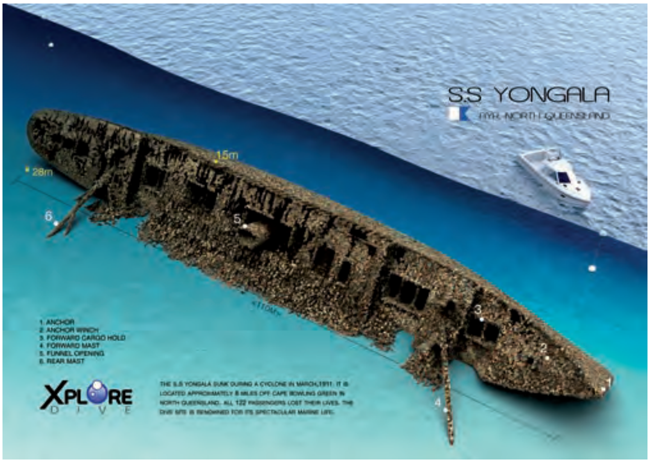
Underwater cultural heritage deserves protection because it is of general and public interest, and as part of our common maritime heritage it has a unique value for humanity. Protection instruments such as the 2001 Convention emphasize this notion of shared heritage. If the public interest is not served and if the public is not included in information and protection, research and management are of limited use. The Rules that specifically address information sharing and dissemination are *Rule 35* and *Rule 36*.

Informing the public

Rule 35. Projects shall provide for public education and popular presentation of the project results where appropriate.

Activities directed at the underwater cultural heritage can take very different forms. They can include meticulous survey or extensive excavation, but they can also have consolidation or better access as their objective. Whatever the reason, once all the research, planning, logistics, survey, excavation, conservation, analysis, curation, management plan, and reporting is finished, the project still is not complete until the results have been shared with a wide audience.

▶ © José Manuel Matés Luque. Interpretation panel on the *Bakio* shipwreck, placed on the seafront in the town of Bakio (Bizkaia, Basque Country, Spain), close to where the site is. The beach and seafront are used by many people, an excellent opportunity for raising awareness on underwater heritage.



◄ © Xploredive. Shipwreck trail card of the *SS Yongala*, Great Barrier Reef Marine Park, Queensland, Australia.
Shipwreck trails exist all over the world. While certain maritime sites are too fragile and archaeologically sensitive to support public access, there are other more robust sites that have become stable in their environment. Effectively interpreted and actively managed, they can sustain large numbers of visitors. The shipwrecks that are highlighted in such a trail can be selected for the tragic circumstances surrounding their loss, their historical significance, and because they provide a fascinating underwater experience for divers. Usually water-proof booklets and land-based interpretive signs are located along the coastline to assist in the interpretation of the wrecks.
The *SS Yongala* (1911) lies in the central section of the Great Barrier Reef Marine Park. It was an early 20th century interstate coastal steamer that sunk during cyclonic weather. It provides a snapshot of Edwardian life in Australia and is now one of Australia's most highly regarded and popular wreck dives. The wreck is also the final resting place of the 122 passengers and crew who were aboard the *Yongala* on her 99th and final journey.

Reasons for informing the public

All archaeological research is futile if results are not shared. Archaeologists need to disseminate new information among the research and academic community to further the scientific aims of identifying cultural change and understanding past human behaviour. However, it is at least as important to share information with the public at large. Archaeology has the unique ability to inform our understanding of ordinary people of the past, rather than favouring kings and generals who are often the focus of historical narratives. This connection to the public of the past is a means to engage the public of today.

The public's interest in the past is illustrated by the popularity of television shows, movies, books, and other publications that focus on archaeology and history. The production of well-researched and well-presented data for a general audience is a powerful tool for making sure the public gets accurate, interesting information, rather than the over-simplified or over-inflated, and sometimes erroneous "facts" generated by the media and by organizations with more interest in profit than preservation. Effective public education also ensures the longevity of archaeology by generating support for it.

In many cases, the public has rights to archaeological information. For example, when sites are located on public lands or when public taxes are used to fund archaeological investigations, people are entitled to know what is happening, how their money is being spent, and what the results of their investment are. Public programming utilizing quality productions that address archaeology works two ways. On the one hand it illuminates the value of the work being performed. On the other hand, however, it also shows the need for archaeological research in general to prevent the destruction of cultural heritage sites and consequent loss of heritage information.

On a conceptual level, the idea that everyone has a fundamental right to know their past is a compelling argument for sharing archaeological information with the public. In some archaeological circles – as with other ivory tower scientists – there has been a tendency to hoard information or to think of the public as somehow incapable of understanding archaeological principles. This is not just elitist, but short-sighted as well. Rather, a broader public understanding of the importance of archaeology and of the information archaeological research provides can serve to further the goals of protection, preservation, and conservation of non-renewable cultural heritage sites.

Not every specialist team-member may be an equally good communicator, while still being valuable for

***Rule 35* mandates that projects must provide for public education and dissemination of results. Suggestions for fulfilling this:**

1) Make sure at least one member of the project team has experience in public archaeology and sharing of information.
2) Assign responsibility for producing public outreach and education programmes to the project's public archaeologist in order to make certain this requirement is not overlooked.
3) Ensure adequate funding is included in the project budget for the development and production of public-oriented materials.
4) Remember to include all groups of the public, not just sport divers.
5) Consider innovative methods for public education; there is no one right way to engage the public!

▲© M. Harpster. The 2008 class of the Maritime Heritage Awareness Certificate Training, Karpaz Maritime Heritage Program, Cyprus.
A key component of the Karpaz Maritime Heritage Program was a public outreach and education programme supported by the Nautical Archaeology Society, called the Maritime Heritage Awareness Certificate Training. This program focused on engaging local dive businesses to aid in the protection of the maritime cultural heritage of Cyprus. This class, from April 2008, incorporated individuals from the Greek and Turkish Cypriot communities, making it the first bi-communal training program on the island of Cyprus dedicated to protecting the island's maritime heritage. Pictured (in alphabetical order) are Drew Anderson, Harald Barthel, Cengiz Bergun, Caroline Brash, Laura Coombe, Andrew Costas, Jon Duerden, Marios Evangelou, Bob Harvey, Clive Hemming, Ian Hodge, Steph Lawlor, Clive Martin, Diane Millward, Nicos Nicolaou, Christos Patsalides, and Mark Thorne.

the team or its research. This may be so, but it is no excuse for not communicating. It is therefore wise to compensate with other team-members who have more affinity with public archaeology.

In addition to the above, heritage tourism is one of the fastest-growing segments of the tourism industry and visitors appreciate the opportunity to experience first-hand authentic sites and artefacts as a way to connect to their past. Promotion of public access to archaeological sites is part of UNESCO's Guidelines (see Rule 7), and is related to the idea that the heritage has a unique value for humanity. Furthermore, heritage tourism provides real and significant economic benefits for the local community. Often, one of the first ways potential visitors learn of sites to visit is through popular presentations about projects and discoveries. This interest then leads to tourism and additional learning.

Advantages of sharing information

Educating the public about the goals of archaeology and about the results of archaeological research has multiple advantages, especially where the underwater cultural heritage is concerned. Because of years of misinformation from the media and propaganda produced by commercial shipwreck salvagers, much of the public does not understand the difference between scientific archaeology and treasure hunting. Divers who would never dream of chipping a brick out of a historic building to take home do not see anything wrong with chipping a porthole out of a historic shipwreck. There seems to be a misunderstanding in the minds of many people that heritage sites on the bottom of the ocean are eligible for looting. Although much legislation has been directed toward combating the looting of underwater cultural heritage sites, perhaps the best way to change public opinion is through effective education.

▲ © Tasmanian Parks and Wildlife Service.
Rudder of the *Sydney Cove* shipwreck on display in the Queen Victoria Museum and Art Gallery, Tasmania, Australia.

Education leads to appreciation, which leads to protection. People appreciate and value what they know about and understand; actually visiting a site provides an even stronger sense of connection. Additionally, fostering appreciation for one heritage site generally has the result of encouraging appreciation for other sites.

Ultimately, sites are discovered and protected, or looted and destroyed, at the local level and in the context of surrounding communities' attitudes toward their past. Archaeologists have a unique opportunity, and, it may be argued, a responsibility, to provide local people and others with the information and ability to become an integral part of investigating and protecting their own cultural heritage, on land or under water.

General considerations on how to inform the public

Project designs and budgets should take into account public outreach goals and the materials and products needed to reach those goals.

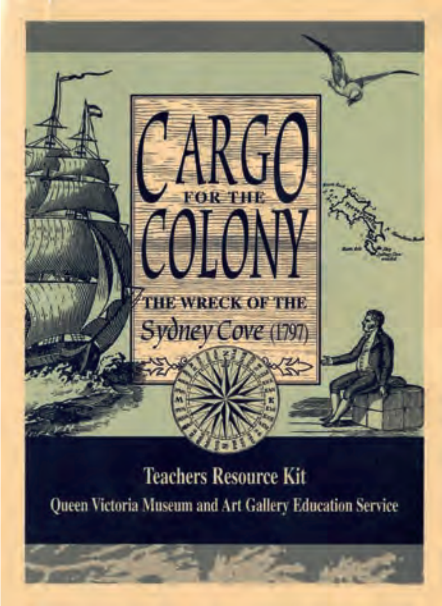
Team qualifications

A team member who is responsible for public outreach and education, along with archaeological responsibilities, is a necessary component of the project and should be considered as part of *Rule 10* (f): composition of team and qualifications.

Many university archaeology programmes now offer courses in public archaeology and internships where students can practice strategies for public outreach and education. Alternatively, archaeologists often find themselves performing public archaeology due to necessity, gaining familiarity with public outreach through on-the-job training. The field of public archaeology is a growing part of the science, with ever more professionals focusing on outreach, education, and public interpretation of sites as primary research and career directions. A team member with prior experience, ideas for viable public programs, and the capacity to manage a project's outreach plan will prove invaluable. This team member can also help to fulfil *Rule 10* (p): programme for publication, which should include public synthesis of results.

Funding and partnerships

Funding for public programmes should be considered, including sufficient funds for development of programmes, printing of outreach materials and interpretive literature, and creation of exhibits and displays. In some cases, once an initial printing of literature, such as brochures or underwater guides, is complete, a local organization may be able to take over successive printings. Partnerships with local museums or libraries are an excellent means of producing exhibits, which have the advantage of one-time outlay of funds to build. If the team is successful in creating local excitement and support for the project, in-kind donations of materials may be sought, from cement to create underwater markers, to the use of boats and donated chemicals for conservation.



▲ © Tasmanian Parks and Wildlife Service. Teachers' resource kit, entitled *Cargo for the Colony, on the Sydney Cove* wreck produced by the Queen Victoria Museum and art Gallery Education Service, Tasmania, Australia.

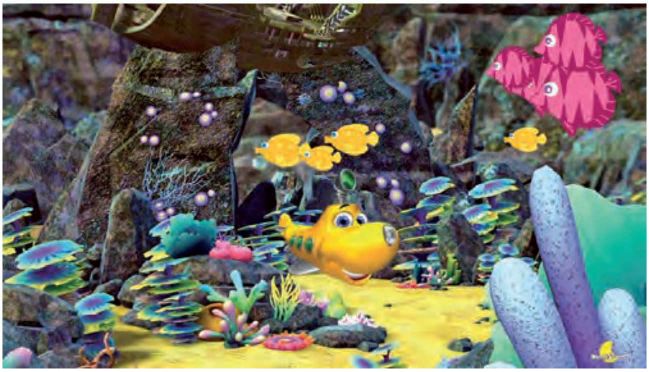
Targeting specific groups

The "public" is composed of people of all ages and backgrounds, which enables archaeologists to pursue many avenues of education and outreach.

Children

School children may be too young to dive and visit the site, but they are eager to learn about seafaring and shipwrecks. Activity books, colouring books, posters, hands-on activities, travelling educational trunks, and presentations directed at a young audience are all viable options. Today's children are tomorrow's citizens who will be responsible for developing and implementing public policies and legislation regarding historic and archaeological site preservation. A positive learning experience focusing on archaeology at a young age will have far-reaching consequences.

▶ © UNESCO. Underwater Cultural Heritage Web site of UNESCO's 2001 Convention Secretariat for children (www.unesco.org/new/en/culture/themes/underwater-cultural-heritage/the-heritage/kids-page).



Lesson plans for teachers and educators will help ensure that young people receive factual information about archaeology and underwater cultural heritage. Archaeologists can work with local teachers to develop lesson plans featuring the project, including topics such as the scientific method, survey strategies, issues of working in an underwater environment, site identification and history, conservation and the chemistry of waterlogged artefacts. Curricula can be produced that will fit into existing classroom procedures when working with teachers who are familiar with educational standards for the area, state, or country. Because of archaeology's appeal and inter-disciplinary nature, and especially the allure of shipwrecks and sunken sites, lessons that are engaging and entertaining, as well as informative and educational, can be developed.

▶ © Ships of Discovery. Snorkeler viewing the landing gear of a TBM Avenger.

Submerged archaeological sites are increasingly exposed to damage by inexperienced or unaware divers. To ensure a worldwide respect for submerged heritage by individual divers the promotion of a Code of Ethics is essential in order to set a common standard.

The States Parties to the 2001 Convention and the Scientific and Technical Advisory Body of the 2001 Convention fully endorse the UNESCO Code of Ethics for Diving on Submerged Archaeological Sites.

UNESCO Code of Ethics for Diving on Submerged Archaeological Sites

1. Protect underwater cultural heritage for future generations.
2. Leave wrecks and submerged ruins untouched.
3. Obey legal protection of archaeological sites.
4. Seek permission to dive on designated sites.
5. Only archaeologists may remove objects.
6. Do not take souvenirs.
7. Respect measures that protect sites.
8. Report discoveries to the responsible authorities.
9. Hand over objects that you took.
10. Do not sell our common heritage.
11. Document discovered sites.
12. Be careful when taking photographs.
13. Stay safe.
14. Be a role model.
15. Support ratification and compliance with the UNESCO 2001 Convention on the Protection of the Underwater Cultural Heritage.

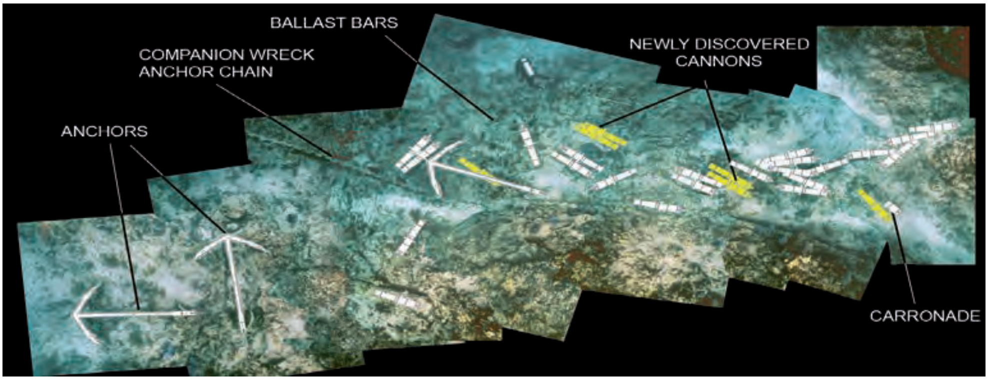
Sport divers

Because of their existing interest in the underwater world, sport divers are a prime target for outreach. In most cases, the local diving community will be well aware of the underwater cultural heritage in their area and will be extremely interested in the research. Through the incorporation of information on cultural resources into the existing and effective education about submerged natural resources, divers can be taught to recognize the underwater cultural heritage as part of the marine environment and deserving of the same respect and preservation. Moreover, engaging divers at an early stage of the project and making sure to keep them informed will help prevent misinformation, unpleasant confrontations, and hard feelings, and will help promote cooperation, stewardship, and protection. Divers often become valuable volunteer members of the research team, offering hours of labour, important local information, and a powerful advocacy voice among their peers for underwater historic preservation. Furthermore, diving organizations are an effective option for long-term site monitoring and management according to *Rule 25;* by encouraging a local dive club to "adopt" the shipwreck-site, archaeologists and heritage managers (who may be based elsewhere or will leave the area at the end of the project) can be assured the site will be watched over and cared for.

Local communities

In many cases, the public can, and should, be involved in the archaeological process from the beginning. This applies in particular to local communities. It is vital for local inhabitants to be implicated in the study and protection of their underwater cultural heritage. This engagement with local people, for whom the underwater cul-tural heritage has a real and immediate connection, is crucial for long-term protection. The local in-habitants see the site on a regular basis and can effectively monitor activities at the site, such as diving and fishing. By engaging them in initial research and in continuing investigations, a sense of stewardship for the underwater cultural heritage can be fostered, which ultimately will help ensure protection. The individuals who participate in the research can then become ambassadors for archaeology, by sharing information with their community and providing examples of how everyday people can be directly involved with researching local history and heritage.

Community organizations provide wonderful opportunities for outreach because they are directly tied to the local identity, stay current with local events and news, and often need speakers and programmes for their meetings. Historical and genealogical societies, libraries, museums, educational agencies, environmental clubs, and civic groups are generally eager to hear about archaeological research in their area. In addition, speaking to one group often generates contacts for others and the team's public archaeologist may well find him or herself on the local speaking circuit.



▲ © Ships of Discovery. Photo mosaic of the wreck of the *Endemion*, Turks and Caicos Islands, United Kingdom.
The well camouflaged anchors, cannon, and carronades are highlighted in a photo mosaic of the British Navy *Endymion*, a 5th rate wrecked while on patrol in the Turks and Caicos Islands in 1790.

Further out at sea, the same role and the same sense of ownership will apply to discoverers of sites and to traditional and new users of the sea, from fishermen of distant ports to offshore operators. Even if these groups have a different way of being locally embedded, they have very strong feelings about maritime heritage and the space in which they operate. Even though it may be a challenge to engage them, it will prove to be worthwhile.

Final synthesis

Rule 36 addresses the final synthesis upon completion of an activity directed at the underwater cultural heritage.

Rule 36. A final synthesis of a project shall be:

> **(a) made public as soon as possible, having regard for the complexity of the project and the confidential or sensitive nature of the information; and**
> **(b) deposited in relevant public records.**

The difference between the final report and synthesis for the public

A final synthesis for the public is a different product than the project report which is dealt with in *Rule 30*. Often, much of the technical information contained in reports is not necessary for informing the public of project goals and results, although project leaders may choose to make project reports available to those

▲ © BAR / FPAN. Map of Florida's shipwreck preserves. In 1987 Florida began to develop a statewide system of underwater parks featuring shipwrecks and other historic sites. The shipwreck preserves have become popular attractions for skin and scuba diving visitors to witness a part of Florida's history first-hand. They contain not only interesting archaeological features, but also an abundance of marine life that make the parks living museums in the sea. Each site is interpreted by an underwater plaque; a brochure and laminated underwater guides are available from local dive shops. The parks are open to the public year round, free of charge. There are eleven parks at present, and several others under development. Even a virtual experience on these sites is offered at www.museumsinthesea.com, where the visitor can access underwater video footage of the wreck and the marine life, as well as a video about the history of each vessel.

who are interested in learning more. Consequently, a public synthesis may be shorter, or may take an entirely different form. Consideration should also be given to providing translations of the public synthesis.

Possibilities for public synthesis

Booklets, brochures, posters, film documentaries, illustrated books or other publications such as magazine articles, exhibits or displays of artefacts and information, and websites are all acceptable and effective ways of synthesising information for public education. If the site is made accessible to the diving public (*Rule* 7), waterproof site guides, underwater monuments or plinths, and trails marked with line are tried and successful methods for interpretation. Case studies from around the world are available to provide ideas and models. If, however, the site is intended to be an underwater archaeological preserve or shipwreck park for divers and snorkelers, do not forget interpretive materials for the non-diving public as well.

Rule 36 **requires that a final project synthesis shall be made public and deposited in public records. In order to fulfil this:**

1) Understand that the project's public synthesis is generally a different product than the project's final report.
2) Consider alternative methods for public synthesis, such as websites, posters, site guides, brochures, and lavishly illustrated publications.
3) Provide periodic updates for the public if the project is long-term; do not wait until the very end to explain the project.
4) Recognize some information may be too sensitive to immediately share with the public.
5) Deposit the synthesis product in archives and other locations that are easily accessible by the public. Consider including public-oriented material on the Web.

Some underwater cultural heritage sites may also be appropriate for inclusion as part of a larger maritime heritage trail that can feature maritime sites above and below water. These trails boost tourism, enhance the local economy, educate citizens and visitors, promote appreciation for history and culture, and serve as effective management tools.

Complexity of the project

Archaeological projects, especially full-scale excavation of sites, are most often a multi-year, or even multi-decade, undertaking. The amount of material recovered that requires conservation, analysis, and interpretation adds to the time between initial discovery and investigation and the production of the final report and public synthesis. This is an accepted and understood fact of the discipline, although the public will be eager to hear of on-going research and discoveries. Consider the preparation of interim or periodic updates for the public, such as press releases or articles detailing the extent of work so far. Websites are an extremely effective and relatively simple way to enable the public to keep abreast of project progress; many project websites include web logs ("blogs") of daily activities. By keeping the public informed about current developments, the project

▶ © Swedish Maritime Museum. The Vasa Museum, Stockholm, Sweden.
The Vasa Museum has a reputation of having a professional visitor service of a kind that you rarely find in museums. To welcome as many persons as possible in the building on any given day, despite climate restrictions, an efficient system of queuing and guiding practices has evolved. The entrance system is designed to let people in as directly as possible. Opening hours are generous and groups are let in before or after closing. Guided tours in several languages are constantly being held by groups of students from a multicultural background. Texts and films are also written and spoken in different languages. Museum staff employs various schemes to steer clusters of visitors away from the most crowded points in the museum. The visitors, most of them in the Vasa for the first time, will find guides in distinct clothing around the museum. There is a visitor services desk near the entrance which acts both as an information point on the Vasa and as a booking central for taxis and the like.

team can maintain a level of community excitement and interest in the project.

Sensitive information

In some cases, a site may be too fragile or the information recovered too scientifically sensitive to immediately share with the public. For example, a site in imminent danger of looting or vandalism may require that the site location remain confidential. A shipwreck in the stage of open excavation that exposes especially fragile timbers or other components may make it unsuitable for visitation. If human remains are discovered, archaeologists may be required by ethics, law, and cultural convention to refrain from making the discovery public. These cases must be decided on an individual basis, although the team leader should be prepared to answer questions, sooner or later, related to the decision, remembering that fundamentally heritage and archaeological research are public, not confidential.

Relevant public records

Relevant public records are any depository that can be accessed by the public. These can include public libraries; archives of community museums; series of research documents of local historical societies; college and university libraries; and municipal, county, state, or other governmental archives. The World Wide Web is perhaps one of the best repositories for public documents, since it is easily accessible by people all over the world. Consider attaching public-oriented materials to the project website, or linked to the project's sponsoring agency's website. These can be viewed or downloaded at the public's discretion and will be available to the widest possible audience.

Rules

concerning activities directed at underwater cultural heritage

General principles

Rule 1. The protection of underwater cultural heritage through *in situ* preservation shall be considered as the first option. Accordingly, activities directed at underwater cultural heritage shall be authorized in a manner consistent with the protection of that heritage, and subject to that requirement may be authorized for the purpose of making a significant contribution to protection or knowledge or enhancement of underwater cultural heritage.

Rule 2. The commercial exploitation of underwater cultural heritage for trade or speculation or its irretrievable dispersal is fundamentally incompatible with the protection and proper management of underwater cultural heritage. Underwater cultural heritage shall not be traded, sold, bought or bartered as commercial goods. This Rule cannot be interpreted as preventing:

(a) the provision of professional archaeological services or necessary services incidental thereto whose nature and purpose are in full conformity with this Convention and are subject to the authorization of the competent authorities;

(b) the deposition of underwater cultural heritage, recovered in the course of a research project in conformity with this Convention, provided such deposition does not prejudice the scientific or cultural interest or integrity of the recovered material or result in its irretrievable dispersal; is in accordance with the provisions of Rules 33 and 34; and is subject to the authorization of the competent authorities.

Rule 3. Activities directed at underwater cultural heritage shall not adversely affect the underwater cultural heritage more than is necessary for the objectives of the project.

Rule 4. Activities directed at underwater cultural heritage must use non-destructive techniques and survey methods in preference to recovery of objects. If excavation or recovery is necessary for the purpose of scientific studies or for the ultimate protection of the underwater cultural heritage, the methods and techniques used must be as non-destructive as possible and contribute to the preservation of the remains.

Rule 5. Activities directed at underwater cultural heritage shall avoid the unnecessary disturbance of human remains or venerated sites.

Rule 6. Activities directed at underwater cultural heritage shall be strictly regulated to ensure proper recording of cultural, historical and archaeological information.

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

Rule 8. International cooperation in the conduct of activities directed at underwater cultural heritage shall be encouraged in order to further the effective exchange or use of archaeologists and other relevant professionals.

Project design

Rule 9. Prior to any activity directed at underwater cultural heritage, a project design for the activity shall be developed and submitted to the competent authorities for authorization and appropriate peer review.

Rule 10. The project design shall include:

(a) an evaluation of previous or preliminary studies;
(b) the project statement and objectives;
(c) the methodology to be used and the techniques to be employed;
(d) the anticipated funding;
(e) an expected timetable for completion of the project;
(f) the composition of the team and the qualifications, responsibilities and experience of each team member;
(g) plans for post-fieldwork analysis and other activities;
(h) a conservation programme for artefacts and the site in close cooperation with the competent authorities;
(i) a site management and maintenance policy for the whole duration of the project;
(j) a documentation programme;
(k) a safety policy;
(l) an environmental policy;
(m) arrangements for collaboration with museums and other institutions, in particular scientific institutions;
(n) report preparation;
(o) deposition of archives, including underwater cultural heritage removed; and
(p) a programme for publication.

Rule 11. Activities directed at underwater cultural heritage shall be carried out in accordance with the project design approved by the competent authorities.

Rule 12. Where unexpected discoveries are made or circumstances change, the project design shall be reviewed and amended with the approval of the competent authorities.

Rule 13. In cases of urgency or chance discoveries, activities directed at the underwater cultural heritage, including conservation measures or activities for a period of short duration, in particular site stabilization, may be authorized in the absence of a project design in order to protect the underwater cultural heritage.

Preliminary work

Rule 14. The preliminary work referred to in Rule 10 (a) shall include an assessment that evaluates the significance and vulnerability of the underwater cultural heritage and the surrounding natural environment to damage by the proposed project, and the potential to obtain data that would meet the project objectives.

Rule 15. The assessment shall also include background studies of available historical and archaeological evidence, the archaeological and environmental characteristics of the site, and the consequences of any potential intrusion for the long-term stability of the underwater cultural heritage affected by the activities.

Project objective, methodology and techniques

Rule 16. The methodology shall comply with the project objectives, and the techniques employed shall be as non-intrusive as possible.

Funding

Rule 17. Except in cases of emergency to protect underwater cultural heritage, an adequate funding base shall be assured in advance of any activity, sufficient to complete all stages of the project design, including conservation, documentation and curation of recovered artefacts, and report preparation and dissemination.

Rule 18. The project design shall demonstrate an ability, such as by securing a bond, to fund the project through to completion.

Rule 19. The project design shall include a contingency plan that will ensure conservation of underwater cultural heritage and supporting documentation in the event of any interruption of anticipated funding.

Project duration – timetable

Rule 20. An adequate timetable shall be developed to assure in advance of any activity directed at underwater cultural heritage the completion of all stages of the project design, including conservation, documentation and curation of recovered underwater cultural heritage, as well as report preparation and dissemination.

Rule 21. The project design shall include a contingency plan that will ensure conservation of underwater cultural heritage and supporting documentation in the event of any interruption or termination of the project.

Competence and qualifications

Rule 22. Activities directed at underwater cultural heritage shall only be undertaken under the direction and control of, and in the regular presence of, a qualified underwater archaeologist with scientific competence appropriate to the project.

Rule 23. All persons on the project team shall be qualified and have demonstrated competence appropriate to their roles in the project.

Conservation and site management

Rule 24. The conservation programme shall provide for the treatment of the archaeological remains during the activities directed at underwater cultural heritage, during transit and in the long term. Conservation shall be carried out in accordance with current professional standards.

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

Documentation

Rule 26. The documentation programme shall set out thorough documentation including a progress report of activities directed at underwater cultural heritage, in accordance with current professional standards of archaeological documentation.

Rule 27. Documentation shall include, at a minimum, a comprehensive record of the site, including the provenance of underwater cultural heritage moved or removed in the course of the activities directed at underwater cultural heritage, field notes, plans, drawings, sections, and photographs or recording in other media.

Safety

Rule 28. A safety policy shall be prepared that is adequate to ensure the safety and health of the project team and third parties and that is in conformity with any applicable statutory and professional requirements.

Environment

Rule 29. An environmental policy shall be prepared that is adequate to ensure that the seabed and marine life are not unduly disturbed.

Reporting

Rule 30. Interim and final reports shall be made available according to the timetable set out in the project design, and deposited in relevant public records.

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.

Curation of project archives

Rule 32. Arrangements for curation of the project archives shall be agreed to before any activity commences, and shall be set out in the project design.

Rule 33. The project archives, including any underwater cultural heritage removed and a copy of all supporting documentation shall, as far as possible, be kept together and intact as a collection in a manner that is available for professional and public access as well as for the curation of the archives. This should be done as rapidly as possible and in any case not later than ten years from the completion of the project, in so far as may be compatible with conservation of the underwater cultural heritage.

Rule 34. The project archives shall be managed according to international professional standards, and subject to the authorization of the competent authorities.

Dissemination

Rule 35. Projects shall provide for public education and popular presentation of the project results where appropriate.

Rule 36. A final synthesis of a project shall be:
(a) made public as soon as possible, having regard to the complexity of the project and the confidential or sensitive nature of the information; and
(b) deposited in relevant public records.

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La Rochelle University and Arc'Antique. In 2007, he founded A-CORROS that specializes in diagnosis and expertise in the corrosion and conservation of metal heritage, and in 2008, he founded the Mediterranean Centre for Conservation and Restoration.

Jasen Mesić, Croatia
Jasen Mesić was appointed Minister of Culture of the Republic of Croatia in 2011. In his previous role as the state secretary in the Croatian Ministry of Culture, he participated on behalf of his country at the four expert meetings devising the 2001 Convention. An archaeologist with an international background and member of ICOMOS/ICUCH, since the 1990s, Jasen Mesić has been actively engaged in the protection of underwater cultural heritage along the Adriatic coast of Croatia. With his support, the International Centre for Underwater Archaeology was founded in Zadar in 2007, benefitting European countries and the Mediterranean region. He is a member of the Scientific and Technical Advisory Body of the 2001 Convention.

Xavier Nieto Prieto, Spain
Xavier Nieto Prieto was appointed director of the Spanish National Museum of Underwater Archaeology in Cartagena (ARQUA) in 2010, having directed the Centre d'Arqueologia Subacuàtica de Catalunya since 1992. He was previously appointed professor of underwater archaeology at Barcelona University, having worked in the archaeological research centre in *Diputación de Girona*. He holds a BA, MD and PhD in prehistory and ancient history, and has published extensively in the field of underwater archaeology. He has served as a member of the Group P.A.C.T. at the Council of Europe and is the Spanish representative in ICOMOS/ICUCH.

David Nutley, Australia
David Nutley is a maritime archaeologist and a Director of Comber Consultants Pty Ltd, archaeological and heritage consultants based in Sydney New South Wales, Australia. Since 1988, he has been involved in developing underwater cultural heritage programmes both in Australia and internationally. Mr. Nutley is a former president of AIMA and current vice-president of the ICOMOS/ICUCH. On behalf of ICUCH, he cooperates with UNESCO in the promotion and

fostering of the implementation of the 2001 Convention and he co-edited the UNESCO/ICOMOS publication 'Underwater Cultural Heritage at Risk'.

Iwona Pomian, Poland
Iwona Pomian has complemented her university training in underwater archaeology with extensive diving and documentation experience. In 1992, she assumed the position of director of the Underwater Research Department of the Polish Maritime Museum. She participated in the Baltic Group for Protection of the Cultural Heritage, in the NAVIS project, and has cofounded the Polish "Wraki" working group. She is responsible for inventory and protection of underwater cultural heritage in the Pomeranian Province. She is the author of several dozen publications concerning marine archaeological research and protection of the cultural heritage of the Baltic Sea.

Della Scott-Ireton, USA
Della Scott-Ireton holds a BA in anthropology, a MA in historical archaeology and international relations, and a PhD in anthropology. Being a certified scuba instructor with NAUI, she conducted extensive research projects in Florida and the Cayman Islands, before joining the Florida Public Archaeology Network where she serves as the Northwest Region Director. Her research interests include public interpretation of maritime cultural resources, and training of avocationals in archaeological methods and practices.

Athena Trakadas, Denmark
Athena Trakadas is a curator at the Viking Ship Museum in Roskilde, Denmark, and co-editor of the *Journal of Maritime Archaeology*. She is a commercial diver and holds BAs in Classics and Anthropology, a MA in Nautical Archaeology, a Cand.Mag. in Roman Archaeology, and a PhD in maritime archaeology. She has worked on maritime and terrestrial archaeological projects throughout the Mediterranean and Northern Europe and is the Founding Director of the Morocco Maritime Research Group, as well as Co-director of the Montenegrin Maritime Archaeological Rescue Project.

Robert Veccella, French Polynesia
For the past twenty years, Robert Veccella has directed

the French Polynesia branch of the Naval Archaeology Research Group, which is dedicated to underwater archaeology, maritime history and maritime cultural heritage. Holding a diploma in architecture and a post graduate degree in archaeology, he actively works to increase both divers' and non-divers' awareness by organizing heritage protection seminars in Tahiti.