Bringing the Intangible to Life:  
How Digital Media has Enabled Non-Divers and Audiences Worldwide Access to Submerged Cultural Heritage Sites

BY KAROLYN GAUVIN

A thesis submitted in fulfillment of the requirements for the degree of Masters of Maritime Archaeology

Department of Archaeology  
School of Humanities  
Flinders University, South Australia  
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Declaration of Candidate

I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

Signed,

Karolyn Gauvin

22/02/2011
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Abstract

The public interpretation of submerged cultural heritage is important. While significant progress has been achieved by way of public outreach and interpretation of submerged cultural resources for divers, these same efforts have not been reciprocated to give non-divers the same benefits. Most interpretive programs are designed specifically for divers.

This thesis argues that theoretical concepts from the New Museology can be applied to the management and interpretation of submerged cultural resources, more specifically, that digital media can be used to enable non-divers access to sites once thought intangible to them. It also acknowledges that it is possible to develop interpretive strategies specific to non-divers that can be both entertaining and educational.

This research reviews previous and current attempts made by archaeologists and cultural heritage managers in working with digital media. In order to communicate the importance of shipwrecks and other submerged cultural heritage sites for terrestrial and non-diving audiences, research into the current uses of digital media and its potential for interpretation is crucial.

This study demonstrates that by using digital media, it is possible for archaeologists and cultural heritage managers to interpret submerged cultural heritage sites for divers, non-divers and people of all ages. The creation of stereoscopic (3D) images on the sites comprising the WWII Invasion Beaches Underwater Heritage Trail is the object of a case study for developing digital media in an effort to engage a non-diving audience. The three-dimensionality of the photographs is believed to be a dynamic approach to interpreting submerged cultural heritage sites that divers, non-divers, and people of all ages can appreciate. It is hoped that this research will contribute to the limited publications available on the subject so that archaeologists and cultural heritage managers can use this research to gain inspiration for future interpretive strategies.
In the history of anthropology’s search for fundamentals and universals, storytelling is one of the few we have discovered. Storytelling is a familiar and accessible form of communication with children and adults around the world (Bell 2009, p. 35). True stories are presented as a means of interpretation by archaeologists and heritage managers through various forms. Archaeologists and heritage managers have the complex task to learn and evolve and to keep telling stories, “…to re-examine many of [our] legends, historical records, and archaeological discoveries, and thereby to peel away layers of inaccuracies and sift through centuries of misconceptions” (Coombs 2004, p. 12). By thinking outside the box and reaching out to the public, archaeologists and heritage managers are not only sharing facts, but also sharing stories that connect audiences with their past and their present as well as encouraging them to contemplate their future. Storytelling, just as the interpretation of archaeology, “attempts to deal with the unintended, the subconscious, the worldview, and mindsets of individuals (i.e., their humanistic values) as reflected in the sites, features, and artefacts left behind” (Jameson 2005 in Jameson 2007, p. 9).

Storytelling is one approach to interpret maritime archaeology and submerged cultural heritage sites to audiences, and this can be achieved in a variety of ways, using an assortment of media. Archaeologists and heritage managers have attempted various strategies and approaches to interpret maritime archaeological resources, and to share their related stories with the public. *In situ* maritime resources have been utilized to promote dive tourism, all the while educating divers and preserving the resource. Maritime heritage trails, underwater archaeological preserves and shipwreck parks are all proven *in situ* methods for promoting public access to maritime cultural sites for divers (Green 2004, p. 376; Leshikar-Denton & Scott-Ireton 2007, p. 64; Nutley 2007, pp. 35-6; Scott-Ireton 2007, pp. 21-2; Watts & Knoerl 2007, p. 224). However, divers represent only a small percentage of the population. Although the exact number of
active divers is unknown, a study (Davison 2007) suggested that there were 1.2 million divers, plus or minus 15 percent, actively diving in the United States in 2006. Considering that scuba diving is not a cheap recreational activity, it should also be stressed that the average scuba diver usually tends to be white, educated and upper class. Therefore, other strategies to interpret submerged cultural heritage must be implemented to engage terrestrial or non-diving audiences. This engagement may be accomplished through different and newly developed forms of media.

The gradual integration of digital media, rather than traditional media has meant that the interpretation of submerged cultural resources has become an interactive experience, conducive to audience participation. Traditional media consists of communication and expression techniques that existed before the age of computers. Digital media is a broad term, which encompasses a wide range of traditional media such as images, film, music, spoken and written word, but whose interactive nature stems from its computer-enabled manipulations (Hermann 1997, p. 67). Progressively, museums around the world have been incorporating digital media into their displays, and using this technology to engage audiences. These practices are discussed in light of the New Museology Theory (Vergo 1989).

Museum theory is the study of the material object as the focus of exhibition and interpretation strategies, and is an accepted element in museums and for historic preservation (Macdonald and Fyfe 1996; Henderson and Kaeppler 1997). New Museology Theory addresses dissatisfactions with the ways in which museums were regarded and presented in the past. New Museology Theory is the study of museums as societal components that draw from and contribute to community identity (Vergo 1989; Bennett 1995; Weil 2002; Anderson 2004). This is of particular importance when considering in situ maritime cultural resources as museums in non-traditional settings, and also in recognizing how these submerged sites are interpreted for non-divers.

Digital media and the uses for this rapidly-evolving technology in both traditional museum settings and non-traditional arenas is discussed in this thesis. The introduction of these new technologies has inadvertently led to significant changes in the way museums perform their functions as well as in the way they are perceived by the public.

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1 Active is defined as a diver participating in a minimum of five dives per year.
This thesis examines the New Museology Theory in light of the latter information and addresses how digital media has influenced interpretation strategies in museums today. Specifically, this research discusses how digital media has led to a change in audience expectations of museums and how exhibits are interpreted and presented to the public. It also considers how the introduction of digital media has inevitably enabled audiences around the globe to have access to information about submerged cultural heritage sites without ever having to leave the house.

**Problem Orientation**

The public interpretation of submerged cultural resources is important. McCarthy (1983) recognized early on that “the archaeologist must explore ways and means of preserving and presenting wreck sites to the public… we must be prepared to ‘show it’ to all walks of life, to professional people, labourers, school children, politicians, the unemployed and the handicapped.” Although archaeologists and cultural heritage managers realize that the public interpretation of submerged cultural heritage sites is important, outreach efforts usually focus in and around diving audiences. Sometimes these approaches happen to include a more diverse audience such as the non-diving public, but usually these initiatives are not specifically intended to cater to the needs of other groups. Perhaps the reason for the lack of balance in public interpretive approaches stems from the fact that maritime archaeology is still in its infancy.

The management and interpretation of submerged cultural heritage sites is still a relatively new field. Only within the last thirty years have archaeologists and heritage managers looked beyond the water’s edge and striven to change the public’s perception of underwater cultural resources, emphasizing education and preservation versus treasure hunting and souvenir collecting (Hannahs 2003, p. 14). Since maritime archaeology is a relatively new discipline, the interpretation of submerged cultural heritage sites has largely been a result of initiatives based on trial and error.

Few scholarly publications exist which specifically discuss the management and public interpretation of submerged cultural resources. These publications have only started to become apparent within the last decade or so. Published works include two books of edited papers dealing with the management and interpretation of underwater
archaeological resources (Spirek and Scott-Ireton 2003; Jameson and Scott-Ireton 2007), as well as a limited number of contributions in the form of conference proceedings, papers in edited volumes, and journal articles (Alves 2006; Bell 2009; Bernier 2006; Broadwater 2006; Castro and Fitzgerald 2006; Elkin 2006; Firth 2006; Garrett 2007; Gribble 2006a, 2006b; Guérout and Veccella 2006; Hamilton 2006; Harris 2002; Jeffrey 1987, 1990, 1993, 2003; Johnston 2006; Keith 2006; Leshikar-Denton 2006; Leshikar-Denton and Luna Erreguerena 2008; Luna Erreguerena 2006; Lynn Hall 2006; Manders 2006a, 2006b; McCarthy 1983; McCarthy and Garratt 1998; Nutley 2006a, 2006b; Punchard 1990, 1992; Ringer 2006; Smith and Couper 2003; Scott-Ireton 2006; Staniforth 1993, 1994, 2006; Stanley 2006; Strachan 1995; Van Tilburg 2006; Varmer 2006; Viduka 2006). These publications explore management and interpretive endeavours in programs around Australia, Canada, and the United States and other parts of the world. They offer examples of interpretive strategies attempted in their respective programs. These publications also uncover how divers and non-divers have received these interpretive approaches.

An important contribution to the field of study was Scott-Ireton’s 2005 PhD research, which created a theoretical framework for creating in situ maritime heritage attractions that were accessible to the public. This work draws from previous attempts to preserve and protect maritime heritage sites to provide quality public interpretation and outreach programs.

Of the aforementioned publications, none specifically discuss interpretation strategies catering solely to non-diving audiences. Furthermore, only a handful explicitly explores the use of digital media to interpret submerged cultural heritage sites for the non-diving public (Dermody and Mires 2007; Satchell 2008; Watts and Knoerl 2007).

While significant progress has been achieved by way of public outreach and interpretation of submerged cultural resources for divers, these same efforts have not been reciprocated to give non-divers the same benefits. Most interpretive programs are designed specifically for divers. At times, there is some overlap in the design of a program, which allows for non-divers to also enjoy the interpretive materials; however, signage placed along a shore-based trail will certainly not give viewers the same
experience as that of divers who are able to access the three-dimensional qualities of a wreck and experience the underwater environment. Divers are able to gain a better perspective of the dimensions of a wreck, its construction, and also an understanding of how the vessel may have sunk. Divers are also able to witness individual details on a wreck site, such as possible burn marks, damaged areas that may indicate the cause of sinking, individual fasteners, as well as the vessel’s positioning on the seabed. These elements could easily be overlooked when interpreting an overall site for the public on land. There is only so much information that will fit on a shore-based sign or exhibit.

![Figure 2. The shore-based signs placed along the Port Elliot Maritime Heritage Trail in South Australia offer limited interpretation to non-divers who do not get to experience the three-dimensional qualities of the underwater world (Photograph by author).](image)

This thesis argues that theoretical concepts from the New Museology can be applied to the management and interpretation of submerged cultural resources, more specifically, that digital media can be used to enable non-divers access to sites once thought intangible to them. It also acknowledges that it is possible to develop interpretive strategies specific to non-divers that can be both entertaining and educational.
Research Questions

This thesis endeavours to answer the following fundamental question:

- How effective have the efforts of archaeologists and cultural heritage managers been in interpreting shipwrecks and other submerged cultural heritage sites for the non-diving public?

This thesis also aims to provide answers to the following secondary questions:

- Is the use of digital media an effective strategy for interpreting underwater cultural heritage sites for non-divers?
- What digital media have archaeologists and cultural heritage managers used to interpret submerged cultural heritage sites for the non-diving public?
- Are the financial and human resources available to archaeologists and heritage managers for the implementation of public interpretation programs using digital media?

Case Study: The WWII Invasion Beaches Underwater Heritage Trail & 3D Photography

Saipan, a Pacific island in the Commonwealth of the Northern Mariana Islands has a wealth of underwater archaeological remnants from WWII. The Battle of Saipan (1944) left behind an assortment of submerged shipwrecks, landing vehicles, tanks, aircrafts and other miscellaneous hunks of metal. With an American Battlefield Protection Program Grant from the US National Park Service, a team of maritime archaeologists surveyed and mapped these WWII sites for inclusion in a WWII Underwater Heritage Trail.

This underwater heritage trail, which was to be completed at the end of 2010 (McKinnon 2010, pers. comm.), is the object of a case study for developing digital media in an effort to engage a non-diving audience. The sites comprising the trail were photographed as anaglyph images, and transformed into stereoscopic (3D) images for public interpretation. These images can be displayed in museums, local displays, on the Internet, in books, in documentaries, movies and on CD-ROMs. The three-dimensionality of the photographs is believed to be a dynamic approach to interpreting submerged cultural heritage sites that non-divers can appreciate. This approach was
inspired by the recent revival in the popularity of 3D photographs and blockbuster movies in the media. Additionally, 3D gaming and 3D televisions are now available for private use, as well as some 3D digital cameras, which have adopted a glasses-less system.

Figure 3. Stereoscopic (3D) image of Emily seaplane wing and debris, Saipan, CNMI (Photograph by author).
Significance of Research

This research is significant for a number of reasons. To begin with, little research has been conducted to date discussing the importance of digital media to the public interpretation of submerged cultural resources, especially for non-divers. Most archaeologists and cultural heritage managers understand the importance of publishing articles and making their research available to the public in some way. However, most “are not trained to be good storytellers.” In fact, Young (2002, p. 240) suggests, “they are trained to be bad storytellers, which is why so many manuscripts… are bone dry and bloodless.” Only a certain kind of public will respond to and be interested in scholarly reports. This is why alternate forms of interpretation must be explored to reach a more substantial audience. Digital media is believed to not only make the interpretation of archaeology more dynamic and interactive for the public, but more specifically, it can make submerged cultural heritage sites more accessible to non-divers.

This thesis reviews previous and current attempts made by archaeologists and cultural heritage managers in working with digital media. In order to communicate the importance of shipwrecks and other submerged cultural heritage sites for terrestrial and non-diving audiences, research into the current uses of digital media and its potential for interpretation is crucial since a number of benefits will be achieved. This research is important because digital media has the potential to reach mass audiences around the world, primarily through the use of the Internet. Furthermore, with the enhanced use of digital media there is the potential to share and exchange ideas and materials that will enhance the way in which archaeologists and heritage managers are able to communicate with the public.

This thesis contributes to the scholarly literature and provides archaeologists and heritage managers with options to interpret their underwater cultural heritage. Drawing from theoretical concepts in the New Museology (Vergo 1989), this thesis investigates the newly emerging efforts that have tapped into the usage of digital media as a means of interpretation. This is significant because no such research has been dedicated to this purpose previously. By understanding theory, archaeologists and cultural heritage managers will better comprehend the needs of their public and will be able to cater to specific requirements.
This research is useful to archaeologists and cultural heritage managers, both new to the field and experienced, who are faced with the daunting task of telling stories and making history speak. The public interpretation of submerged cultural heritage sites is still a young discipline; hence, the use of digital media to interpret these sites is in its infancy as well. Technology has been developing at an astounding pace, and archaeologists and heritage managers are not necessarily equipped with the tools and technological know-how to create interpretive programs using these new digital forms. Further, the WWII Invasion Beaches Underwater Heritage Trail located in Saipan, CNMI (Micronesia), is used as a case study for interpretation of submerged sites through the use of stereoscopic (3D) photography. Through scholarly, theoretical and practical perspectives, this study will explore the potential of 3D photography to recreate the underwater world, which for non-diving audiences may seem intangible. This case study is significant because it presents a relatively simple and affordable strategy for archaeologists and heritage managers to display the three-dimensionality of submerged cultural heritage sites for the public, specifically non-divers.

This research presents an overview of current interpretive strategies in Australia, Canada and the United States and provides ideas for archaeologists and cultural heritage managers to try different approaches. Due to a range of variables, (i.e., submerged resources, location, audiences, financial resources, human resources, etc.) it is impossible to implement a standardized plan for interpretation. Thus, the interpretation of submerged cultural resources using digital media discussed in the following chapters should be regarded as examples of what can be achieved, but should also be adapted according to the varying needs of the individual program. While submerged sites such as tanks, airplanes and shipwrecks may appeal to a select audience able to dive these sites and experience them firsthand, it is the responsibility of archaeologists and cultural heritage managers to interpret and make the resource available to a wide array of people. This research is important because it is believed that the use of digital media to interpret submerged cultural heritage sites is valuable to audiences on both an international and local scale. Audiences around the globe should be able to experience the rich maritime heritage that is on offer without needing to get wet. This is possible through the use of the Internet and the distribution of documentaries on CD-ROMs and DVDs. This
research is also of value to the local people of Saipan whose submerged cultural heritage sites are now accessible to the non-divers as well.

**Chapter Outline**

Chapter 1 is an introduction to the subject and includes a problem orientation and the research questions, which guide the study. It also includes an introduction to the case study as well as a section on the significance of the research. Chapter 2 defines digital media and explores the New Museology Theory in relation to current practises. In Chapter 3, a methodology of the research techniques involved in this study is elaborated. Particularly, this describes how the literature review was conducted and which sources were used. Next, the WWII Underwater Heritage Trail in Saipan is presented as a case study for photographing underwater cultural heritage sites in 3D. This is followed by an outline of methodologies employed for this case study. This includes the preparation of materials prior to the fieldwork, data collection in the field, as well as the post-processing techniques involved in creating 3D photographs. Chapter 4 reviews the creation of the first underwater archaeological preserves (Michigan, US, 1981) (Scott-Ireton 2005, p. 46), underwater heritage trails, (Rottnest Island, WA, Australia, 1981) (McCarthy & Garratt 1998, p. 127) and National Marine Parks (Fathom Five National Marine Park, Ontario, Canada, 1987) (La Roche 2003, p. 36). Current traditional approaches are reviewed in a table. This chapter also presents an overview of the current implementation of digital media used for the public interpretation of submerged cultural sites. These are also presented in a table. Programs in Australia, Canada and the United States are reviewed, looking at innovative approaches, failures and successful endeavours. Chapter 5 draws conclusions on the significance of this thesis, which contributes to the limited research and publications that have been achieved to date in the field of public interpretation of submerged cultural heritage management. This chapter also provides answers to the questions posed in this introduction and discussed throughout the chapters. It ponders future directions and research potential concerning the role of digital media in interpreting submerged cultural resources for the non-diving public.
Chapter 2
Digital Media and the New Museology

Maritime archaeologists and cultural heritage managers have yet to dive into the world of digital media. On occasion, certain programs have dipped their big toe into the pond, but generally speaking, no one has dared take the plunge and fully immerse themselves into the plethora of fast-changing ideas and technologies. Perhaps therein lies the problem. Digital media is continuously changing, growing, and improving. Technological breakthroughs occur regularly making it difficult to keep pace with the latest tendencies. It takes long enough for interpretive programs to be conceptualised, approved by the many levels of management, and created, that by the time they become a reality, they run the risk of already being yesterday’s news. On the other hand, creating interpretive programs using digital media have the potential to offer the public an entertaining and educational experience that is difficult to achieve through a static display. This chapter introduces digital media under its various forms and makes connections to New Museology Theory, is regarded as the underlying structure defining current museum practices (Vergo 1989). This chapter also explores how audiences’ changing expectations and the growth of heritage tourism influence the public interpretation of maritime cultural resources for non-divers.

Digital Media

Digital media refers to products and services available on digital computer-based systems, which respond to the user’s actions by presenting content such as text, graphics, animation, audio, etc. This content is known as digital information. There are four key attributes that define digital information and make it truly unique. Digital information is manipulable, networkable, dense, and compressible (Feldman 1997, p. 3). When this digital information is used in conjunction with a range of media, the results offer enormous possibilities to enhance and enrich the interpretation of the maritime cultural heritage experience.
The attractiveness of digital information is that it is infinitely changeable. From the moment digital information is created or captured in digital form to the moment it is delivered to its user and beyond, it can easily be changed. This is significant because manipulable information can be interactive information. This is a remarkable difference, which contrasts the traditional passive, static experience that characterises the analogue world (Feldman 1997, pp. 4-6; Thomas 1998, pp. 4-5).

Another important feature that makes digital information so appealing is its ability to be networkable. This simply means that information in digital form can be shared and experienced by large numbers of users simultaneously (Feldman 1997, p.6; Portnoff, Susbielle & Dalloz 2009, p. 40; Rudman, Sharples & Lonsdale 2008, p. 164). Networks can be used to connect a small number of individuals, but can also be much bigger to reach audiences globally. Within these networks, there is also the possibility for users to access digital information at the same time as other users, depending on the type of media used.

Information available in digital form is very dense, meaning its storage capacity is greater and more compact than traditional ways of storing data (Feldman 1997, pp. 6-7; Tallon 2008, pp. xiii-xix). An example of this would be to consider the space that is taken up by the printed volumes of the Encyclopaedia. This same collection takes up significantly less space when digitised and stored on a compact disc (CD). Not only does the Encyclopaedia take up less space, but also, the media on which it is available is portable, meaning the Encyclopaedias can be taken virtually anywhere. This pertains not only to text, but to graphics, images and video as well. If digital information is not compact enough as it is in its original form, it is possible to compress it and make it even more dense. The ability to make digital information compressible becomes important when handling large files and transferring them from one location to another. Once they have been transferred, they can be decompressed and used from the new location (Feldman 1997, pp. 7-8; Portnoff, Susbielle & Dalloz 2009, pp. 61-6). Certain types of media enable access to the digital information in its compressed form, thus allowing for increased storage on these devices. One such example is the ability to play music in .mp3 format, which takes significantly less space than a normal audio file.
Increasingly, devices are able to play .mp3 files in that format, rather than having to transform them into a more readily recognizable format.

Digital information can be accessed on a range of media. These devices include, but are not limited to computers, the Internet, CDs, digital video discs (DVDs), video games consoles, and portable media players such as .mp3 players, global positioning systems (GPS), cellular phones and smart phones, personal digital assistants (PDAs), laptop computers, etc. (Portnoff, Susbielle & Dalloz 2009, pp. 59-60). These digital media devices are accessed daily by people around the world. Many people in Australia, Canada and the United States own at least one of these digital media players, or have access to one of these devices through their place of work, academic institution, family members, or friends. Not only do these devices serve as communication tools, they can also provide pleasure in the form of entertainment. Needless to say, digital media and the direct access to information in digital form has become an integral part of our daily lives and has certainly revolutionized the way in which museums are approaching their interpretive displays. A closer look into current museum practices and New Museology Theory is necessary to understand how archaeologists and cultural heritage managers approach the interpretation of submerged cultural heritage sites for the non-diving public.

**The New Museology and Non-Traditional Museums**

**History and Theory**

The concept of museums as establishments has evolved immensely since the European Renaissance when travellers and explorers showcased their findings in cabinets of curiosities. These collections belonged to men whose power and wealth permitted them to engage in such pursuits. The collections they amassed were of every kind imaginable: works of art, artefacts, antiquities, scientific instruments, minerals, and fossils, human and animal remains, etc. (Vergo 1989, p.2). Cabinets of curiosities could comprise a single room in a house or could have been so extensive as to be housed in an entire building. The collections were places to study a variety of things, but were also a
symbol of wealth, power and privilege in society. Two notions remained as the underlying philosophy guiding museum practice in the first public establishments to be opened, a philosophy that prevailed for decades. It was not until the New Museology Theory was introduced that museums started changing in the way they are perceived.

The New Museology Theory studies museums, their history and underlying philosophies. Moreover, New Museology Theory examines the various ways in which museums have established and developed in their role as an educational mechanism under social and political pressures (Vergo 1989, p. 1). Museums are spaces for transmitting messages that can be powerful tools for changing or reinforcing public opinion simply because of the authoritative and legitimising status museums hold (Macdonald & Fyfe 1996, p. 5). The very nature of what a museum is, what it should be and what it represents as well as the kind of museum it is, has been changing in definition (Vergo 1989, p. 41). Eco-museums, museums in the sea, and even museums without walls have increasingly been recognized as ‘museums’ because of the range of activities in which they are involved, and the messages they wish to communicate with the public. Several studies (Addyman & Garner 1984; Corsane, Davis, Elliott, Maggi, Murtas & Rogers 2007; Davis 2005; Prentice 2005; Richter, L.K. 2005; Scott-Ireton 2005) have successfully argued that museum theory could be meaningfully applied to the management of in situ maritime cultural resources and other types of open-air museums to be interpreted for public education and enjoyment. This thesis further argues that museum theory and current practices can be applied to the interpretation of submerged cultural heritage sites to enable access to non-divers by using a range of digital media.

The first digital media introduced into museum spaces occurred as early as the 1960s. One of the first projects to emerge came in 1963 from the Smithsonian Institution’s National Museum of Natural History. The Automated Data Processing (ADP) Committee formed a project known as SELGEM, which stood for Self Generating Master. SELGEM was essentially a database, which used text data fields delimited by numeric tags and special characters. Over the next two decades, subsequent museum institutions started using this database to manage their collections (Jones-Garmil 1997, pp. 35-6). Over the next two decades years, museums continued to
develop and implement databases to manage their collections. Another example, in 1972, the National Inventory Programme (NIP) began in the National Museums of Canada. NIP was created to manage national inventories of Canadian heritage, both in humanities and the natural sciences, as a response to the UNESCO Convention on Protecting Collections (Jones-Garmil 1997, p. 38).

In 1977, the Apple computer was invented and the era of personal computers commenced. While it took some time before the personal computer found its way into museums (as is the case with many significant advances in technology), once it was adopted, it revolutionized the way in which collections were managed and how new information was recorded (Jones-Garmil 1997, p. 39).

The 1980s brought exciting changes to museums as many new technologies were introduced. In 1981, the IBM PC was introduced and a range of software specific to museum applications was subsequently developed for use on the IBM and Apple personal computers (Jones-Garmil 1997, pp. 41-4). From this time, museums continued to push forward, using the newly introduced technologies to experiment on a variety of levels, with text and images. By 1995, the Internet was introduced and instantly became flooded with World Wide Web pages; a significant contribution to public outreach was made by museums posting their sites online (Jones-Garmil 1997, pp. 47-51).

Many of the trends seen in museums have resulted from advancements in technology. “Computing is no longer the exclusive realm of military, government, and big business. It is channelled directly into the hands of very creative individuals at all levels of society, becoming the means for creative expression in both its use and development. The means and messages of multimedia will become a blend of technical and artistic achievement. Consumer products will be the driving force” (Negroponte, in Jones-Garmil 1997, pp. 48-9). At the basis of the ongoing shift present in museums is the constant change existing in today’s society. We are a consumer-driven society, exposed to multiple kinds of media every day. Museums are simply keeping up with society’s developing trends in hopes to continue welcoming audiences to visit their institutions, which in most cases continue to generate a profit (Filippini-Fantoni & Bowen 2008, p. 81).
Exhibition and Interpretation

Museums now have more choices than ever to present cultural heritage in exciting ways by using digital media. These new technologies are causing significant changes in the way museums perform their functions and in the way the public perceives them. Digital media transforms the interpretation of objects and cultural heritage from an ‘object-based’ focus to a ‘narrative-based’ structure (Besser 1997, p. 161). Storytelling is at the forefront of this movement, whereas in the past, the object would have been the primary focus.

Personal handheld audio guides are a popular addition to the museum experience. The trend is towards personal relevance and interpretations, interactivity, and easy access and control of content. These devices accomplish just that. The user is able to select which stories are interpreted, and which ones can be skipped (Portnoff, Susbielle & Dalloz 2009, p. 59; Tallon 2008, p. xiv). Handheld devices are available in many forms, and although many of them have similar characteristics, each one has its own unique functionality. These handheld technologies can include mobile phones, digital cameras, mp3 players, and PDAs (Portnoff, Susbielle & Dalloz 2009; pp. 59-60; Tallon 2008, p. xviii). As the range of Apple products (iPod, iPhone, iPad, etc.) began to be used by the public, these devices also quickly became adopted by museums as a vehicle to deliver podcasts and audio tours over the Internet (Dowden & Sayre 2007, p.36).

Computers, CDs, and DVDs are other ways museums can use digital media to create media-rich exhibitions. This form of media combines images, text and sound, to create comprehensive and interactive displays. These devices can present films, video loops, and even animations integrated into a display (Semper 1998, p. 122). Most viewers recognize “that computers and CD-ROM technology can provide choices in terms of the depth of information presented, as well as what is presented and, in many cases, how it is presented” (Dierking & Falk 1998, p. 66).

The Internet is viewed as an “important amplification” (Seid Howes 2007, p. 67) to the educational visions of museums. Internet websites can be used to research, learn, teach, socialise, participate, shop, plan, and/or for entertainment. An Internet website is not designed to supplement the museum experience, but rather to complement and
elaborate on the experience. The museum and the Internet share a fundamental goal – providing the public with easy access to information. Internet websites can provide dynamic and interactive learning experiences because they have the capacity to display text, images, audio and video, as well as graphics and animations. The creation of graphic user interfaces makes it possible for users to operate many computer applications with minimal training. This holds true for the Internet and users of the World Wide Web. “When interfaces are easy to use and the cost of information is not expensive, users will explore all kinds of new information resources” (Besser 1997, p. 158). Often websites have links to other websites, and thus can unfold a chain of serendipitous discoveries on the subject that was originally researched. Furthermore, the Internet allows users to bring objects and sites into their personal spaces, and decide when they want the interaction to take place (Besser 1997, p. 154). A visit to the museum would be controlled by the confines of the hours of operation and personal schedule. The Internet enables audiences to research and discover the things that matter to them, on their own schedule.

Social-networking sites such as MySpace ©, Facebook ©, and Twitter © are popular forums on the World Wide Web. These sites represent a shift in emphasis from the “Internet as a collection of pages to the Internet as connections between people” (MacArthur 2007, p.57). The user is no longer simply a ‘viewer’, but has the freedom to express thoughts, post images, video and other content that will be viewed by others around the world. Other popular sites on the Internet that have made communication and sharing ideas easily accessible to the general public have included Wikipedia ©, as well as endless Blogs and discussion forums related to an abundance of topics. These avenues all have the potential to be exploited by archaeologists and cultural heritage managers to engage diving and non-diving audiences in discussions about submerged cultural heritage.

Edutainment

The term edutainment was coined as early as the 1970s when National Geographic produced a series of documentaries for the Society (Brittain & Clack 2007, p.22). Much like documentaries, museum exhibits can use digital media to enhance a
display by using entertainment to attract and maintain its audience, all the while incorporating deliberate educational content and meaningful messages. The audience member is an engaged participant who is drawn into a subject as the result of an interactive and dynamic experience (Brittain & Clack 2007, p. 22; Falk & Dierking 2008, pp. 23-5). The public can retain so much more information through an edutaining experience, because it usually stimulates the senses. “People have preferred modes of perceiving and processing information; memory storage and retrieval are also highly idiosyncratic processes shaped to a large degree by a person’s previous experience, knowledge, feeling, and physical well-being” (Dierking & Falk 1998, p. 59). What this suggests for museums and those responsible for designing enjoyable learning experiences for the public is that techniques maximising choice should be explored. Edutainment through the use of digital media can fulfil this goal.

Edutainment may seem to be a virtuous concept to archaeologists and cultural heritage managers interpreting for the public; however, a session entitled ‘Technology Across the Divide: State of the Art Tools for Terrestrial and Marine Archaeologists’ held at the Society for Historical Archaeology Conference at Amelia Island, Florida in January 2010 made it clear that managers are still undecided about the term and its implications. The opinions exchanged by the numerous presenters were split. While some managers emphasized that their role as interpreters was not to entertain the public, others reinforced the theory that it is important to have a balance between education and entertainment when presenting archaeological resource materials. One presenter (Allen 2010), promoted the use of YouTube © as a way for archaeologists to start making informed decisions about their projects while edutaining the public. Archaeologists at Heritage Victoria have linked photographs they uploaded to Flickr © to their own website (Heritage Victoria 2010). This strategy enables Heritage Victoria to publish a greater number of photographs onto the Flickr © website than their own, and it also makes their work available to a greater number of people who may not be familiar with the Department. Managers still have options of what they want to present to the public and how they want that information shared. The reality is that the public is expecting to receive this information, but is anticipating to be entertained as well.
Changing Audiences

Managers in museums today have the daunting task of interpreting for a range of audiences. The best museums will present a variety of interesting material that appeals to different age groups, education levels, personal interest, and technical levels. Audiences expect to be mentally, and perhaps even physically engaged by what they see, experiencing a personal connection with the objects, ideas, and experiences displayed. Audiences visiting museums in groups expect a shared experience, allowing everyone to exchange and communicate their knowledge (Dierking & Falk 1998, p. 57). Audiences expect more from their museum experience seeing as they are subjected to ‘more’ in their personal lives. They expect a dynamic and interactive experience that will result in educational and entertaining benefits.

The Internet is being used more and more for what it was originally intended: data sharing and collaboration. A range of resources is available on the Internet and there should be something to cater to the desires and diverse tastes of changing audiences who are demanding more. Most of the websites reviewed in this study included educational resources that were balanced with some form of entertaining media. This is the trend we are heading towards. Edutainment is not a concept of the future. It is here; it is now. Not only do the needs and wants of audiences keep changing, but the technology keeps changing as well. Many people own some form of personal handheld audio device. This could be a mobile phone, a digital camera, mp3 player or Apple product. More than likely, audiences will provide their own handheld devices and the content for these will be available for download from the Internet. Of course, since so many different systems exist, a way to make content standardised and accessible across the board would be fundamental.

Global Audiences

The Internet is an exciting form of media because it enables global communication. Global networks can be created, connecting audiences from different countries, enabling almost unlimited communication (Hermann 1997, p. 65; Portnoff, Susbielle & Dalloz 2009, pp. 27-28). Not only is it possible to communicate with audiences worldwide, but also museums have to take into consideration that they are
interpreting and catering to the expectations of a diverse public. Audiences from a range of backgrounds will have access to museum websites; therefore, it is important that these sites be mindful of different cultures and the messages they present. Another important point to be made is that audiences accessing these websites can be of any age; therefore, it is in the museum’s interest to consider who the audience is and for whom they want to interpret.

The Internet has proven itself as a tool, which can enable audiences around the world to share data and communicate with one another. Accessibility to information via the Internet is easier than ever. The online Museum of Underwater Archaeology (MUA) (www.uri.edu/mua/) is a great example of how people from all over the world can communicate and share knowledge and data through a common interest. Recently, a Postgraduate Student from the University of Otago, Matthew Carter, posted his research conducted with the Wisconsin Historical Society on the wooden canaller Walter B. Allen to the MUA website. Within a couple of weeks, his research journal had been viewed over 2000 times from people in 23 different countries (Matt Carter 2010, pers. comm.). Digital media enables global interaction and interactivity amongst its users.

Figure 4. The Museum of Underwater Archaeology provides archaeologists, cultural heritage managers, students, and the general public with the opportunity to publish their research on its website to be shared with people around the world (Photograph courtesy of Museum of Underwater Archaeology).
Heritage Tourism

Many motives exist to travel, including the desire to experience the sun, surf and sand of a destination, or merely the need to escape the home environment. Factors influencing the travel destination can include the scenery and climate, budget, but also purpose for the trip. Culture ranks high on the list when it comes to reasons why tourists select certain destinations over others (Sayers & Spennemann 2006b, p. 375). Heritage tourism is on the increase worldwide, focusing on sites, sights, museums, and cultural experiences such as festivals and traditional communities (Spennemann, Look, & Graham 2001, p. 30). Increasingly, tourists choose to have meaningful and educational experiences in order to experience a more profound appreciation of society and culture. Digital media, primarily the Internet, is a key resource for tourists considering visiting cultural heritage sites. “The role travel agents play in helping customers make travel decisions is declining and that of other sources is increasing, such as the World Wide Web…” (Sayers & Spennemann 2006d, p. 413). Potential tourists tend to conduct preliminary searches over the Internet before deciding whether or not to plan a trip to a certain heritage destination. Not only does the Internet enable future tourists to plan their trip in anticipation of future travel, but it also allows virtual visitors who cannot travel (for a variety of reasons) the ability to experience the cultural heritage sites as well. Ultimately, it is not possible to replace the physical experience of travelling to a site; however, digital media enables many cultural heritage sites as well as museums to be recreated for virtual visitations. Some virtual tours enable viewers to navigate through a 3D spatial reconstruction of a site. If all this is possible for sites located on land, why are archaeologists and cultural heritage managers not accessing this technology to interpret submerged sites for non-divers?

Discussion

Advancements in Digital Media

The digital media used to interpret submerged cultural resources for non-divers has evolved enormously in the last twenty years making it possible to do a myriad of
things that were never thought conceivable. The technology has evolved and in many cases, it has become much simpler to use. However, archaeologists and heritage managers have plenty to keep them busy without having to worry about how to achieve web coding, design, layout, and mastering numerous other technologies available (Watts & Knoerl 2007, p. 233). There are specialists who make a living from creating media and making it work. Collaboration with these specialists is essential to make digital interpretation a success. In the case of the Museum of Underwater Archaeology, Managing Director Kurt Knoerl was convinced that as the technology became easier and more accessible, archaeologists and heritage managers would take advantage of that to post their own online exhibits and blogs. This has not been the case. If anything, Knoerl attributes the consistency of people wanting to exhibit through his site to the fact that it is still easier to send off an email to MUA and attach a couple of images. It may also be a time and budget issue for many people. Bureaucracies that exist in universities and governmental agencies are often so slow or restrictive that it is easier to turn to the MUA to get things done in a timely manner (Kurt Knoerl 2010, pers. comm.).

Conclusion

If the public interpretation of submerged cultural resources is still in its infancy, then the interpretation of these resources through the use of digital media is still at the foetus stage. There has been some progress following with the evolution and rapid growth of technology; however, this growth has been due in large part to this sort of reaction wherein people see the effort and advances others are making and they want to share in it as well. In a way, archaeologists and cultural heritage managers are all waiting to see what others are going to come up with first before they go ahead and take the plunge with both feet. With the advances we have seen in technology over the last few years, it would seem that digital media should only become easier and more accessible to use. Inevitably, it will become a more common way to enable access to submerged cultural heritage sites for non-divers and audiences in general.
Chapter 3

Methods and Sources:
Digital Media and the Interpretation of Submerged Cultural Heritage

This chapter outlines the methodologies employed to determine what approaches have been taken in the past as well as the present to interpret submerged cultural resources for the non-diving public. Further, it introduces the Battle of Saipan (1944), providing a brief historical background. This chapter also presents the methods used for the case study, which describes the creation process for 3D photography of WWII sites for the WWII Invasion Beaches Underwater Heritage Trail in Saipan, Commonwealth of the Northern Mariana Islands. This section closely examines the steps taken prior to commencing the fieldwork, data collection in the field, as well as the post-processing of data required to complete the creation of the 3D images. Finally, this chapter examines at the limitations that were present during the literature review and historical research, as well as those encountered during the fieldwork and post-processing of the data.

Literature Review & Informal Conversations

To better comprehend past and current approaches used to interpret submerged cultural heritage sites for the non-diving public, an extensive study of literature was undertaken. Since few publications exist pertaining to the public interpretation of submerged cultural resources, and even fewer specifically target the use of digital media, other sources were utilized as well. In particular, the Internet proved to be an important tool, enabling some access to a variety of interpretive programs administered by a range of agencies. Journal articles, newspaper articles, blogs, and an assortment of government interpretive materials in the form of pamphlets, brochures and signage have contributed to this literature review. To fill the gaps in the literature, informal conversations with archaeologists and heritage managers in Australia, Canada and the
United States took place in the shape of emails, phone conversations, or face-to-face interaction.

The research for this thesis builds on Della A. Scott-Ireton’s 2005 PhD dissertation, which used the theories of museology, resource management, heritage tourism, and education and their application to the management and interpretation of museums in non-traditional settings. Her research created a theoretical framework for creating in situ maritime heritage attractions, which are accessible to the public. Although some of the interpretive programs discussed in the dissertation touch upon the use of digital media, it does not specifically explore the use of digital media in interpretation for non-divers. This thesis uses Scott-Ireton’s research as a launching point to gather information on what precisely has been achieved and can be achieved to enable non-divers and audiences worldwide access to submerged heritage sites.

Two publications dealing specifically with the interpretation of submerged cultural resources are available at the present time. These two edited volumes, Submerged Cultural Resource Management: Preserving and Interpreting Our Sunken Maritime Heritage (Spirek & Scott-Ireton 2003) and Out of the Blue: Public Interpretation of Maritime Cultural Resources (Jameson & Scott-Ireton 2007a), proved to be very beneficial to this thesis’ literature review. These publications consist of multiple articles, which contribute current ideas, research and scholarship associated with the interpretation of maritime cultural resources. Additionally, these publications include contributions from archaeologists and heritage managers working on and creating programs in Australia, Canada and the United States.

As not all programs were discussed in these publications, and also because it was imperative to this research to obtain the most recent data available, Internet websites pertaining to the individual programs were also consulted. The information obtained from these websites was very useful in gaining a more complete account of the interpretive programs to date. However, not all programs had comprehensive websites describing their state or province’s interpretive approach to maritime cultural heritage. Inevitably, this meant that informal conversations with archaeologists and cultural heritage managers had to take place to provide a thorough account.

The informal conversations with maritime archaeologists and cultural heritage
managers started in 2009 and continued to the time of this writing. They took place with professionals in Australia, Canada, as well as the United States. Some of these conversations were achieved through face-to-face verbal communication, some through emails, and others through telephone conversations. These exchanges not only helped to create a more comprehensive account of current interpretive strategies, but some professionals shared their visions for the future and indicated forthcoming plans for project development. Written consent was received from all the archaeologists and heritage manages to cite personal communications in this thesis. The permissions to use personal communications are included in Appendix C.

In addition to the review of individual chapters in the two edited volumes, Internet program websites and informal interviews, a number of scholarly journal articles, blogs, and unpublished conference proceedings written by heritage professionals were consulted. For example, a newspaper article from La Tribune (Bombardier 2010, p. 5) in Sherbrooke, Québec, describes a ‘world premiere’ initiative for interpreting cultural heritage sites and submerged archaeological sites using the iPad.

Vergo’s The New Museology (1989) was consulted, as well as a number of publications dealing specifically with the integration of digital media for museum interpretation. It was found through these publications that it is possible to take museum theory and apply it to non-traditional museums such as shipwrecks and submerged aircrafts and tanks. The sources consulted in multiple edited volumes on the subject provide the underlying theory transferable to museums in the sea.

Along with the many documents reviewed to create a broad picture of interpretive strategies in Australia, Canada and the United States, a number of other sources were consulted, which explore the history and creation of 3D photography (Green 2004; Ray 1999), as well as the history of Saipan and the Battle of Saipan, nearing the end of WWII (Carrell 1991; 2009; CNMI Division of Historic Preservation 1996; 2004; Hezel 2000; Russell 1994; SEARCH 2008). Primarily, sources consulted for underwater photography and creation of 3D photographs were found in Maritime Archaeology: A Technical Handbook (Green 2004) as well as in Scientific Photography and Applied Imaging (Ray 1999). Countless conversations with digital imaging professor Tim Doherty from Bishop’s University in Lennoxville, Québec, contributed to the fine-
tuning of the equipment necessary for the creation of 3D photographs as well as the actual conception of these images using © Adobe Photoshop CS4. As well, conversations with underwater photographer Patrick Baker, from the Western Australian Museum’s Shipwreck Galleries, contributed to the background research of stereoscopic images. His employment at the Shipwreck Galleries over the last 40 years has included work with stereoscopic imagery, photogrammetry, and scientific photography. He has worked with a range of equipment, and has even built his own underwater camera housings.

Stereoscopic (3D) Photography of the WWII Invasion Beaches
Underwater Heritage Trail, Saipan, CNMI: A Case Study

Saipan: A Brief Historical Background

The island of Saipan is the second largest in the Marianas archipelago. It measures roughly 22 kilometres long and 8 kilometres wide (Russell 1994, p. 1). Archaeological evidence on Saipan suggests that the Indigenous Chamorros have resided on the island for nearly 4000 years (Russell 1994, p. 1). Over the years, Saipan has seen occupation from a number of other countries. The Portuguese-Spanish explorer, Ferdinand Magellan discovered the archipelago in the early 1500s and claimed the island chain for the Spanish crown. An important Carolinian population established itself on Saipan in the early 1800s, seeking refuge from the Caroline Islands. Near the latter end of the 1800s, the Spanish-American War broke out in the Marianas, during which the U.S. claimed Guam, the largest island in the archipelago. The Spanish quickly sold off their remaining assets in Micronesia, which resulted in German control of the Marianas with the exception of Guam. The Germans governed Saipan from 1899 to 1914, when the Japanese captured German naval vessels and took occupation of Germany’s island possessions (Russell 1994, pp. 2-6).
Although the Marianas remained unscathed during World War I, in 1921 the League of Nations granted Japan occupation of the Mariana Islands (with the exception of Guam), as well as the Caroline, Marshall and Palau Islands (SEARCH 2008; Russell 1994, p. 4). For the next two decades, Japan focused on commercial development of the islands and set up large sugar plantations and refining mills, which operated on Saipan, Tinian, and Rota (CNMI Division of Historic Preservation 1996, p. 3). In 1941, the export of processed sugar, alcohol and other products to Japan ceased at the outbreak of WWII. By 1944, the Japanese anticipated an attack by the U.S. Efforts to fortify the Islands were not sufficient, and after weeks of fighting, Saipan and the other islands in the Marianas fell to American troops. The Battle of Saipan claimed thousands of Japanese and U.S. casualties. Following the capture of the islands, Saipan and Tinian were transformed into airbases to support an American invasion of Japan. The Pacific war came to a sudden halt following atomic bomb attacks launched from Tinian in the summer of 1945 (CNMI Division of Historic Preservation 1996, p. 2; 2004, pp. 7-8).
Figure 6. Stereoscopic (3D) photograph of a Japanese tank left stranded at the foot of the Last Command Post on Saipan, CNMI. This constitutes an important stop for tourists wanting to experience heritage tourism sites on the island (Photograph by author).
In 1976, the U.S. Congress and then-President Gerald Ford, signed into law the creation of the Commonwealth of the Northern Mariana Islands to provide residents with self-government and U.S. citizenship (CNMI Division of Historic Preservation 2004, p. 8). This agreement entitles Saipan and the Commonwealth to engage in several federal programs, including those that involve the preservation, management and interpretation of terrestrial and submerged cultural heritage. Today, remains from the Battle of Saipan are scattered all around the island and in the surrounding water, and are a constant reminder of the painful history that took place there. Evidence of ruined buildings, bombed fortifications, pillboxes, battle sites, submerged shipwrecks, landing vehicles, tanks, aircrafts and other assorted sites are dispersed around Saipan (CNMI Division of Historic Preservation 1996, p. 3).

**Submerged Cultural Heritage Sites**

Since 1979, a number of submerged cultural heritage surveys and assessments have documented cultural sites in the waters surrounding Saipan. These surveys were conducted by multiple agencies, including: the Pacific Studies Institute on Guam 1979/1980, the National Park Service 1983, 1990 & 2009, the University of Guam’s Micronesian Area Research Center with the Defense Environmental Restoration Program 1984, Pacific Basin Environmental Consultants 1985, Pacific Sea Resources 1986, the National Oceanic and Atmospheric Administration’s Office of Response and Restoration 2001, as well as the Southeastern Archaeological Research, Inc. (SEARCH) 2008. The primary focus for each of these agencies (with the exception of Pacific Sea Resources) was to document and identify the sites located on the island and in the surrounding waters. Pacific Sea Resources, a treasure salvage firm, worked on the 1638 wreck of *Nuestra Señora de la Concepción* (McKinnon 2010b, pp. 7-9).

The most recent project undertaken is that of the WWII Invasion Beaches Underwater Heritage Trail, engaged by McKinnon, Flinders University. The project is funded through a grant received from Flinders University, the National Park Service’s American Battlefield Protection Program as well as Ships of Discovery and Exploration Research. Three field seasons took place over 2009-2010, measuring, photographing, videotaping, and documenting WWII sites in Tanapag Lagoon, which will be included...
on the underwater trail due for completion at the end of 2010 (McKinnon 2010, pers. comm.). The most recent field season was held in concurrence with the Flinders University Maritime Archaeology Fieldwork Practicum (ARCH 8109B) from 13-26 June 2010. Students from Flinders University, Texas A & M, and the Florida State University not only assisted in mapping and recording the WWII sites, but several students conducted their own research in Saipan to help satisfy the necessary requirements to obtain a Master’s degree in Maritime Archaeology. This chapter is a result of the research and stereoscopic (3D) site recording achieved on 12 submerged WWII sites in Tanapag Lagoon, Saipan. It analyses the data collected and critically discusses the results in relation to the theory and practical applications examined in earlier chapters.

Tourism Base and Heritage Tourism

Saipan, being a remote island in the heart of Micronesia, relies on tourism and heritage attractions to stimulate its economy. “Cultural tourism has been regarded as the panacea to cure the economic troubles of the Pacific Island communities, particularly of the Pacific micro-states” (Sayers & Spennemann 2006b, p. 375). A study conducted by Sayers and Spennemann (2006c, p. 388) revealed that in 2005, “…the Commonwealth of the Northern Mariana Islands (CNMI) hosted 443,812 visitors of which 63.2% were Japanese.” This same study also uncovered that the majority of tourists travelling to Saipan wanted to experience “sun and surf” and to enjoy a relaxing holiday in an exotic location. Visiting WWII relics also ranked high on the list, as 58.8% of the 720 respondents claimed to have experienced WWII sites on the island (Sayers & Spennemann 2006a, pp. 1-3). Few tourists travel to Saipan each year, and of these visitors, only a fraction have scuba diving qualification or an interest in WWII sites. Using digital media to interpret the submerged WWII sites around Saipan is an effective way to increase the number of visitors and to engage audiences worldwide.

Conception of the Project

The inspiration to conduct stereoscopic (3D) photography on the 12 sites of the WWII Invasion Beaches Underwater Heritage Trail came about following a guest
lecture by Wendy Van Duivenvoorde at Flinders University, whereupon she showed maritime archaeology students 3D photographs of sites that archaeologists at the Western Australian Museum’s Shipwrecks Galleries had worked on. The images presented that day sparked the idea to photograph a collection of sites in 3D that could be shared with and interpreted for non-divers. Few interpretive programs target specifically non-diving audiences; therefore, the stereoscopic photographs taken in Tanapag Lagoon are significant because they recreate the underwater environment and give non-divers access to the three-dimensional qualities of the wreck sites. The evolution of this technology from analogue to digital led to the reflection of how digital media has changed the way in which submerged cultural heritage sites are presented to the public, specifically for non-diving audiences.

The opportunity arose to join a team of archaeologists working on Saipan for two field seasons. The first field season took place in February 2010. Unfortunately, at that time, financial limitations and time constraints meant that the stereoscopic equipment required to commence the project was not available. The second field season occurred in June 2010. At this time, the stereobars had been designed and built, and a second underwater camera housing had been purchased. The fieldwork was able to go forth as planned.

This case study was used to examine how, by using digital media, theoretical approaches stemming from the New Museology can be applied to effectively interpret submerged cultural heritage sites for non-divers. The remainder of this chapter describes this case study.

3D Photography: A Case Study

Photography plays an integral part in underwater archaeology and can be an extremely practical method to record a site. It is important to differentiate between general photography for the purpose of illustrating a site, and specialized archaeological photography that focuses on specific features and can later be used for making site plans (Green 2004, p. 227). In the first instance, the composition needs to focus on a specific aspect of the work being conducted. For example, this could be a diver holding an artefact, or demonstrating how to record a site. Generally, a wide-angle lens should be
used to allow for a greater depth of field. In the latter instance, it is a good idea to use scales to illustrate the size and proportion of features on a wreck site. This type of photography can be used to achieve photomosaics of entire sites, or to create site plans later on (Green 2004, pp. 227-8).

It is important to plan a dive and decide ahead of time what images the photographer wants to achieve (Green 2004, p. 229). Archaeologists use underwater photography of submerged cultural heritage as a recording tool to make site plans, and also to monitor site deterioration in the future. Underwater photography is also used to interpret submerged cultural heritage sites for diving and non-diving audiences. A good underwater photograph can make a greater impact than any amount of words, especially since the underwater world is not familiar to everyone.

“Divers… are the only visitor group who fully experience the three-dimensional qualities of the aquatic environment” (La Roche 2003, p. 37). This set of ideas led to the conception of creating stereoscopic (3D) images as a means of interpreting submerged cultural heritage sites for non-divers. A case study on the wrecks constituting the WWII Invasion Beaches Underwater Heritage Trail in Saipan was used as a model to produce these 3D photographs. The following outlines the methodology involved in creating the 3D photographs that are discussed in the case study.

**Equipment Assemblage**

Before travelling to Saipan, thorough planning of the equipment necessary for stereoscopic photography was essential. Basic research was undertaken by consulting *Maritime Archaeology: A Technical Handbook* (Green 2004) as well as *Scientific Photography and Applied Imaging* (Ray 1999). These two volumes each contained sections specific to stereoscopic imaging and provided the framework and scientific knowledge to build a camera holder that would house two underwater cameras. The two cameras and their underwater housings had to be located and measured before the construction of this holder could commence because it needed to be custom-built. This author already owned one camera: a Canon PowerShot A640 (10.0 mega pixels) and its underwater housing. A second camera was borrowed: a Canon PowerShot A620 (7.1
mega pixels), and its underwater housing was purchased second-hand from eBay (since the model was discontinued and could not be found elsewhere).

Figure 7. Stereoscopic (3D) image of one of the propellers on the site of the *Emily* seaplane (Photograph by author).
The initial idea of building a convertible holder that could allow both horizontal and vertical photographs to be taken was dismissed because it would have been too complicated to construct, and more bulky to handle. After careful consideration, it was decided that two holders needed to be built: one holder to allow photographs to be taken horizontally, and the other holder to enable vertical photographs.

Stainless steel strips, along with stainless steel screws with plastic knobs, were purchased from the local hardware store. For the vertical holder, small pins were welded to the screws to facilitate manipulation of the screws that attach to the camera housing. All the screws used are 0.6 cm in diameter and were filed down to measure 3.6 cm in length. This was the maximum length the screw could be to attach to the inside of the camera housing and still fall flush against the holder frame. The plastic handles used on both of the holders were recycled from old shop tools and were screwed to the base of the holders. Craftsman Gaëtan Labrèque assisted with the welding of the screws and the plying of the stainless steel strips. Hair elastics were used to secure the screws to the individual holders so they would not be lost accidentally when the cameras were transferred from one holder to the other underwater. Ideally, for this type of stereoscopic photography, the cameras should have been distanced between 6 and 8 cm apart, which is the average distance between an individual’s eyes. This was not possible to achieve with the horizontal holder because of the width of the cameras in their underwater housings. On the horizontal holder, the closest the cameras could be to one another without touching was 16 cm apart. The cameras on the vertical holder were positioned 8 cm from one another. Because of the positioning of the cameras on their respective holders, it was believed that the cameras on the vertical holder would be more efficient for taking close-up stereoscopic images, whereas the horizontal holder would be more conducive to stereoscopic images taken further away from the subject. The screws did not have a locking mechanism; therefore, this meant that the cameras were free to swivel and be positioned as needed to focus in on the subject, in the same manner as a set of eyes would focus in on a given focal point. Each holder was tested on land with the cameras attached to ensure that the 3D effect could be achieved before the equipment was taken into the field.
Data Collection in the Field

The fieldwork took place from 13-26 June 2010, and coincided with the Flinders University Maritime Archaeology Fieldwork Practicum (ARCH 8109B), held in Saipan in the Commonwealth of the Northern Mariana Islands, Micronesia. Overall, twelve sites were photographed and surveyed in Tanapag Lagoon on the western side of the island. Eight of these sites were dived, and four were snorkelled. In total, 990 minutes were spent underwater photographing these sites.

The two cameras were not synchronized to fire simultaneously, thus triggering both cameras at the same time manually required a bit of practice. Both cameras’ white balance was adjusted during the first dive. This was done to ensure that both cameras would essentially have the same colour balance present within their images. Once the cameras were set up, taking photographs of the wreck sites was a relatively easy process. The conditions underwater during the first week of diving were such that the visibility was around 20 – 30 metres. Also, the sites dived were quite shallow, never exceeding 9 metres in depth. This meant that there was a significant amount of light penetrating the sites, making the task of photographing the sites rather simple. There was little current to fight against during the first week, which meant that buoyancy control and taking steady photographs was fairly easy as well. Depending on how many dives were allocated to each site, the cameras were either transferred from the vertical
holder to the horizontal holder mid-dive, or in-between dives. The task of changing holders underwater took approximately two minutes to complete. The spare holder was kept inside the pocket of the buoyancy control device (BCD) until the time came to transfer the cameras over. The process of transferring the cameras from one holder to the other was systematic to ensure that the ‘right’ camera stayed on the right side, and the ‘left’ camera stayed on the left. Once the transfer of cameras was complete, the spare holder was stored in the BCD again.

Even though the process of photographing wrecks in 3D was fairly straightforward, some problems were encountered along the way. When surfacing from the first dive, it was noticed that the camera housing had a small leak. The camera itself was not affected; however, the exact source of the leak was never discovered despite substantial testing. Flinders University had a Canon PowerShot A630 (8.0 mega pixels) camera that was congruent with the dimensions of the A620 that flooded. The lens of the A630 lined up perfectly with that of the A640, and the project was able to continue as planned.

At the end of every day, the camera holders and the cameras in their underwater housings were thoroughly rinsed in fresh water to avoid the corrosive build up of salt. Once the camera housings were dried, the cameras were removed and the photographs were uploaded to a computer. There the files were carefully labelled according to ‘right’ or ‘left’ images, and were then categorized according to wreck site.

The other situation to arise was the deteriorating visibility that eventually settled in during the second half of the fieldwork. This change in visibility restricted the depth of the images and meant that close-up shots were taken to achieve image clarity, rather than capturing entire features. Unfortunately, due to the limited period allocated to this field project, additional dives under better visibility were not possible during this trip.
Figure 9. The vertical stereobar holding the two Canon cameras in their underwater housings is shown here. This system was used to record the WWII Invasion Beaches Underwater Heritage Trail in Saipan, CNMI (Photography courtesy of D. Ulloa & D. McHenry).
Post-Processing

Once in the lab, it was possible to start creating complementary colour anaglyphs (3D images) from the ‘left’ and ‘right’ images taken during the fieldwork. This process was achieved using © Adobe Photoshop CS4. In Photoshop, the respective ‘left’ and ‘right’ images of the same photograph were labelled ‘left’ and ‘right’. It is essential that the ‘left’ and ‘right’ images do not become mixed up because the illusion of three-dimensionality would no longer be recognized when viewed.

The next step for creating complementary colour anaglyphs in this case was to resize the images. Because the two cameras used were not the same model, they did not take pictures in the same format. The ‘right’ images were taken with the A640, whereas the ‘left’ images were taken with the A630. This resulted in the ‘right’ images measuring 3648 x 2736 mega pixels, and the ‘left’ images measuring 3264 x 2448 mega pixels. It was not possible to change the size on the camera in the first place; therefore, it needed to be done when brought into Photoshop. It was decided that the ‘left’ image would be blown up to the size of the ‘right’ image, this way if the merged file was ever enlarged, it would not lose as much detail as a smaller file would.

Once the two images were the same size, they were merged into the same file. Once they were both within the same workable file, the opacity of the top layer was decreased to about 50% to allow the two images to be aligned. Obviously, they did not match up since they were taken from slightly differing distances and angles; however, the key was to match up a small area or a single point somewhere in the middle ground of the image. Everything in back of this point recedes, and everything in the foreground becomes three-dimensional. Once the two images are aligned, the opacity of the top layer was restored back to 100%.

The ‘right’ image is congruent with the red colour filter; thus the ‘right’ image, needed to be adjusted. Within this adjustment layer, there was a levels tab, which was selected. Within the levels tab the colour channels are accessible. The red channel was brought down to 0, and then a clipping mask was added to the ‘right’ layer for the change to register.
The same process was then applied to the ‘left’ image, only this time with the green and blue channels. Both the values of these channels must be brought down to 0. Once this has been completed, again, a clipping mask was applied to the ‘left’ layer.

The next step was to blend the two layers together to achieve one stereoscopic image. Accessing the blending options menu, and lightening the top layer achieved this. This enabled the bottom layer to show through and the blue and red halos became apparent around the object in the photograph. The final step was to crop the image so there were no longer any overlapping areas present in the image. Once all these steps were completed, images could be viewed and enjoyed through a pair of red/cyan 3D viewing glasses.

Figure 10. Stereoscopic (3D) image is being created in © Adobe Photoshop CS4. The colour filters for the ‘left’ image are being adjusted to 0 (Photograph by author).

Limitations in the Methodology

A number of limitations were encountered during the methodologies involved with this thesis. The first to arise was the fact that very few publications exist regarding the public interpretation of submerged cultural resources, and even fewer exist pertaining specifically to the interpretation of submerged cultural resources for non-
divers using digital media. The data collected is limited to the literary sources that were available and to the archaeologists and heritage managers who were approached.

Limitations were also discovered while photographing the WWII sites in Tanapag Lagoon. Unfortunately, the unpredictable tides can be attributed to the poor visibility encountered during the second week of the fieldwork. Time constraints and financial limitations did not allow for subsequent fieldwork to be continued at a later time. Continuing this project in the future is possible, although at the time of this writing nothing is planned.

After reviewing the completed 3D photographs and discussing at length with Patrick Baker, it became apparent that the equipment being used limited this project. The two Canon PowerShot cameras used for this project are excellent point-and-shoot cameras and take good photographs underwater; however, a project of this scope could have benefited from using professional equipment. At the very least, wide-angled cameras would have been greatly advantageous, as they would have enabled the images captured to reveal more depth and a greater scope. Realistically, access to this equipment could not have been achieved in time for this field project based solely on the fact that all expenses incurred were self-financed. If future work were to be undertaken on this project, collaborating with a professional photographer could be an option. Another option to upgrade the camera equipment would be to apply for a small grant to assist with this project.
Chapter 4
The Public Interpretation of Submerged Cultural Heritage:
Traditional Approaches, Digital Media and 3D Photography & Video

Why practise maritime archaeology in the first place? Of course there are several valid answers to this question, but at the core of this discussion lies the innate desire in people of all societies to connect with and appreciate heritage values that instil a sense of well-being (Jameson & Scott-Ireton 2007b, p. 1). “By examining the places where people lived and the traces left behind, archaeologists strive to discover the fabric of everyday life in the past and to apply this knowledge in seeking a greater understanding of the broader historical development of societies” (Jameson 2007, p. 9).

The values associated with the practice of maritime archaeology can be viewed as commemorative or associative benefits as well as an increase in our knowledge of history, which help to fill gaps in the historical record (McManamon 2002, p.31). Because such a wide range of people have a vested interest in the practice of maritime archaeology, it is important to consider a variety of strategies when interpreting for the public.

Maritime archaeological research has found its way into textbooks, museum exhibits, television documentaries, popular news articles, magazines, pamphlets, Internet sites, on interpretive panels placed along the roadside, and has also been interpreted in situ in the form of maritime heritage trails, underwater archaeological preserves, and shipwreck parks for the diving public. This chapter looks at traditional means of interpreting submerged cultural heritage sites in Australia, Canada, and the United States, and examines in depth the ways in which digital media are incorporated into these same programs.
Traditional Interpretation

Traditional approaches to interpreting maritime cultural heritage sites can be viewed as any method used in the past or present that does not involve the use of digital technology. Museum displays concentrate on the object and interpretation is strictly through the use of text and images. For underwater archaeologists, the focus for these traditional approaches has been to establish underwater archaeological preserves, shipwreck parks, maritime heritage trails, underwater museums, and sanctuaries, to protect and preserve the resources in situ, while still enabling diver access. These programs are usually interpreted specifically for divers using a variety of strategies that may include: underwater plinths, waterproof booklets or cards, as well as underwater markers and guidelines to help divers navigate a predetermined path. Other interpretive strategies that can be enjoyed by the non-diving population as well as divers include: land-based signage, predetermined cycling or pedestrian paths, glass-bottomed boat tours, submarine tours, canoeing and kayaking in shallow areas, museum displays, as well as television documentaries, and news articles. It should be noted that the non-diving public also enjoys some of the interpretive programs that are designed for divers. Non-divers can enjoy waterproof booklets and cards without diving. It also holds true that divers can participate in the activities designed for non-divers. The two are not mutually exclusive.

Scott-Ireton’s (2005) PhD research provides a comprehensive overview of the traditional interpretation approaches occurring in Australia, Canada, and the United States. While this research dates to 2005, a current review of these approaches can be found in Appendix A. This summary of traditional interpretation approaches combines Scott-Ireton’s research with a number of examples taken from papers published in the two edited volumes on the public interpretation and management of submerged cultural resources (Jameson & Scott-Ireton 2007a; Spirek & Scott-Ireton 2003). Web pages of government agencies as well as some avocational groups were reviewed for recent data collection. Furthermore, information obtained from heritage managers by way of informal conversations was also used to build on the existing knowledge that was
available of these programs. Table 1 provides an overview of these programs and the traditional interpretive approaches that have been implemented to date.

Figure 11. Photographic exhibitions in museums represent one of the traditional methods used to interpret submerged cultural heritage sites for the public. This temporary exhibit at the Australian National Maritime Museum in Sydney is of maritime archaeologists surveying wreck sites during the 2009 Wrecks Reef expedition (Photograph by author).

Digital Media

Considering that only a small percentage of the population is qualified to dive, and that some highly significant sites are too fragile or too dangerous to dive recreationally, alternative means of accessing these sites to cater to a larger, more diverse audience must be considered. Digital media may just be the answer. This section takes a closer look at the programs set forth by government agencies and
avocational groups in Australia, Canada, and the United States and focuses specifically on the ways in which digital media is used to interpret submerged cultural heritage for the non-diving public. Innovative programs have been established in a number of regions, and these successful approaches should serve as models for future interpretation.

The programs reviewed may have different interpretation strategies; however, the avenues taken to interpret the submerged cultural resources all stem from roughly the same paths. The Internet has been used by all of the programs reviewed and is regarded as a highly desirable way to interpret submerged cultural heritage for local and global audiences. These sites provide information for divers and non-divers. Several of the programs reviewed also chose to use social-networking websites Facebook © and Twitter © as public outreach tools. A variety of other digital media was also used to interpret submerged cultural heritage, but the main variable amongst the programs is the content they choose to make available to the public. Table 2 provides a detailed overview of the strategies used to interpret submerged cultural resources using digital media in Australia, Canada, and the United States. Only those programs employing digital media are discussed in detail. A list of all websites reviewed and discussed in this chapter can be found in Appendix B.
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**TABLE 2. Interpretive Strategies using Digital Media in Australia, Canada, and the United States**

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Australia

Interpretation efforts in Australia are diverse and vary from state to state. Each state is responsible for its own programs and interpretation of these programs. The only interpretation incentive that has been applied on a national level has been the creation of the Australian National Shipwrecks Database. This database is accessible to members of government, archaeologists and cultural heritage managers, students, and the general public via a website (http://www.environment.gov.au/heritage/shipwrecks/database.html). This website documents all of the country’s known shipwrecks. The new Australian National Shipwrecks Database (ANSDB) was launched in December 2009 and includes many supplemental fields of information that were not available in the original design. The new ANSDB has the capacity to attach photographs of the wreck sites, as well as the ability to link shipwrecks to artefacts recovered from the site of the wreckage. Environmental information is available to divers wishing to dive a site. Lists of passengers and crews travelling aboard the sunken vessels may also be attached in the database. Additionally, the new ANSDB facilitates access to online permit applications to dive wreck sites listed under the *Historic Shipwrecks Act 1976*. This database can be found on the Australian Government’s Department of Sustainability, Environment, Water, Population and Communities website, but is managed by each of the state and territory historic shipwreck agencies (Australian Government 2010). Keeping the information current in the database is a lengthy and ongoing process. It is not uncommon to find overlaps in the database, where two wrecks with slightly different spelling turn out to be the same vessel. Substantial amounts of time and effort from the states and territory will be required to purge and update the current data. At the time of this writing, the database is intended as a basic tool for those researching vessels wrecked in Australian waters. It does not provide an entertaining interpretation of the wrecked vessels, nor is this the intent. Future research and input of information into the database will provide the public with a more detailed and comprehensive picture of shipwrecks found in Australian waters.

The interpretive strategies using digital media in Australia have been similar throughout the six states and Northern Territory. All seven programs rely on a website
to provide the public with a range of resources, including school resources, management of submerged resources, diver resources, training, links to a number of publications, as well as interpretation of archaeological resources. These websites all have images and text. All but the Northern Territory include site maps. New South Wales, Tasmania and Victoria also include videos on their respective sites to communicate with the public. Queensland, Victoria and Western Australia have also used the social-networking sites Facebook © and Twitter © as another avenue for communicating with audiences and keeping their current projects in the public spectrum.

Victoria has taken a slightly different approach, using a website that enables “photos and videos to be shared with the world” (www.Flickr.com) to post and manage a series of archaeological photographs taken from several submerged vessels located in Port Phillip Bay. Not only are the wrecks featured on Flickr ©, but Heritage Victoria has also created artefact folders for PS Clonmel and SS City of Launceston on the website. As an interpretation tool, Flickr © probably allows the maritime archaeologists at Heritage Victoria more freedom to share these images than if they were to publish them on their own site. The archaeologists at Heritage Victoria do not have direct access to their website for the purposes of updating and maintaining content. A technician is responsible for the entire site content published online for all the branches of Heritage Victoria. By using the Flickr © website to post photos of their work and of submerged cultural heritage, Heritage Victoria maritime archaeologists have direct control over what content is presented and when it is available.

Ultimately, the majority of the programs reviewed are those that have been established by government agencies. The interpretation of maritime resources through a government-created website can be limited in the frequency with which the content can be updated. Maritime archaeologists and heritage managers are not the ones responsible for the construction and maintenance of the government websites, thus the content consequently tends to suffer as a result.

By using the Flickr © website to display archaeological images, Heritage Victoria is appealing to a larger audience and catering to the needs of non-divers. Heritage Victoria has also used YouTube © to upload an animation video of the submerged landscapes of Port Phillip Bay. This is a 3D landscape visualisation that
cumulates 120 hours of digital editing and model preparation (Heritage Victoria 2010). The Heritage Victoria website also boasts a podcast interview with project manager and maritime archaeologist Hanna Steyne, who describes her research into the submerged cultural landscape of Port Phillip Bay.

In Tasmania, the development of digital media products has been used for the interpretation of marine reserves, including one wreck/habitat site. These are touch screens viewable at one reserve, plus they are available as DVDs (Mike Nash 2010, pers. comm.). Podcasts are available for download on the Parks and Wildlife website, but these document projects that only pertain to terrestrial archaeological sites, and submerged ecosystems that show off the diversity in aquatic life. If these podcasts exist to showcase Tasmania’s aquatic biodiversity, certainly there is potential to create similar podcasts for the state’s significant submerged resources.

In Queensland, the Museum of Tropical Queensland created a virtual Shipwreck Trail that was live on the museum’s website for nearly a year. Unfortunately, recent modifications to the website resulted in malfunctions; however, the virtual trail should be available online shortly following some adjustments to the museum’s website (Ed Slaughter 2010, pers. comm.). This initiative is an interactive way for the public to discover Queensland’s shipwrecks without ever getting wet, or even leaving the house.

In Western Australia, underwater photographer Patrick Baker has been developing 3D images of submerged archaeological sites for the Shipwrecks Gallery over the last 40 years. The digital age has certainly made the 3D process much more accessible. These images are used to interpret the wrecks located in Western Australian waters for school groups and in travelling exhibits (Patrick Baker 2010, pers. comm.).

The Australian National Maritime Museum in Sydney, NSW, uses digital media for interpretation in a more dynamic way. The exhibits interpreted in the museum offer a range of stand-alone displays, while others use digital media exhibits such as touch screens and audiovisual displays. The only archaeological display on permanent exhibition is that of the HMS Sirius anchor, which does not have any form of digital media associated with its interpretation. At the Australian National Maritime Museum, audio guides are not available; however, guided tours are available upon request. The museum’s website (http://www.anmm.gov.au/site/page.cfm) provides a range of
interpretive materials, including images, videos, games, maps, text, and blogs. The Australian National Maritime Museum (2010) stays in touch with the public through the use of social-networking communities such as Facebook © and Twitter ©, as well as uploads of videos on YouTube © and photographs on Flickr ©.

Canada

The Parks Canada Agency is responsible for the interpretation of submerged cultural heritage sites for the whole of Canada, within the National Parks system. Despite being responsible for a range of other areas (National Parks, National Historic Sites, National Marine Conservation Areas), the Parks Canada website provides an assortment of interpretive strategies touching on past and recent archaeological expeditions. Submerged cultural heritage sites are interpreted on the Parks Canada website through images, video, 3D animated tours, interactive maps, and text. The 3D tour is that of the Red Bay submerged archaeological site off the coast of Labrador.

The Parks Canada Agency uses the social-networking sites Facebook © and Twitter © to communicate with the public and share their latest news. Parks Canada also uses YouTube © to broadcast their latest expeditions and to interpret sites through interviews conducted with maritime archaeology staff. These same videos are available directly on the Parks Canada website; however, their size on screen is only about 2.5cm x 4cm. This indicates that the Parks Canada website has limited space available for interpretation through high-resolution files and requires collaboration with other organizations to exhibit their materials over the Internet. It could also suggest a desire to reach an even larger audience since YouTube © is international and Parks Canada may not be recognized on the same global scale. The Parks Canada website content is designed to cater to a range of audiences. Available on the website are educational games for children of all ages, recent news articles detailing archaeological research, as well as field reports from past projects.

Local museums and community programs in Canada are actively interpreting submerged cultural heritage sites in their respective areas. In what is claimed to be a worldwide first, La Société d’Histoire de Sherbrooke (the Sherbrooke Historical Society in Québec) launched in July 2010, a program whereby it is possible to rent an iPad that
serves as a personal guide to visitors making their way around the Murals Heritage Trail. This trail includes 18 historical sites of cultural significance, including 13 murals representing significant people and places in Sherbrooke’s history, as well as five archaeological sites along the river pertaining to native Abénakis occupation. The iPad functions as a map, using GPS coordinates to connect the 18 sites to one another. When the iPad finds itself in one of these 18 sites, it automatically unlocks a folder filled with historical images, videos, interviews, and maps relevant to that particular site. The data displayed on the iPad is more substantial and interactive than a simple interpretive panel would be and can be rented for CDN $10/day (Bombardier 2010, p. 5). The use of audio guides and other handheld digital media is common practice in many museums around the world. Through the iPad, this technology is now available to interpret submerged cultural heritage sites as well as other non-traditional museums.

Figure 12. Tourist using the iPad to supplement interpretation of the Murals Heritage Trail in Sherbrooke, Québec (Photograph by author).
United States

The programs reviewed in the United States revealed that the interpretive methods were similar to those in Australia and Canada. The website is again the most popular choice for interpretation of submerged cultural heritage sites using digital media. Again, all of the programs reviewed included images and text as a basic mode of interpretation, but a few programs adopted new, engaging strategies that were not seen elsewhere. For example, the state of Massachusetts uses digital imaging to create large scale photomosaics of shipwrecks that are used to practice “mock” archaeological digs (Victor Mastone 2010, pers. comm.).

In Vermont, the Lake Champlain Maritime Museum held a live broadcast in November 2009 from the Sarah Allen shipwreck. This footage is currently available as a video podcast on the Lake Champlain Maritime Museum’s website. The Museum’s website is also host to a blog covering a range of topics, in which professionals, students, and the general public can participate in a discussion (Lake Champlain Maritime Museum 2010).

The State of Florida is host to the website Museums in the Sea. This website features Florida’s 11 archaeological preserves, which includes guided video tours of each of the sites. Several narrated videos are available on the Museums in the Sea website and are divided up by sections on each of the wrecks. The Florida Public Archaeology Network also hosts a website featuring the Mardi Gras shipwreck with video content, and published daily blogs when the field project was underway (Della Scott-Ireton 2010, pers. comm.).

The National Oceanic and Atmospheric Administration features live underwater broadcasts on its website. The live footage of submerged heritage sites gives non-divers the opportunity to experience the underwater world and be part of the action. The website also provides access to GIS informational layers of all the marine sanctuaries, and can be downloaded for personal use on Google Earth or Arc Explorer (National Oceanic Atmospheric Administration 2010).

Dermody and Mires, staff members at East Carolina University in communications and maritime studies, developed content for the video iPod as a tool to enhance the visit of a maritime heritage trail, located on the historic waterfront in
Wilmington, North Carolina. This public outreach strategy was specifically developed for non-diving audiences. Optimising on the iPod’s mobility factor and the fact that audio for the device is available through earphones enables visitors to freely move about the heritage trail while listening to stories and watching underwater videos of the wreck. Visitors gain access to the intangible underwater world presented before them. These devices are available from the Information Booth at the beginning of the river walk in exchange for a deposit. It is anticipated that these videos will eventually be made available on an Internet website for free download so that future visitors to the trail can listen to them on their personal devices (Dermody & Mires 2007, pp. 83-4).

The State of Wisconsin’s maritime archaeology department has aligned itself with Geocaching, the official global GPS cache hunt site (www.geocaching.com). Essentially, ‘geocaching’ consists of “a high-tech treasure hunting game played throughout the world by adventure seekers equipped with GPS devices. The basic idea is to locate hidden containers, called geocaches, outdoors and then share your experiences online. Geocaching is enjoyed by people from all age groups, with a strong sense of community and support for the environment” (Geocache 2010). Wisconsin has developed Geocaching Trails to aid in site interpretation. They are known as ‘WiscMaritime’ on the Geocaching website (Tamara Thomsen 2010, pers. comm.). Maritime archaeology is often confused with treasure hunting and looting of sites. Government agencies, archaeologists, cultural heritage managers, students and individuals around the world are working hard to ‘re-educate’ the public to ensure that the right messages are given. Geocaching Trails provide participants with the ‘thrill’ of the hunt and finding treasure, but the reward is in fact to locate the hidden container to sign the visitor’s book stored inside. The reward essentially is attributed to the experience spent outdoors exploring and discovering the sites along the way. The Wisconsin maritime archaeology department has created Geocaching Trails connecting maritime sites located on land as well as others located underwater. From the comments left on the Geocache website, this interpretive strategy is a success with divers, non-divers, and people of all ages.

The Museum of Underwater Archaeology (MUA) is a non-profit website established in 2004, whose mission is to encourage underwater archaeologists to utilize
the Internet and to share their research with one another and the public through web-based museum-style exhibits (Kurt Knoerl 2010, pers. comm.). The website features exhibits, project journals, and blogs. To date, the website has published over 300 pages by approximately 90 maritime archaeologists from all over the world (Kurt Knoerl 2010, pers. comm.). The Museum of Underwater Archaeology publishes all these materials on its website at no cost to the exhibitor.

3D Photography and Video

The use of 3D photography and video in maritime archaeology is not readily used. Progressively, more and more programs are incorporating some form of 3D technology into their programs, but usually this revolves around 3D scanning, spatial reconstructions and animations of artefacts or entire vessels (Heritage Victoria 2010; Parks Canada 2010). The fees associated with these projects is often too costly and does not necessarily fit into a program’s budget without seeking financial assistance from external sources.

The development of 3D gaming, TV, and film is growing in popularity in Australia, Canada, the United States, and around the world. This new technology can produce superb results, but requires polarising or shutter glasses to be able to view the three-dimensionality of its content. Access to these resources is generally limited by costs and by the familiarity archaeologists and cultural heritage managers have in working with this equipment. Essentially, this technology has great potential as a research tool for archaeologists, but is not yet commonly used for public interpretation.

The practical application of 3D photography or stereophotography has changed dramatically over the last decade. In the past the equipment needed to achieve stereoscopic images underwater was bulky and complicated to manipulate. The same 3D effect can be produced now, that was produced 50 years ago, but with fewer complexities. With the advancement in technology, the bulky analogue cameras have largely been replaced by digital instruments, capable of recording sites in high definition, at a comparatively lesser cost (Green 2004, p. 183). That is not to say that
this technology is inexpensive, but in relation to its predecessors, it is much more accessible.

Stereophotography is possible either by using one camera and offsetting it by a defined distance to create the three-dimensional parallax, or by using a pair of cameras fixed at a defined distance on a stereobar with precisely defined optics (Green 2004, p. 183). Merging these two images to create the illusion of three-dimensionality in an anaglyph is more easily achieved at present by using computer software. The simplest, most cost efficient way to view these images is with a pair of red/cyan cardboard-framed glasses.

The premise of an anaglyph image is that the right and left images are combined into one photograph. Replacing the red layer from the right image with the red layer from the left image produces a colour anaglyph. The left eye with its red lens sees the red layer. The right eye with its cyan lens sees the blue/green layer. The overlapping three layers give a full colour image, with the slightly differing viewpoints of the red and blue/green layers giving the spatial information to the viewer’s brain, which interprets the two viewpoints as 3D (Patrick Baker 2010, pers. comm.).

Relatively few archaeologists or cultural heritage managers have used 3D photography, or even video to record and interpret submerged cultural heritage sites for the public. In the 1960s and 1970s, a series of photogrammetric surveys were carried out on shipwrecks in Yassi Ada, Turkey, using stereophotography (Green 2004, p. 183) and in 1971, it was used to produce topographic plans of the Kyrenia shipwreck (Green 2004, p. 183).

At the Western Australian Maritime Museum Shipwreck Galleries, archaeologists and other staff members have been experimenting with underwater 3D photography for approximately 40 years. Patrick Baker, head of Photographic and Video Services has designed a range of stereoscopic equipment to photograph underwater sites. In the past, Baker used a pair of 35mm film Nikonos cameras with 15mm, wide-angled lenses. Now, the digital age has enabled him to upgrade to two Olympus compact cameras with Sea & Sea 16mm supplementary lenses. These cameras are mounted alongside one another on a stereobar and fired by the photographer at the same moment (Patrick Baker 2010, pers. comm.).
The Western Australian Maritime Museum Shipwreck Galleries have used stereophotography on a number of sites. Archaeologists have used the images produced as a research tool to analyse the fine details on sites without necessarily having to return to them to dive. The 3D photographs have also been used by the museum as a public outreach tool to show audiences the work they have been doing on wreck sites (Patrick Baker 2010, pers. comm.). In the past, archaeologists from the Museum have shown these images as part of a PowerPoint presentation to Maritime Archaeology students at Flinders University. These received positive feedback from the entire audience. Recently, these images were again shared through a PowerPoint presentation; this time to students taking an archaeological photography course to receive their AIMA/NAS Part III certification, following the 2010 AIMA Conference held in Melbourne, Victoria.

Figure 13. Stereoscopic (3D) photography survey conducted by the Western Australian Museum Shipwreck Galleries (Photograph courtesy of P. Baker).

At the time of this writing, there is an important project underway off the coast of Newfoundland, Canada. The Institute of Nautical Archaeology is conducting
Expedition Titanic, to create a permanent digital record of the site as it exists now, for future monitoring and research. Since the Titanic wreck site is located two and a half miles deep, recreational diving is not an option. Remote operated vehicles (ROV) are being used to record the site in depth. Part of this process has focused on the creation of detailed 3D photographs of the site, as well as a virtual tour. These 3D images are intended to be shared with the public, but also allow archaeologists and scientists access to the wreck. In this case, not only is 3D photography a means of interpreting the site for the public, but it is also an important research tool for the Expedition Titanic team and their current mission (Institute of Nautical Archaeology 2010).

While in the final stages of this research, it was made known that the National Park Service (NPS) in the United States was working on 3D video to aid in site interpretation. The USS Arizona Memorial’s submerged battleship, located in Pearl Harbor, off the Island of Oahu, was captured in stereoscopic three-dimensional high definition (3D HD). The newly available 3D survey tools “are bringing the researchers into the very areas they are interested in observing, without ever having to get wet. At the same time, they are allowing the public to experience these wrecks through immersive 3D displays in visitor centers and museums” (Lange, Seeb, & Seymour 2011).

Private Companies

Currently, a private company called Art To Media™, established in Mascouche, Québec, makes waterproof 3D dive maps of sites located in the United States, Canada, the British Virgin Islands, Croatia, the Mediterranean, the Red Sea, Cuba, Mexico, Truk and the Pacific Islands, the Cayman Islands and the Bahamas. This company also uses digital media to make 3D animated maps for the Mares Icon HD dive computer. They even make 3D animated dive videos, which are available for the iPod. They also sell DVDs of 3D dive maps of popular dive sites in Florida and the Cayman Islands. These products are sold on the company’s website and range in price from USD $3.00 to $20.00 (Art To Media™ 2010).
Conclusion

The technology enabling the creation of stereoscopic images has evolved enormously in the last decade alone. Digital media has made it easier for archaeologists and heritage managers to conduct research and to display it to the public. Stereophotography, once thought impossible for an archaeologist to achieve, “… unless one had dedicated personnel with expertise, can now be conducted by anyone with a good camera, a computer, and some training” (Green 2004, p. 183). Although the creation of 3D photographs and video is a relatively simple process in the current digital age, the success of these techniques lies in the way these are displayed to the public and how they are perceived. Private companies are optimising the opportunity that digital media holds to interpret underwater heritage sites for the public. Their specialized skills allow them to create a range of dynamic and interactive products that divers, non-divers and people of all ages can enjoy. A balance in traditional interpretation techniques and digital media is necessary for success. Collaborations amongst archaeologists and people with specialized skills may be necessary to create successful programs as well.
Chapter 5

A Case Study of Stereoscopic (3D) Photography on the
WWII Invasion Beaches Underwater Heritage Trail:
Discussion & Conclusions

The interpretation of submerged cultural heritage sites for non-divers presents obvious challenges for archaeologists and cultural resource managers who are responsible for making these sites accessible to the public. Until now, efforts to present shipwrecks and other submerged heritage sites have focused principally towards divers. In some instances, interpretive efforts for divers have overlapped to include non-divers and the general public; however, few programs exist specifically for non-divers.

Preceding chapters looked at theoretical and practical applications of previous and current approaches to interpreting submerged cultural heritage sites. These chapters emphasized the fact that few interpretive strategies have been set forth to engage the non-diving community. They also highlighted the potential of digital media to interpret submerged cultural heritage in clever and engaging ways to include non-divers and the general public. The following chapter analyses and discusses the research questions outlined in Chapter 1. Finally, it presents future research potential and a conclusion.

Data Analysis & Discussion

How effective have the efforts of archaeologists and cultural heritage managers been in interpreting shipwrecks and other submerged cultural heritage sites for the non-diving public?

Essentially, the answer is plain and simple. Archaeologists and cultural heritage managers have not displayed much forward thinking in their efforts to interpret shipwrecks and other submerged cultural heritage sites for the non-diving public. The literature review conducted in Chapter 4 demonstrates that most of the traditional
Interpretive efforts to date have focused largely on interpreting sites *in situ* for the diving public. The primary goal for archaeologists and cultural heritage managers is firstly from a management standpoint to preserve and protect sites, and secondly, to interpret them for the public. Establishing *in situ* maritime heritage trails, underwater archaeological preserves, and shipwreck parks, in most instances satisfies these management requirements. Granting divers access to submerged cultural heritage sites is the next step. Once a wreck is deemed stable enough to support diver traffic, the site may then be opened up to the public for unlimited visitation, through a dive tour operator, on one’s own, or through limited visitation upon the successful application of a permit. This formula has amassed proven success with the diving public. However, in comparison, archaeologists and cultural heritage managers seldom deviate from the established parameters to think outside the box.

Rarely have wreck sites and other submerged cultural heritage sites been interpreted specifically for non-divers. Most often, the sites that receive the most media coverage and have outreach programs geared towards non-divers and audiences of all ages are those that have a high historical significance (USS *Monitor* off the coast of North Carolina, RMS *Titanic* off the coast of Newfoundland, *Batavia* off the coast of Western Australia). These sites have received a substantial amount of attention in the media, and because the public has responded positively, these wrecks have been included in subsequent exhibits that are part of museum displays, and land-based exhibits. CDs and DVDs, including short films, documentaries, and even movies released about these wrecks, also have been created. The Internet will generate a wealth of materials on such popular wrecks, because the public has demonstrated to interpreters that they have an interest.

Lesser-known wrecks generally do not receive the same level of interpretation because they are not as significant on a national, or even on an international level. These smaller sites are often quite significant to the local communities where they are found, as they are the final resting places of their past. As such, these sites are interpreted and promoted through dive tourism. Evidence of this can be seen in various maritime heritage trails established in Australia, Canada, and the United States. The Cooper River Underwater Heritage Trail in South Carolina is one such example.
trail consists of six sites, none of which are high profile. Since the sites on the Cooper River were already registering an elevated number of local divers, the transition to incorporate the sites on a dive trail was intended to provide additional information about the sites for divers. It also aimed to re-educate local divers to respect and protect their underwater resources (Spirek & Harris 2003, pp. 169-171). Similarly, Fathom Five National Marine Park in Ontario is home to a number of low profile shipwrecks. These sites are available to the public through diving, snorkelling and glass-bottomed boat charters (LaRoche 2003, p. 37).

Supporting materials for these sites usually target divers, but can extend to include the non-diver as well. Most of the interpretive literature that has been published concentrates on explaining dive sites for divers, describing dive conditions and site orientation. While a diagram of a site is an interesting feature for a diver to look at on a plasticised card while diving a site, it offers little more than a generalized site plan for a non-diver who does not have the same point of reference. Some historical information as well as photographs may be provided in a booklet or on a dive card. Generally speaking, these materials are gauged towards divers as support materials for their underwater experience. The Venn diagram below illustrates that interpretation for divers and interpretation for non-divers and the general public is not mutually exclusive. There is definitely some overlap in the way submerged cultural heritage sites are interpreted for the public.

Figure 14: Venn diagram illustrating the overlap of interpretation programs for divers, non-divers and the general public (Diagram by author).
In some areas, glass-bottomed boat charters (Rottnest Island & Fathom Five National Marine Park) and submarine operators (Cayman Islands & Saipan) are available to enable divers and people of all ages to get a closer look at shipwrecks and other submerged cultural heritage sites. While these strategies are good alternatives to diving the sites, these tours are not readily available around the world and can be costly to operate. Additionally, they can be incorrect and misleading because they are run by private companies who may have little knowledge of the history of the wrecks and are more focused on selling spaces, which leads to telling exciting stories, rather than getting it true and accurate.

Maritime archaeological research has been published in textbooks, museum exhibits, television documentaries, popular news articles, magazines, pamphlets and booklets. Realistically, most archaeological research never becomes published in popular media. Most of the research conducted is available through archaeological reports and academic publications. Ultimately, these publications will only appeal to a small percentage of the population. In order to cater to a wider audience and make submerged cultural heritage sites more accessible to non-divers and the general public, other forms of media must be considered. Digital media is believed to be an effective strategy for interpreting submerged cultural heritage sites for non-divers and people of all ages. Digital media is an effective outreach tool to interpret sites locally, using handheld audio-visual displays such as the iPad, iPod, or an audio guide. Furthermore, by using the Internet to interpret local underwater cultural heritage, smaller communities are able to share their cultural heritage with others around the world who may have similar interests.

Is the use of digital media an effective strategy for interpreting underwater cultural heritage sites for non-divers?

As discussed in the earlier chapters, different interpretive programs using digital media exist. Already, digital media is used to interpret submerged cultural heritage sites in Australia, Canada, and the United States. The potential to push current programs even further is possible as well. Most individuals use digital media on a regular basis in their personal lives (.mp3 players, mobile phones, digital cameras, GPS units, etc.);
therefore, it only makes sense for archaeologists and cultural heritage managers to take advantage of this fact and make the interpretation of submerged cultural heritage sites available to divers, non-divers and the general public on a range of digital media products. Individuals are exposed to digital media and its content daily. We are part of a generation that is exposed to a plethora of digital media that is continually changing and evolving. We want to be impressed and to have our expectations surpassed. Popular culture and the media have led us down this path. Not only do we want to be informed and learn about submerged cultural heritage sites, we expect this to be done in an entertaining fashion.

Digital media is an effective strategy for interpreting underwater cultural heritage sites for divers, non-divers and the general public. Digital media fulfils many of the theoretical concepts discussed in the New Museology. As an interpretation tool, digital media allows archaeologists and cultural heritage managers to move away from the ‘object-based’ focus that was once at the core of museum displays. The new ‘narrative-based’ structure makes room for storytelling and more in depth interpretation (Besser 1997, p. 161). Furthermore, the premise of digital media is that it is an interactive application, which allows users to engage with the content in a dynamic way.

Personal handheld guides can present audio and visual content that can supplement a land-based trail or exhibit. The content can include maps, photographs, videos, historical accounts in narrative form, as well as music, etc. Computers, CDs, and DVDs also display audio and visual content to inform and engage users. The applications available for computers are often user-friendly and are more interactive than traditional displays. The Internet is definitely an effective strategy for interpreting underwater cultural heritage sites for divers, non-divers, and people of all ages. The Internet is a reasonably easy and cost-effective way for archaeologists and cultural heritage managers to display and interpret their research. Again, the Internet can present its content in both audio and visual format, but the key aspect of the Internet is that it reaches audiences around the world, presenting viewers with the same content, and it can connect users to one another as well. People with similar interests from opposing sides of the world can easily communicate with one another and share their thoughts and
ideas through the Internet. Social-networking websites Facebook © and Twitter © are currently popular sites used to share thoughts and opinions about a range of topics.

Digital media is not only an effective strategy for interpreting submerged cultural heritage sites for people all over the world, but it is also an efficient tool for making potential visitors desire to take part in heritage-tourism. While the Internet is a way to interpret underwater cultural heritage sites from afar, it can also be used for researching site locations and planning future travels. This is an important tool for divers who wish to learn more about a dive site before travelling to it, but it is also a significant form of media for non-divers who are interested in submerged cultural heritage. Non-divers and people of all ages can travel in the virtual world and experience these same sites on the World Wide Web. The Florida-based website www.museumsinthesea.com is one example of how the Internet can be used to display underwater submerged cultural heritage sites for non-divers and the general public. This website interprets all of Florida’s 11 shipwreck preserves through underwater video footage, historical information and photographs, as well as including biological data specific to the dive site. The Museums in the Sea website comprehensively interprets the 11 preserves while being mindful of the different audience groups.

For the WWII Invasion Beaches Underwater Heritage Trail and the 3D case study, the Internet will be a useful application because it will allow people from all over the world the possibility to learn about the submerged cultural heritage sites located in Tanapag Lagoon, off the remote Island of Saipan. Digital media, specifically the Internet, is an effective communication tool in this case, enabling audiences worldwide access to the submerged WWII sites without having to physically travel to them. In some instances, it may evoke a desire for viewers to physically travel to Saipan. Because travel to and from Saipan can be costly depending on where audiences are living, the Internet remains the most cost effective means for audiences to ‘travel’ in order to learn more about the island’s submerged WWII sites.
What digital media have archaeologists and cultural heritage managers used to interpret submerged cultural heritage sites for the non-diving public?

Archaeologists and cultural heritage managers in Australia, Canada and the United States use digital media in similar ways to interpret submerged cultural heritage sites for the public. Chapter 4 presents a compilation of these efforts in Table 2. Of the 19 programs reviewed in Australia, Canada and the United States, all 19 programs currently make use of the Internet to interpret the submerged cultural heritage sites located in their jurisdiction. All of the websites have some images and some text. The remaining content varies from one program to the next. What is clear from reviewing the 19 programs is that there is no standardized way of presenting content on a website. Website content varies according to the sites being interpreted and also according to the financial and human resources available for support.

Social networking communities Facebook © and Twitter © ranked well amongst the 19 interpretive programs. Slightly less than 50% of the programs utilize these social networking websites to interact with the public. In most instances, programs that use Facebook ©, also used Twitter ©.

By reviewing the programs that use digital media to interpret submerged cultural heritage sites, it became evident that few of the strategies specifically targeted non-divers. In the United States, the state of Massachusetts uses photomosaics of wreck sites to hold ‘mock’ archaeological digs for non-divers. The state of Wisconsin hosts Geocaching Trails for non-divers to supplement site interpretation. These trails take viewers on a journey, discovering various aspects of Wisconsin’s maritime history along the way. Audio/video tours using the iPad and iPod were developed in Sherbrooke, Qc and in Wilmington, NC respectively. These tours were created for non-divers to supplement the existing heritage trails with additional information and interactive features. The narrated tours tell stories of the respective areas’ maritime history and include additional features such as photos and videos.

Few strategies involving digital media have been used to interpret submerged cultural heritage sites for non-divers and the general public. That is why the stereoscopic (3D) photographs taken in Tanapag Lagoon, Saipan are so significant. Stereoscopic images have been in existence for several decades, but have made a recent
resurgence with the advancements in digital technology. The stereoscopic images presented in this thesis were created using digital media: two digital cameras and computer software (© Adobe Photoshop CS4). These stereoscopic images can be presented in various forms. One of the outcomes of this project is to present the images on the WWII Invasion Beaches Underwater Heritage Trail’s website. Red/cyan viewing glasses are necessary to view the three-dimensionality of the photographs. The author acknowledges that it is unlikely for viewers to have a pair of red/cyan viewing glasses just lying around at home. This is why the stereoscopic images will be accompanied by an easy activity designed to create your own red/cyan viewing glasses from the comfort of your own home.

Another possible outcome of this case study is the publication of a 3D picture book, which would be accompanied by detailed site histories, as well as a pair of red/cyan glasses for viewing. This project is still under negotiation, as it would require financial assistance from an external source to go forth.

**Are the financial and human resources available to archaeologists and heritage managers for the implementation of public interpretation programs using digital media?**

In the previous question, a review of the current digital media used for public interpretation programs revealed that there are few different interpretive approaches utilized in Australia, Canada and the United States. The interpretive strategies using digital media focus largely on the Internet as a research tool, as a means of interpretation, as a communication outlet, and as a networking facility. The Internet is a complete package; however, not all viewers want to sit behind a computer all day and sift through an overabundance of websites. The Internet is massive and it is easy to become tangled in its web. Surely if the financial and human resources were, in fact, available, archaeologists and cultural heritage managers would have introduced new, exciting ways to interpret submerged cultural heritage sites, especially when considering such a wealth of digital media exists.

To better answer this question, it was necessary to communicate with archaeologists and cultural heritage managers in Australia, Canada and the United States
during the course of 2010 to find out whether they believe they have the necessary financial and human resources to interpret submerged cultural heritage sites for the public using digital media. Some of the respondents have asked that their answers not be identified for the purposes of this discussion; therefore, they shall remain unidentified. The following respondents have agreed to have their answers revealed in this discussion:

- Clare Kinloch, Public Communications Officer, South Australia, Australia
- Victor T. Mastone, Director/Chief Archaeologist, Massachusetts, USA
- Mike Nash, Maritime Heritage Officer, Tasmania, Australia
- Ronnie Rogers, Staff Archaeologist, Saipan, CNMI, USA
- Della Scott-Ireton, Northwest Region Director, Florida Public Archaeology Network, USA
- Roger Smith, State Underwater Archaeologist, Florida, USA
- Tamara Thomsen, Maritime Archaeologist, Wisconsin, USA

For the respondents who asked to remain unidentified, it was clear they felt as though they were not receiving the necessary financial and human support required to interpret their submerged cultural heritage through the use of digital media. For the other respondents, the answers to this question were mixed. Mastone answered that even though no funds are specifically designated for such efforts, he still felt as though the necessary funding was available. Furthermore, he added that “the outreach/engagement component of a federal grant may provide additional, limited one-time support” for such endeavours. Mastone also claimed that his agency has the necessary human support and skills available through the centralized agency-wide IT personnel, which “may be available to devote work efforts for discrete projects and tasks.” Smith believes that Florida State coastal management grants from federal funding sources are sufficient for the interpretation in Florida. He also considers his agency to have the required human resources and skills to create and maintain interpretive programs using digital media.
Scott-Ireton says that state and education grants are available for the Florida Public Archaeology Network (FPAN), “but we don’t have dedicated digital media budgeted, other than standard web design and maintenance.” FPAN does, however, have a dedicated Web Architect with the expertise to create and maintain websites. In Tasmania, Nash says that the “federal government funding through the Historic Shipwrecks Program” is not sufficient, but goes on to say that the human support is available to his agency.

In South Australia, Kinloch does not believe that the funding, nor the necessary human resources and skills are available. Thomsen finds that the State of Wisconsin is in a similar position. Their budget relies on “90% grant funding and 10% State funding.” Because of “State budget difficulties, it puts us as a ‘nonessential status’ for IT support, so this is outsourced.”

Perhaps the biggest incentive for this case study and for participating in the creation of the WWII Invasion Beaches Underwater Heritage Trail is to provide some support to the archaeologists in Saipan. At the time of this writing, Saipan is the only program with underwater cultural heritage sites that does not have an Internet website. Rogers could not be more transparent about the present situation. “We currently have a consultant working on website development. The only problem is that none of our staff has any training or experience adding and updating information. Seriously, we do need help.” Their funding is provided through the Historic Preservation Fund Grants, which is administered by the US National Park Service. Rogers believes that they could include funding for digital media projects in their anticipated activities. “There is so much potential for what we can do with the website and at a big savings to us over the current practice of expensive re-publishing paper books every few years. That money could go to other projects.”
Conclusions

“We are drawn to a new medium of representation because we are pattern makers thinking beyond our old tools” (Murray, in Roegiers & Truyen 2008, p. 67).

The reviews to the last question are mixed, but it appears that with more human support and skills, as well as adequate funding set aside for the purpose of creating and maintaining interpretation programs using digital media, programs in Australia, Canada and the United States will be more successful. Realistically, archaeologists and cultural heritage managers cannot be expected to perform their normal duties, as well as those of a web designer, encoding technician, and IT specialist. Collaborations with skilled individuals are necessary to build strong, successful programs. University students with particular skills are often happy to help with projects at little or no cost, especially if they are able to receive University credit in exchange for their work.

Digital media is an effective way to interpret submerged cultural heritage sites for the non-diving public and people of all ages. Perhaps with increasing collaborations and additional human skills, interpretive programs in Australia, Canada, and the United States will be able to break the mould and try different strategies to interpret sites for non-divers.

Future Research Potential

There is no doubt that the importance of cultural heritage resides in how it shows us something about ourselves and about the world we live in. The interpretation of cultural heritage through storytelling connects audiences with their past and their present and encourages them to contemplate their future. While it is true that audiences will not necessarily associate with the cultural heritage of others, it does not take away from its significance just by virtue of being part of the heritage of those others with whom we share the world. In this sense, the heritage of others becomes our own.

The task of heritage interpretation is to enable the visitor to recognize what is, in a sense, already his/her own. In considering the use of digital media for interpreting submerged cultural heritage sites for divers, non-divers, and the general public, one of
the most common strategies used is that of photographing sites and displaying them to
the public. Underwater cameras and now underwater digital cameras are used as
research tools by archaeologists to document sites, but also to present submerged sites to
the public. Photographs can be mass-produced and reproduced for distribution. Does
digital media enable greater engagement with submerged cultural heritage sites for non-
divers and the general public, or instead, is there simply a greater level of engagement
with the reproduced site? In Benjamin’s (1936) terms, several important aspects are lost
through mechanical reproduction. The loss of the object or site’s aura, the loss of its
specificity and the loss of its context are all fundamental concerns discussed in
Benjamin’s work. Future research to determine whether these key aspects are lost
through mechanical reproduction would no doubt make for a fascinating study. Further
research to determine whether there is a difference between 2D and 3D images in terms
of their representation to the public would also be beneficial. In the meantime, we can
continue to enjoy the mechanically reproduced images of submerged cultural heritage
sites that are in circulation, knowing full well that no matter how great an image, it does
not measure up to the real thing.

By combining New Museum Theory with current trends in digital media as well
as the expertise of archaeologists and cultural heritage managers, this research has
demonstrated that few efforts have been implemented to interpret submerged cultural
heritage sites for non-divers. This thesis has also introduced the idea that digital media
presents archaeologists and cultural heritage managers with the potential to create
dynamic, edutaining interpretive strategies to reach non-divers and people of all ages.
Additional research could be conducted to further concretise these conclusions.

The public (divers, non-divers, and the general public) should participate in a
study to determine whether they believe that archaeologists and cultural heritage
managers have been successful in their efforts to interpret underwater cultural heritage.
This study should take place in Australia, Canada and the United States to ensure and
even distribution of results, as well as to determine if certain programs are excelling
over others. This research could be conducted by distributing questionnaires to dive
shops, tourist information centres, maritime museums, etc.
A similar study targeting the public’s views on the use of digital media to interpret underwater cultural heritage sites would also be valuable. Additionally, the public would be able to contribute ideas and their expectations from archaeologists and cultural heritage managers.

Another study aiming to receive feedback from the public about the use of 3D photography to interpret submerged cultural heritage sites would also be essential. The 3D photographs taken as a part of this case study were well received by audience members (primarily archaeologists and cultural heritage managers, as well as some divers, non-divers and the members of the general public) attending the AIMA 2010 conference in Melbourne. Further research to broaden this test group to establish whether 3D photography is in fact a successful way to interpret underwater cultural heritage sites would be important. This research would be of utmost value, and would help to solidify the theories expressed in this thesis.

Additionally, future outcomes anticipated to result from this research would be to make the 3D photographs available to the public. As discussed in the previous chapter, it is expected that once the WWII Invasion Beaches Underwater Heritage Trail website is launched online, these 3D images will be featured on the site. The application for a small grant for the publication of a picture book will also be a future project. In addition to the data collected in June 2010, it would be beneficial to return to Saipan for subsequent diving to amass higher quality photographs with better visibility. It would be favourable to re-shoot some of the sites (mainly the tanks) that were photographed while snorkelling because it was difficult to photograph these wrecks. These sites should be photographed with Scuba equipment to ensure controlled buoyancy and stability underwater. In the meantime, the search for additional funding sources will continue in hopes to assist with future projects on Saipan and with 3D photography equipment.

Conclusion

This research examined digital media in light of the New Museology Theory and applied its concepts to the ways in which archaeologists and cultural heritage managers interpret underwater cultural heritage sites for non-divers. The interpretive approaches
are varied; yet, they are not necessarily numerous. This research makes evident that Australia, Canada and the United States are still at the infancy stage when it comes to using digital media for the interpretation of submerged cultural heritage sites.

The Internet is the most widely used medium for interpretation. Archaeologists and cultural heritage managers will have to fully embrace the Internet as a tool that can connect the public more interactively with underwater heritage sites, rather than a mere information outlet that conveys boring facts. The media is available to create amazing programs and interpretation materials for divers, non-divers and people of all ages. Partnerships with people who have the specialized skills to create these programs may well be a necessity if programs are to create interpretive materials that meet the public’s increasing expectations.

Archaeologists utilize digital media on a daily basis when in the field or at the office. They use handheld GPS and GIS applications, smart phones, and remote sensing equipment regularly. This digital media is commonly used as survey equipment; however, only a handful of the programs reviewed during this study take advantage of the media available to create dynamic interpretive approaches for the public. Wisconsin and Québec are the only programs to use GPS applications to supplement their maritime heritage trails: Wisconsin with its Geocaching Trails, and Québec with its GPS enabled iPad tour. Only the programs in Québec, Massachusetts, and North Carolina take advantage of handheld audio guides by creating programs focused around Apple products. There is definitely room for improvement for all three countries reviewed in this study. Additional financial and human support will be necessary for these programs to develop in the future.

The case study presented in this research is evidence that exciting projects can be achieved with limited resources. The entire technological component for building the stereoscopic stereobar and aligning the underwater cameras was self-taught, and developed through trial and error. The equipment used for this project was by no means expensive or professional. This case study proves that the digital media is available now to archaeologists and cultural heritage managers to create remarkable programs. While
additional funding and human resources can go a long way, sometimes the only thing missing is a little creativity, and a lot of determination.
Appendix A
The Public Interpretation of Submerged Cultural Heritage:
Traditional Approaches

This appendix takes an in-depth look at traditional methods of interpreting submerged cultural heritage sites in Australia, Canada, and the United States. This section updates the research compiled in Scott-Ireton (2005) by reviewing the programs and their endeavours to date.

Australia

Australia’s coastline stretches 25,760 km (Central Intelligence Agency 2010 online) and has an estimated 6500 hundred known shipwrecks lost in its waters. Of these, about 1625 have been located (25%), and approximately 500 sites (less than 8% of the total) have been linked by public access trails (Smith 2003, p. 124; Strachan 1995, p. 27). The Western Australian Museum’s Shipwreck Galleries established the first shipwreck trail in 1981 at Rottnest Island (Philippou & Staniforth 2003, p. 135; Smith 2003, p. 122; Scott-Ireton 2005, p. 58; Strachan 1995, p. 29). There was a surge in maritime heritage trails and allowing public access to these sites following the 1985 amendments of the Historic Shipwrecks Act of 1976. The creation of shipwreck trails and public outreach programs in Australia has been administrated by either local museums or governmental resource management agencies. To date, Australia’s seven states have been unable to coordinate their activities, resulting in different education and preservation efforts across the country (Philippou & Staniforth 2003, p. 137; Smith 2003, p. 125). The following presents an overview of the state programs in alphabetical order.

New South Wales

New South Wales has produced a number of both land-based and underwater maritime heritage trails; however, the NSW Heritage Office is not the primary agency responsible for these incentives. The NSW Heritage Office put forth a set of guidelines
in 1995, and again in 1998, to enable individuals and community groups to develop “high quality shipwreck trails” (Nutley & Smith 1998). Bronze circular plaques on the roadside and some underwater plinths act as interpretive markers for these trails (NSW Heritage Office 2010). These plaques are by a variety of authors, from a variety of backgrounds, for a variety of audiences (Nutley 2007, p. 50). According to Tim Smith (2003, p. 126) of the NSW Heritage Office, his agency purposely decided against developing shipwreck trails as part of their core curriculum due to their distinctive “lack of available staff resources and funds to initiate and complete successful projects, and the inability to continue the required dedicated promotion, upkeep, and expansion.”

This is a reality that many governmental agencies face; however, research reveals that successful programs will have strong community involvement from the inception of a project to create stewards for the resources in question (Scott-Ireton 2005, p. 92). These stewards take pride in maintaining and promoting their resources to be enjoyed by future generations.

Instead, the NSW Heritage Office has placed emphasis on community-based shipwreck recording programs, encouraging volunteers and dive shops to research, map and publish independent projects (Smith 2003, pp. 126-7). There is a concern, however, with the fact that there is a distinctive lack of consistency when it comes to the design of interpretive literature, which is intended to allow for creative freedom from those establishing the trails (Philippou & Staniforth 2003, p. 142).

The Australian National Maritime Museum is located in Sydney, NSW, and was established in 1991. This museum has a range of exhibitions that aim to explore Australia’s links with the sea, as well as to consider how maritime activities and issues have shaped the lives of people in Australia (Australian National Maritime Museum 2010). The Australian National Maritime Museum offers only a couple of exhibits pertaining specifically to archaeology and resources found submerged in Australian waters. These consist of the anchor of HMS *Sirius*, wrecked in 1790, which is displayed at the entrance to the museum as a permanent exhibition; the other is of the Wrecks Reef archaeological expedition conducted at the end of 2009, presented as part of a temporary photographic display. These exhibits are ‘object-based’, meaning that the displays speak for themselves with only a few lines of text serving as supporting interpretation.
Northern Territory

The Northern Territory holds a rich maritime history, revealing an array of lighthouses, jetties, shipwrecks, aircraft wrecks, maritime rock art and evidence of other maritime-related activities; however, little has been interpreted except for information, which can be found in the Museum and Art Gallery of the Northern Territory’s Shipwreck Database (Northern Territory Government 2010). The Northern Territory possesses a reported 232 shipwrecks and 73 aircraft wrecks, the majority of which have yet to be located. The majority of known sites in Darwin Harbour are shipwrecks and aircraft associated with the WWII Japanese raid on Darwin which have yet to be located. At the joint conference for the Australasian Institute for Maritime Archaeology and the Australasian Society for Historical Archaeology held in Adelaide in 2000, David Steinberg of the Heritage Branch of the NT Government announced that a maritime heritage trail based in Arnhem Land was in the works (Philippou & Staniforth 2003, p. 136); however, the results of this project have yet to be seen. Recently, Flinders University lecturer in maritime archaeology Dr. Jennifer F. McKinnon was awarded a Flinders University Collaborative Research Grant to work in partnership with the Northern Territory’s Natural Resources, Environment, The Arts and Sports (NRETAS) to explore the feasibility of developing a WWII maritime heritage trail for public interpretation and heritage tourism of submerged sites in Darwin Harbour (McKinnon 2010a). Although diving on the known wrecks is possible, the crocodile population and murky waters could be a concern to divers. In summary, to date, the Northern Territory’s public interpretation and outreach programs have been limited due to these concerns.

Queensland

The dive industry in Queensland is by far the strongest in Australia. The internationally renowned Great Barrier Reef attracts divers from across Australia and the world, not necessarily for its wrecks, but for its beautiful coral reef ecosystem. That is not to say there are not any wrecks to be found. At present, one maritime heritage trail has been established in the state. The SS Moltke and Magnetic Island Shipwreck Trail integrates 20 known shipwrecks into a trail that circles the island. Some of the wrecks
are located in the intertidal zone, which allows snorkeler access. The majority of the sites, however, are only accessible to divers. The shipwrecks around Magnetic Island are interpreted through land-based signage (Garrett 2007).

The Queensland Museum and Museum of Tropical Queensland have been most active in providing interpretation and public outreach of the state’s maritime heritage. Interpretation of HMS Pandora, wrecked in 1791 off the Great Barrier Reef, can be found in the Museum of Tropical Queensland, located in Townsville. This exhibit comprises mainly photographs and some artefacts raised from the site (Museum of Tropical Queensland 2010). In 2009, the Museum of Tropical Queensland published *Your Shipwreck Adventure*, the very first children’s storybook to target maritime archaeology specifically. *Your Shipwreck Adventure* has received terrific feedback so far. The next instalment in the series, ‘Dr Dan’s Field Diary’, is currently in the works and would target a slightly older age group than the storybook (Ed Slaughter 2010, pers. comm.).

**South Australia**

South Australia has a number of shipwrecks scattered in its waters. The South Australian Maritime Heritage Program administered by the Department of Environment and Natural Resources manages these wrecks. Nine maritime heritage trails, including one ships’ graveyard, have been created since the late 1980s (Department of Environment and Natural Resources 2010). Some of these trails are land-based, others are underwater and some were designed to be both. As a result, a range of interpretive materials exists for these sites. The interpretive literature includes pamphlets, waterproof booklets for diving, underwater plinths, land-based signage, and maps of the signage found on land. Comprehensive booklets have been published highlighting a few of the trails. These were designed with historical information, facts about the shipwrecks, current and historical photographs, as well as other facts relating to maritime cultural landscape attractions in close proximity (Philippou & Staniforth 2003, p. 139; Scott-Ireton 2005, p. 58-60).
Tasmania

The Parks & Wildlife Service of Tasmania manages the Maritime Heritage Program for the state. Although a wealth of good historical publications exist on local Tasmanian wrecks, little has been achieved so far to interpret these sites to the public. One heritage trail does exist in Adventure Bay on Bruny Island. This trail is associated with shore-based whaling stations. Another shipwreck trail was completed in 2001. The King Island Maritime Trail features interpretive signage about various shipwrecks (Philippou & Staniforth 2003; p. 136, Scott-Ireton 2005, p. 61).

Victoria

Fewer than 200 of the 800 known shipwrecks have been located in Victorian waters (Department of Planning and Community Development 2010). Managing these wrecks is the Maritime Heritage Unit of Heritage Victoria. The program includes 22 interpreted wreck sites, consisting of eight maritime heritage trails and two larger regional trails linking parts of the eight trails. The interpretive materials designed for these wrecks include pamphlets, site plans, photographs, underwater plinths, site markers visible to boats, and land-based signage. Heritage Victoria also published the Underwater Shipwreck Discovery Kit in 1992, which was essentially a collection of 42 pamphlets in waterproof casings (Philippou & Staniforth 2003, p. 141; Scott-Ireton 2005, p. 60). Only the original pamphlets from this collection remain in Heritage Victoria’s possession, as subsequent printings were never initiated due to the high costs of printing (Hanna Steyne 2009, pers. comm.).

Western Australia

The state maritime archaeology program in Western Australia is operated by the Western Australian Museum. The ‘wreck trail’ movement in Australia started with the Rottnest Wreck Trail in 1981. Soon after, Western Australia started establishing additional wreck trails with an emphasis on offering ‘wreck access’ rather than ‘wreck trails’ (McCarthy & Garratt 1998, p. 129). This surge in providing access to wrecks prompted the Museum to collaborate with high school students in work-experience programs to aid in the creation of these trails. The interpretive materials produced for
these trails included pamphlets, maps, underwater plinths, and land-based plaques (Philippou & Staniforth, p. 138; Scott-Ireton 2005, p. 60). Most of the literature was published in the 1990s and has yet to be updated. Again, the emphasis with these trails was specifically to enable public access to wreck sites. There exists a range of wreck sites, which can be snorkelled, dived, cycled to, or even accessed by the physically challenged. During the summer months, it is possible to pay money to take a tour on a glass-bottomed boat charter around the Rottnest Island wrecks (Strachan 1995, p. 30).

Contrary to the current dull state of wreck trails and related interpretive materials that are overdue for a makeover, the Western Australian Museum’s Shipwreck Galleries is the leading maritime archaeology museum in Australia as well as in the southern hemisphere. Archaeologists at the Museum have worked on a number of projects, including the excavation and raising of timbers from the Dutch wreck *Batavia*. A significant number of artefacts from other wrecks have been raised, conserved and displayed at the Shipwreck Galleries. Many of the displays are set up so that the visitor is in the same space as the artefact and is able to engage with it. The combination of these artefacts with underwater photographic displays, as well as informative text and stories, makes the visit to the museum an educational and interactive experience.

**Canada**

Despite having the longest coastline in the world at 202,080 km (Central Intelligence Agency 2010), Canada has little in the form of interpretation. Parks Canada is the government agency responsible for all the cultural resources in the entire National Parks and Historic Sites system (Scott-Ireton 2005, p. 61). Unfortunately, Canada is lacking the necessary legislation to protect shipwrecks and submerged resources; consequently, the federal, provincial and territorial governments are having difficulty finding common ground when it comes to management (La Roche 2003, p. 29). Only two interpretive programs have been established in Canada so far. In 1987, the country’s first protected submerged cultural zone, located in Louisbourg Harbour, Nova Scotia, was opened to the public under controlled access. This *underwater museum* contained the remains of eighteenth-century warships associated with siege events between France and England. Diver access to these four sites was administered through
a permit system. Tour operators wishing to take divers to the site first had to undergo Nautical Archaeology Society (NAS) archaeological training to improve their knowledge and understanding of archaeology (La Roche 2003, pp.31-4).

The second program was the creation of the Fathom Five National Marine Park, which became part of the National Parks System in 1987 as well. This park is now managed as a Marine Conservation Area. This means that Parks Canada is predominantly concerned with protecting natural, self-regulating marine ecosystems to maintain biological diversity (La Roche 2003, pp. 36-39). Fathom Five includes 27 shipwrecks. Some of these sites can be accessed by snorkel, others can be dived, and glass-bottomed boat charters can access some sites as well. Interpretive materials available are in the form of a leaflet with information on individual wrecks (La Roche 2003, pp. 36-9).

It seems that the idea of the ‘Marine Conservation Area’ has taken off in Canada, with subsequent programs being established across the country to protect and conserve fragile natural ecosystems. However, this same trend did not escalate to shipwreck parks or trails since none have emerged in Canada since Fathom Five. Volunteer groups in Ontario, British Columbia, and Québec have been active in trying to develop divers’ awareness of historical sites (La Roche 2003, p. 39). Groups such as Save Ontario’s Shipwrecks (SOS) and Protect Ontario Wrecks (POW), work with the government to produce interpretive panels and pamphlets, as well as to install mooring buoys (Scott-Ireton 2005, p. 62). Overall, efforts to interpret submerged cultural resources for the public have been limited. Perhaps Chief Maritime Archaeologist for Parks Canada, Marc-André Bernier’s statement at the Society for Historical Archaeology’s 2010 Conference at Amelia Island, Florida, provides some indication of the country’s current state of affairs. Bernier stated that Canada is a “follower and waits to see what interesting new things other programs will come up with first.”

**United States**

The movement to establish shipwreck parks and preserves continues in the United States. When the federal Abandoned Shipwreck Act was passed in 1987, individual states were granted title to historic shipwrecks within state waters. This Act
explicitly attributed management responsibility to the states and delegated to them the
task of establishing shipwreck parks and preserves to ensure public access to these sites
and monitor them for the future. The Abandoned Shipwreck Act specifically mentions
in its guidelines that “underwater parks and preserves should be established and that
interpretive materials should be created for divers and non-divers” (National Park
Service 1990, p. 55 in Scott-Ireton 2005, p. 46). In certain states, programs had already
been established; however, this new legislation certainly prompted additional states to
get the ball rolling. The following is an overview of the most active public
interpretation programs.

**Florida**

Florida’s Underwater Archaeological Preserves program was launched in 1987
and is managed by the Department of State, Division of Historical Resources, through
the Bureau of Archaeological Research (Scott-Ireton 2005, p. 48). The program has
been extremely active since its inception, establishing 11 shipwreck preserves as well as
two trails: the Florida Maritime Heritage Trail and the 1733 Spanish Galleon Trail.
Another trail, the Florida Keys National Marine Sanctuary Shipwreck Trail, was also
established, but in a joint partnership between the State of Florida and the National
Oceanic and Atmospheric Administration (NOAA) (Terrell 2003, p. 151).

The preserves are interpreted principally for snorkelers and divers. Similar to
Canada’s program, the Florida shipwreck preserves are also considered ‘museums in the
sea’ and offer a variety of wrecks differing in age and type (Scott-Ireton 2005, p.48).
The first preserve to be created was that of a 1715 Spanish galleon, *Urca de Lima.*
Other preserves range from a paddlewheel steamboat, *City of Hawkinsville,* to the
nation’s oldest existing battleship, USS Massachusetts (Scott-Ireton 2003, pp. 95-7).
The interpretive materials designed for the preserves include a pamphlet and laminated
site guide for each of the wreck sites, a poster of the entire preserve system, a
comprehensive website that includes all the printed materials and video, and underwater
plaques adjoining the wrecks. Furthermore, the majority of preserves also have a land-
based exhibit located indoors in proximity to the wrecks (Scott-Ireton 2005, p. 50).
Florida’s Maritime Heritage Trail is comprised of six themes: Coastal Environments, Coastal Forts, Coastal Communities, Lighthouses, Historic Ports and Historic Shipwrecks. These themes and associated sites of interest are interpreted in a series of six poster/brochures that illustrate the importance of the maritime sites and respective history. An accompanying website enables public access to visitors wanting to experience the virtual trail (Smith 2003, p. 53). As Scott-Ireton (2005, p. 50) points out, “Although many of the sites featured on the trail are open for public visitation, it is primarily an ‘information trail’ consisting of literature rather than a driving or walking trail because visiting every site around the state is not feasible for the average visitor.”

The second trail, The 1733 Spanish Galleon Trail, links thirteen sites scattered throughout the Florida Keys. The interpretation for this trail focuses on a 24 page interpretive guidebook. This publication includes “… a plethora of colour photos and maps with exciting fonts and an intriguing account of the disaster” (McKinnon 2003, p. 92). A number of considerations were incorporated into the design of this booklet. Important messages including issues related to conservation and preservation are highly featured in this guidebook. To sum up McKinnon (2003, pp. 91-3), “After all, it is difficult to contend with visions of ‘treasure.’” This trail also boasts a booklet.

Maryland

The Maryland Maritime Archaeology Program operates under the Maryland Historic Trust Office of Archaeology. The program established one shipwreck preserve in 1995, a WWII German submarine, U-1105 “Black Panther”, which surrendered at the end of the war and later was sunk in the Potomac River in September 1949. The site is located in deep water with low visibility and strong currents (Langley 2003, pp. 45-8; Scott-Ireton 2005, p. 53). According to the State’s Underwater Archaeologist, Susan Langley (2003, p. 49), “… the Maryland Office of the Attorney General (OAG) would probably have been much happier not to have a preserve open to the public at all. However, in light of the mandate to make submerged cultural resources available to the public, the OAG required only that the site be termed an ‘historic shipwreck preserve’ and not a ‘dive preserve’, to emphasize that the primary purpose is to protect the resource.” Interpretation efforts resulted in the creation of a brochure and an exhibit at
the Piney Point Lighthouse Museum. Perhaps because the emphasis was on site preservation and not on diving the preserve, a travelling display was created in 1997, and a website was launched as well. Ultimately, these two initiatives were aiming to lower diver visitation to the site, but were also intended to gain a larger audience, as well as to interpret the site for non-divers and the physically handicapped (Langley 2003, p. 49). According to Langley’s 2003 article (pp. 52-7), a number of other sites more suitable to diver visitation were under consideration for the subsequent creation of underwater preserves. These have not yet been created, although a recent renewed interest to establish a Marine Protected Area or Marine Sanctuary at Mallows Bay in Charles County could be in the works. The Federal National Oceanic and Atmospheric Administration (NOAA) is ready to sponsor these programs, and has the support of Senator Cardin, who has shown interest in these projects as well (Susan Langley 2010, pers. comm.).

**Michigan**

The State of Michigan was the first to establish a preserve in the United States. In 1981, the Departments of State and Natural Resources aligned to create not one, but two underwater preserves: the Thunder Bay Underwater Preserve in Lake Huron and the Alger Great Lakes State Bottomland Preserve in Lake Superior (Halsey & Lindquist 2003, p. 107; Scott-Ireton 2005, p. 46). The State of Michigan has been quite active in establishing underwater preserves. As of 2007, Michigan had a total of 11 state bottomland preserves (Halsey 2007, p. 159), which are featured in a booklet published by the state (Halsey & Lindquist 2003, p. 107; Scott-Ireton 2005, p. 46).

In 2000, the designation of an area of submerged lands and surface waters as a national marine sanctuary (including an overlapping area of the underwater preserve) meant that the Thunder Bay Underwater Preserve became the Thunder Bay National Marine Sanctuary and Underwater Preserve and subsequently is managed in partnership with NOAA (Scott-Ireton 2005, p.47; Vrana & Stoep 2003, p.22).

Since Michigan’s underwater preserves differ in their nature, significance and management approaches, there has been a variety of interpretive materials and strategies set forth to engage the public. An assortment of materials has been used to develop and
manage underwater cultural resources such as plinths, museums and visitor centre
displays, brochures, booklets, land-based displays, major museum exhibits, small parks
focused on wrecks and project websites (Halsey 2005, p. 168; Scott-Ireton 2005, p.47;

New York

The State of New York has been active in creating a number of shipwreck
preserves and trails, as well as establishing partnerships with multiple government
agencies, local communities and non-profit organizations to create a range of
interpretive materials. The Department of Environmental Conservation is the
administering body for the State of New York and is affiliated with Bateaux Below,
Inc., a non-profit educational corporation comprised of scuba divers trained in
underwater archaeology (Scott-Ireton 2005, p. 51; Zarzynski 2007, pp. 112-5). New
York’s program started in 1993 with the establishment of two preserves: “The Sunken
Fleet of 1758 Preserve” and The Forward Shipwreck Preserve, both in Lake George.
The Forward Shipwreck Preserve was transformed into an underwater classroom in
1998, enabling divers to ‘experience’ an underwater archaeological site with an
archaeological recording grid and two underwater stations complete with thermometers
and recording slates. A second vessel was deliberately sunk nearby and set up with
various stations to allow divers to learn about the lake’s geology, fish life, vegetation,
and colour loss at depth (Zarzynski 2007, p. 117). Since then, two more preserves have
been added, another in Lake George and one in Lake Champlain (Scott-Ireton 2005, pp.
51-52; Zarzynski 2007, pp. 112-121). The Underwater Blueway Trail became a reality
in 2007. This trail is the first of its kind in the United States to link bodies of freshwater
to one another. The six waterways are geographically dispersed around the state and
include sites located in Lake George, Lake Champlain, Lake Ontario, Seneca Lake,
Lake Erie and the Atlantic Ocean. A Visitor Centre was constructed on Lake George to
offer an exhibition space for the region’s submerged resources, and also to promote
local tourism to non-divers wanting to learn more about New York’s maritime heritage
(Zarzynski 2007, pp. 122-3).
The interpretation of submerged cultural resources in the State of New York has also utilised some of the more traditional products that have been used in other programs. Underwater plinths and land-based signs are present at most of the sites. Preserve booklets are available for both Lake George and Lake Champlain. These contain site information, site maps, mooring instructions, and emergency procedures (Scott-Ireton 2005, p. 52). In 2005, Pepe Productions collaborated with Bateaux Below and other partners to produce a more dynamic interpretive experience: “The Lost Radeau: North America’s Oldest Intact Warship” documentary (Zarzynski 2007, p.123). This award-winning DVD certainly enables both divers and non-divers to experience the 1758 *Land Tortoise* radeau (raft) without getting wet.

**NOAA National Marine Sanctuaries**

Although not a state, the National Oceanic Atmospheric Administration’s (NOAA) National Marine Sanctuary Program has been very active creating sanctuaries and collaborating with other agencies on a variety of projects across the United States. The National Marine Sanctuary Program is operated under NOAA Sanctuaries and Reserves Division. The National Marine Sanctuary Act of 1972 was implemented to designate and protect marine environments that are nationally significant due to their conservational, recreational, ecological, historical, scientific, cultural, archaeological, educational or aesthetic merits as national marine sanctuaries (National Oceanic Atmospheric Administration 2010). Currently, 13 national marine sanctuaries and two marine national monuments have been established around the nation, each representing an assortment of marine environments including: coral reefs, deep ocean gardens, deep sea canyons, whale migration corridors, and submerged archaeological sites (National Oceanic Atmospheric Administration 2010). “Most of the National Marine Sanctuaries boast cultural resources, particularly shipwrecks, as part of their resource base and several have initiated public interpretation programs” (Terrell 1995, Bruce G. Terrell 2004, pers. comm. in Scott-Ireton 2005, p. 57).

There exist a range of reasons for establishing marine sanctuaries. The first National Marine Sanctuary was established in 1975 to protect the wreck of the USS *Monitor*, the Union battleship famous for its battle with the CSS *Virginia* (previously...
Preservation of the wreck and enabling public access to the site were a focal point of NOAA. Since the wreck site lies too deep for recreational divers, portions of the wreck, including its turret, engine and propeller, were raised and conserved for display at the USS Monitor Centre (National Oceanic Atmospheric Administration 2010; Scott-Ireton 2005, p. 57).

The Florida Keys boasts the only tropical coral reef in the continental United States. Aside from its natural beauty, the Keys are the site of several hundred wreck sites dating back as far as the seventeenth century (Terrell 2003, p. 151). In 1998, the Florida Keys National Marine Sanctuary formally entered into a partnership with the State of Florida’s Department of State to manage the submerged cultural resources in its waters. The creation of a system of underwater parks and shipwreck trails was the primary focus in this joint venture (Scott-Ireton 2005, p. 57). The result was the creation of a Shipwreck Trail, which includes nine interpreted shipwrecks. The interpretive materials for these sites include site guides, identification buoys, a website, a land-based exhibit and a community outreach program (Terrell 2003, pp. 161-2).

NOAA has created and managed several more marine sanctuaries that have been interpreted in a similar way to the trail created in the Florida Keys. As well as establishing these sanctuaries, NOAA has been involved in numerous archaeological research projects around the nation, as well as other parts of the world. An example of this is the 2002 discovery of a small two-man submarine off the south shore of the island of O’ahu in Hawaii. This submarine was identified as one of five secret weapons of the Japanese Imperial Navy intended to attack Pearl (Van Tilburg 2007, p. 182). Due to the site’s depths and inaccessibility to divers, the wreck site has not been interpreted in the traditional sense. Although a formal website has not been launched specifically for this site, it has been described and discussed on a number of web pages. It is hoped that with the advancement in technology, a ‘virtual’ experience of the submarine could eventually be in the works (Van Tilburg 2007, p. 192).

North Carolina

The Underwater Archaeology Branch of the Department of Cultural Resources’ Division of Archives and History is the state body responsible for the establishment and
management of underwater preserves in North Carolina. At present, North Carolina has created one Shipwreck Preserve at the site of USS Huron, wrecked in 1877 (Lawrence 2003, p.66; Scott-Ireton 2005, p. 51). The interpretive materials developed in conjunction to this site include a pamphlet, land-based signage, an underwater commemorative plinth at the wreck site, as well as a travelling exhibit (Lawrence 2003, p. 69; Scott-Ireton 2005, p. 51).

Another project managed by the North Carolina Underwater Archaeology Branch is the Queen Anne’s Revenge (QAR) Dive Down, Diver Awareness Program. The QAR is believed to be Blackbeard’s flagship, although absolute proof has not yet been established (Wilde-Ramsing & Hermley 2007, p.127). Since the QAR’s discovery in 1996, public outreach in the traditional sense has resulted in various travelling exhibits, documentaries, publications, a permanent exhibit at the North Carolina Maritime Museum, and ‘innovative’ Internet broadcast aimed at pre-collegiate audiences, which went online in 2000 and 2001 (Wilde-Ramsing & Hermley 2007, p. 129). The QAR Dive Down Program was conceived specifically for the recreational diving community, to foster an experience that, while educational, is also entertaining (Wilde-Ramsing & Hermley 2007, p. 132). The Dive Down Program is broken into five different modules to be completed in order: Maritime History, Underwater Archaeology, Coastal Geology, Marine Ecology, and finally the Dive on QAR. This enables divers to gain an understanding of key features they will be experiencing during their dive, and teaches them to respect the resources. (Wilde-Ramsing & Hermley 2007, pp. 135-7).

South Carolina

The Maritime Research Division of the South Carolina Institute of Archaeology and Anthropology (SCIAA), located at the University of South Carolina, is the administrative repository for the State of South Carolina. The Underwater Archaeology Division’s Sport Diver Archaeology Management Program (SDAMP) was established in 1989 to specifically address the role of sport divers in South Carolina and to address management needs pertaining to the state’s legislation and submerged resources. Like most states, only a few trained underwater archaeologists are employed by the state;
however, South Carolina’s program also employs one full-time position dedicated exclusively to public education (Harris 2002, p. 59).

To date, South Carolina has established two maritime heritage trails: an interpretive paddling trail on the Ashley River connecting thirteen sites accessible to kayakers and canoers, and a dive trail on the Cooper River, which incorporates six sites (Scott-Ireton 2005, p. 53; Spirek & Harris 2007, pp. 165-172). These trails were conceived for both divers and non-divers. The interpretive materials created for these two trails include a brochure, laminated slates, mooring buoys, guidelines to safely access the sites, and a website (Scott-Ireton 2005, p. 54; Spirek & Harris 2007, p. 172).

Apart from the two trails created, South Carolina has actively worked on a number of sites within the State, as well as other projects internationally (Harris 2002, pp.68-71). One of the better-known projects has been the recovery of *H.L. Hunley*, a Confederate submarine sunk in 1864 (Conlin 2007, p.201; Hunter, III 2007, p. 204). *Hunley’s* recovery sparked public interest very early on, receiving extensive media coverage. The raising of the vessel was attended by an “overwhelming” number of people who watched directly via the Internet or television, or read about it in the press (Hunter, III 2007, p. 213). Education and public outreach have been at the forefront of *Hunley’s* recovery and conservation efforts. Interpretation materials developed have included documentaries, books, interactive CD-ROMs, Internet-based learning modules, and DVDs. Guided tours at the Warren Lasch Conservation Center (WLCC) are also available on weekends and select weekdays to allow public visitation of *Hunley* and related artefacts. A long-term goal of the project is the establishment of a museum that will permanently exhibit the submarine and its associated artefacts (Hunter, III 2007, pp.213-220).

**Vermont**

The State of Vermont is located inland, thus its maritime activities and resources focus in and around Lake Champlain. Lake Champlain finds itself in the states of Vermont and New York, and its northern most tip falls within the province of Québec, in Canada. The Lake Champlain Underwater Historic Program is the State of Vermont’s governing body responsible for the establishment of preserves. Formal input
from the Underwater Preserve Advisory Committee also plays a role in the creation of the State’s preserves. The Lake Champlain Maritime Museum, along with a number of university programs and volunteers from around the state help with historical and archaeological research and site recording to produce reports and various publications (Cohn 2003, p. 85; Scott-Ireton 2005, p. 47). Vermont currently has nine shipwreck preserves established in Lake Champlain (Lake Champlain Maritime Museum 2010). These sites are interpreted through the Lake Champlain Maritime Museum’s website (2010), as well as through program brochures that provide detailed information and site plans of each preserve. Underwater signage is also present at each of the wreck sites (Scott-Ireton 2005, p. 47-8). At the Lake Champlain Maritime Museum, an entire building is dedicated to the interpretation and education of a number of archaeological projects, which took place in Lake Champlain over numerous field seasons. Some of the displays are interactive and allow for active participation from the visitor.

**Wisconsin**

In 2000, the Wisconsin Historical Society’s Maritime Preservation and Archaeology Program joined forces with the University of Wisconsin Sea Grant Institute to establish a maritime heritage trail network combining both land-based and submerged sites to be enjoyed by non-divers as well as divers. These trails are located primarily in Lakes Superior and Michigan, as well as Green Bay and Door County. Attractions included as part of this trail feature shipwrecks, lighthouses, waterfront parks, museums, and historic markers (Scott-Ireton 2005, p. 54). The Wisconsin Maritime Trails are mainly interpreted through a comprehensive ‘Wisconsin Great Lakes Shipwrecks’ website; however, the majority of these sites are also interpreted through some form of land-based exhibit (Halsey 2007, p. 164). Eighteen of the featured wrecks have visitor guides available in the form of waterproof slates containing site plans, diving information and general history of the individual vessels (Scott-Ireton 2005, p. 56).
Appendix B
Websites Reviewed to Establish Digital Media Currently Being Used to Interpret Submerged Cultural Heritage Sites for Non-Divers

**Australia**

- www.environment.sa.gov.au/heritage/resources/shipwreck_trails.html
- www.environment.sa.gov.au/heritage/about/maritime.html
Tasmania - www.parks.tas.gov.au
Victoria - www.heritage.vic.gov.au
Western Australia - www.museum.wa.gov.au/museums/shipwecks/#shipwrecks/getting-here
Australasian Institute for Maritime Archaeology - http://aima.iinet.net.au/

**Canada**

Marine Museum of the Great Lakes - www.marmuseum.ca/
Maritime Museum of British Columbia - http://mmbc.ca/
Parks Canada - www.pc.gc.ca
United States

Florida
- www.museumsinthesea.com
- www.flheritage.com/archaeology/underwater/maritime/
- www.flheritage.com/archaeology/underwater/galleontrail/

Florida Public Archaeology Network
- www.uwf.edu/fpan/mardigras/

Maryland
- http://mht.maryland.gov/archaeology_underwater.html

Massachusetts
- www.mass.gov/czm/buar/index.htm

Michigan
- www.michigan.gov/dnr/0.1607,7-153-54463---,00.html
- www.michigan.gov/thunderbay

Museum of Underwater Archaeology
- www.uri.edu/mua/

New York
- www.thelostradeau.com/crew.html

National Oceanic and Atmospheric Administration
- http://sanctuaries.noaa.gov/

North Carolina
- www.archaeology.ncdcr.gov/

South Carolina
- www.cas.sc.edu/sciaa/mrd/mrd_index.html

Vermont
- www.lcmm.org/index.htm

Wisconsin
- www.wisconsinshipwrecks.org
- www.maritimetrails.org
Appendix C

Permissions to use Personal Communications

Permission granted.
Patrick Baker
Photographic and Video Services
Department of Maritime Archaeology
WA Maritime Museum Shipwreck Galleries
47 Cliff Street
Freemantle, Western Australia 6160
Australia

That is fine to quote me no worries - at some stage would you be able to send me a pdf copy of your thesis, it sounds interesting.
Matthew Carter
Postgraduate Student
University of Otago
364 Leith Walk, Dunedin 9016
PO Box 56
Dunedin 9054
New Zealand

Yes, ok to cite our communications. Cheers,
Peter Harvey
Maritime Archaeology Director
Maritime Heritage Unit
Heritage Victoria
Level 17, 80 Collins Street
Melbourne, Victoria 3000
Australia

Yes, you have my permission.
Clare Kinloch
Public Communications Officer
Heritage Branch
Department of Environment and Natural Resources
GPO Box 1047
Adelaide, South Australia 5001
Australia
As for citing our email conversations, you have my permission to quote me.
Best of luck with everything and I'll see you in January!
Kurt Knoerl
Chairman of the Board of Directors
Museum of Underwater Archaeology
http://www.uri.edu/artsci/his/mua/MUA.htm
United States

Yes, certainly and I would appreciate a copy of the final thesis also please.
Susan B.M. Langley
State Underwater Archaeologist
Maryland Historical Trust
100 Community Place
Crownsville, MD 21032
United States

I hereby grant you permission to cite any of our spoken/written personal communication
in your thesis. Best of luck with this and future endeavors. Best regards,
Victor T. Mastone
Director and Chief Archaeologist
Board of Underwater Archaeological Resources
251 Causeway Street, Suite 800
Boston, MA 02114
United States

No problems.
Jennifer McKinnon,
PhD Lecturer in Maritime Archaeology
Department of Archaeology
Flinders University
GPO Box 2100
Adelaide, South Australia 5001
Australia

Permission granted for use of information for your thesis. Regards,
Mike Nash
Maritime Heritage Officer
Parks & Wildlife Service Tasmania
134 Macquarie Street
GPO Box 1751
Hobart, Tasmania 7001
Australia
Karolyn, you have my permission to use anything we discussed about the historic resources of the CNMI and their management.
Ronnie Rogers
Staff Archaeologist
Division of Historic Preservation
Department of Community and Cultural Affairs
PO Box 500090 CK 10007
Saipan, MP 96950
CNMI

You may certainly cite me for your thesis! I will look forward to seeing you in Texas, and to seeing your final product! Cheers,
Della Scott-Ireton, PhD, RPA
Director, Northwest Region
Florida Public Archaeology Network
University of West Florida
207 East Main Street
PO Box 12486
Pensacola, FL 32591-2486
United States

No worries,
Ed Slaughter
Maritime Archaeologist
Queensland Museum
70-102 Flinders Street
Townsville, Queensland 4810
Australia

Yes, permission granted.
Roger Smith
State Underwater Archaeologist
Florida Bureau of Archaeological Research
500 S. Bronough Street
Tallahassee, FL 32399
United States
I'm totally happy to be quoted.
Hanna Steyne
Maritime Archaeologist
Maritime Heritage Unit
Heritage Victoria
Level 17, 80 Collins Street
Melbourne, Victoria 3000
Australia

You may use our personal communications in your thesis. Best,
Tamara Thomsen
Maritime Archaeologist
Wisconsin Historical Society
523 Atlas Ave
Madison, Wisconsin 53714
United States
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