

BERMUDA'S FIRST MARITIME HERITAGE TRAIL:

The Practical Archaeology of Maritime Heritage Trails and Interpretation Technologies

by

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ABSTRACT

This thesis explores the applicability of a maritime cultural heritage trail that would grant more public accessibility to shipwrecks and maritime sites, while discerning prevailing cultural themes from the analysis of five shipwreck sites—Morgan's Island wreck site, *Sea Venture*, *Warwick*, *Mary Celestia*, and Western Ledge Reef wreck. It further aims to qualify the use of interpretative museum technologies as a means of increasing public access and supporting the existing efforts of public archaeology. While maritime and submerged heritage trails rely heavily on diver attendance for sustainability, this thesis looks to bridge the gap between divers and the non-diver demographic. A 19-question survey was created and administered to 26 individuals who universally supported the use of interpretative technologies in cultural attractions.

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A Thesis

Presented to the Faculty of the Department of History
East Carolina University

In Partial Fulfillment of the Requirements for the Degree
Master of Arts, Program in Maritime Studies

by

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Chapter 1: Introduction

With hundreds of documented shipwreck sites, Bermuda has become a tangible library of information for underwater researchers, as this great abundance of archaeological material provides unique access to data collection and interpretation. This project aims to explore ways to develop a theoretical heritage trail around the island of Bermuda, designed to educate the public about the value of archaeology and the maritime heritage of the island by conducting a case study of five heritage sites. The sites, selected to present a diverse historical narrative, present an opportunity to not only educate visitors but to also promote local stewardship with the collaboration of stakeholders. Additionally, the availability of more accessible and financially less-burdensome technology and digital platforms offers the potential to create exceptional online content that elevates the impact of the museum experience. With the help of three-dimensional modeling programs, like photogrammetry and virtual and augmented realities, visitors may view and engage with the materials more intimately, encouraging interest and presenting a more accurate interpretation of the sites themselves.

While innovative interpretative technologies have become more widely accepted and considered, their use has rarely been qualified. How much do the people for whom these exhibits and heritage attractions are targeted value or appreciate these technologies as information mediums? How effective are specific strategies in conveying the material? This thesis aims to qualify the use of interpretative museum technologies as a means of increasing public access, expanding upon the existing efforts of public archaeology. While maritime and submerged heritage trails rely heavily on diver attendance for sustainability, the goal of this thesis is to assess ways to bridge the gap between divers and the non-diver demographic. This research also explores the value of an online resource available worldwide for those who are unable to travel,

or who are unlikely to ever visit Bermuda. In a collaborative effort involving stakeholder interviews and surveys, this thesis hopes to become a relevant addition to the larger heritage management and maritime archaeology discourse.

Research Questions

The author formulated four research questions which constitute the backbone of this project. The primary and secondary questions direct the flow and concentration of the project while also ensuring this thesis remains informative yet concise:

Primary:

1. How can the gap between divers and the non-diver demographic be bridged through shipwreck site interpretative strategies and what is the non-diver demographic response to these strategies?

Secondary:

- a. What archaeological information and historical narratives could primary stakeholders fit within the interpretation of the five historical shipwreck case studies as representative of Bermuda's maritime heritage?
- b. How would the stakeholders implement these interpretations in a heritage trail?
- c. How does the current legislation help protect Bermuda's heritage sites and would it help preserve a maritime heritage trail?
- d. Would a maritime heritage trail help to foster a preservation ethic amongst tourists and locals, and would it assist in their adherence to current shipwreck legislation?

Justification

This thesis examines how to actively present these culturally significant sites to the public while increasing awareness and bolstering education efforts. This research also contributes to the field of submerged and maritime cultural resource management through a comprehensive discussion of practical and theoretical strategies used in public interpretation of *in situ* maritime cultural resources and heritage sites, while testing their applicability with a real-world case study. This project further applies an interpretative theoretical framework which aims to modernize current literature on cultural heritage management and presentation. Finally, this thesis provides examples and rubrics for effective interpretation strategies that can be replicated in future projects.

Research Methodology

A heritage trail case study has been compiled to examine the applicability of innovative interpretation strategies while engaging stakeholders in a responsible, meaningful way. This permits the channeling of valuable traditional maritime skills and knowledge towards a mutually beneficial product, allowing maritime cultural heritage to thrive (Nick Hutchings 2018, pers. comm.). There can at times be a lack of different perspectives and community voices on display during the interpretation and presentation of a nation's heritage, and the methodological approach to this thesis strives to ensure the sites along the trail are conveying the most authentic representation of Bermuda and its cultural heritage based on survey responses (Best 2016:1).

Archaeology

Researchers from several organizations and academic institutions have already thoroughly investigated each of the five case study sites, resulting in a trove of archaeological

data ready for examination. A significant amount of data was compiled in the form of site plans, site reports, and artifact profiles. The investigations employed remote sensing technologies, photography, 3D renderings and artifact excavation information. Used in conjunction with the shipwreck's historical accounts, this data helped showcase the cultural significance of the sites and role in Bermuda's larger socio-economic history. The archaeological literature helped the author formulate suggestions on how to incorporate interpretation technologies into the presentation of the sites. *Shipwrecked* (2015) by Gordon P. Watts, proved to be an invaluable archaeological resource during the research of the case study sites, as it provided detailed shipwreck profiles and plenty of archaeological data from prior investigations. The National Museum of Bermuda also generously supplied additional site reports, photographs, and site maps for the research purposes of this project.

History

The research includes a historical narrative of the archaeological sites and a historiography of Bermuda's historical accounts. A literature review of heritage legislative initiatives provides a necessary context for public interpretation and museum involvement. Chapter 2's broad historical review aids in the characterization of Bermuda's omnipresent *maritimity*. The significance of the sites, which each retain their own unique histories, affords an essential and holistic understanding of their roles within a larger heritage trail.

Research included delving into a variety of Bermudian historical literature, as well as primary source documents, like letters, newspapers and maps from the NMB, Bermuda's National Archives, and Bermuda's National Library Digital Collection. Bermuda's National Library Digital Collection has digitized a large volume of Bermudian magazines and newspapers, from the Royal Gazette to the Bermuda Times. This resource is available to anyone

with access to the internet and was used to investigate the historic footprint of the case study shipwrecks. Primary source documents were critical to the historic investigation of the shipwreck sites by providing first-hand accounts from the people who witnessed and experienced these events. The synthetization of these documents allowed for a fresh, and unique, interpretation of the historical events that transpired hundreds of years ago.

The Survey

Innovative interpretative strategies have potential to provide a unique lens through which to view archaeological and cultural sites. Although current literature is abundant with testing on these technologies and ways to use them in archeological research and presentation, there has been little research conducted to analyze the use of these technologies, especially relating to heritage curation. Do the target audiences want to see and interact with these technologies? Do they truly aid in presenting a more accurate historical heritage narrative? Are they more desirable than traditional museum signage?

A survey questionnaire was created using Google's free online resource Google Forms. The survey was a straight-forward, self-administered 19 question questionnaire that aims to gage the level of interest in interpretive museum technologies and mediums; including a heritage trail website, and VR and AR exhibit experiences within a museum. The survey was administered as a web-based graphic questionnaire to encourage participation, and to communicate additional information to the respondents as opposed to other survey types. Cost effective and easily distributed, a web questionnaire was the logical choice of survey form, and facilitated international information gathering (Dillman et al. 2014: 170-171).

The survey questions included likert scale, to obtain useful ordinal data, and open-ended questions that allowed the participant to express specific concerns or desires. The likert scale,

which uses a numbered scale from “very interested” to “not interested”, was used for many of the questions instead of dichotomous (yes or no) questions, which can impact the statistical power, reducing its efficacy (Norman 2010: 627).

Any research conducted using human subjects requires a review and certification through the ECU University and Medical Center Institutional Review Board. As a part of the Office for Research Integrity and Compliance, the Institutional Review Board (IRB) protects “the rights and welfare of human participants in research at East Carolina University, Vidant Medical Center and its affiliates, and in research conducted elsewhere by faculty, students, staff or other representatives of the University in connection with their responsibilities or education” (ECU UMCIRB 2019). This survey project was approved as a "certified exempt" research project (Appendix A).

Data Collection

Data Collection involved collaboration with the NMB staff and archaeologists in brainstorming feasible and realistic exhibit ideas that meet economic and viewership goals, facilitating a well-researched and executed heritage trail. Archaeological data, courtesy of the NMB, was procured for examination and analysis for the case study. Additionally, a final research trip to Bermuda was conducted in March 2018 to assess local sites, conduct stakeholder interviews, and procure photographic data.

The survey was distributed through the NMB’s official Facebook page to a targeted audience. The quantitative value of the Museum and the perceived worth of interpretative museum methodologies can be better understood and evaluated by responses from the public, which will be discussed in length in Chapter 7. The public’s responses may alter the plan to

create and establish a heritage trail on the island, but their input will result in a more effective and exploratory museum experience.

Chapter Outline

Chapter 2 provides a historical context for the five archaeological sites selected for the case study. This chapter examines the relationship between Bermuda and the sea, exploring the theoretical concept of maritimity, and how it plays an instrumental role in interpreting Bermuda's cultural heritage. Chapter 3 delves into the three theoretical approaches—stakeholder theory, maritimity, and new museology—used to create a customized theoretical framework for use in this thesis' research design. Chapter 4 addresses the legislative, historical, and maritime heritage trail literature that is pertinent to the research goals and objectives of this thesis, laying the historical groundwork and legal context within which Bermuda's maritime heritage trail should be constructed and devised.

Chapter 5 is an exploratory look into some of the innovative technologies being used in museums and by other organizations to interpret historical material in a whole new way. Chapter 6 presents a case study of five selected aqueous sites in Bermuda that would make a worthy contribution to Bermuda's first maritime heritage trail. These sites were selected to represent the myriad of different circumstances a historical site may be subject to, while delving into each of their historical and archaeological histories. Chapter 7 discusses the creation of a questionnaire, distributed through the NMB's Facebook page, to assess whether a target audience would respond positively or negatively to the use of technology in museum interpretation.

The conclusion suggests plans of action for the primary stakeholders in their effort to establish a nation-wide maritime heritage trail on Bermuda based upon the historiographic and

archaeological research and supplemented by the data gathered from the survey. Chapter 8 revisits the project's primary and secondary questions and answers them. Chapter 8 also looks ahead with suggestions for further research opportunities. Lastly, the final chapter reiterates the author's hope to have this thesis contribute to the field of heritage management and museum studies by opening cultural experiences to everyone.

Chapter 2: History

Introduction

Bermuda, an Atlantic Island located roughly six hundred miles off the coast of North Carolina was a strategic resupply stop for Europeans traveling to the Americas in the sixteenth, seventeenth, and eighteenth centuries. Countless shipwrecks, a solemn testament to the perilous seascape, line the many miles of coastline and surrounding reefs. In 1505, Spanish navigator Juan de Bermúdez first spotted the uninhabited island, which has since become a popular tourist destination and thriving small country (Oviedo 1526). The historical significance of Bermuda's past presents an educational opportunity for the establishment of a nation-wide archaeological and historical trail. This section delves into Bermuda's history to paint a vivid picture of its past, providing the foundation for an authentic maritime heritage trail.

This chapter serves as a general overview of Bermuda's early history, and due to the sensitive and highly significant nature of Bermuda's black history, this summary only briefly touches upon the black experience on the island, including slavery and attempted revolts, with the understanding that further research should be directed towards Bermudian black history, and by which interpretative means this information should be translated to the public. The author would like to note, however, that Bermuda has begun a momentous shift towards highlighting the complicated and rich history of black Bermudians who were instrumental in sculpting the nation's identity, and who continue to be a vibrant and vital part of Bermudian society.

The Beginning

Captain Juan de Bermúdez deftly navigated the Atlantic waters back to his homestead of Palos, Spain after a successful slave drop-off in the West Indies. Commanding the caravel *La Garza*, Bermúdez spotted the uninhabited landmass which would become his namesake. Spanish

historian Gonzalo Fernández de Oviedo y Valdés accredited Bermúdez with the discovery and the island was then henceforth used as a Spanish navigational marker (Barreiro-Meiro 2002: 16). Oviedo, appointed by the King of Spain as the official Spanish Royal Chronicler, had not only credited Bermúdez with the discovery of Bermuda, but had also penned the first mention of Bermuda in literature. His 1526 publication *De la natural Historia General y Natural de la Indias* chronicles his experience sailing by Bermuda in 1515. Oviedo documented his observations as follows:

I have seen the island that is called Bermuda or La Garza from a Lombard shot distance away. The ship was sailing near the island until it was in eight fathoms of water. The island is small and believed to be unpopulated. I was determined to go ashore with ten or twelve boys and their firearms to put ashore half a dozen hogs of those that were on board for provisions. They would breed and provide meat when needed. Ready to launch a boat from the Nao, a contrary storm befell us. We could not get ashore and had to continue our voyage (Oviedo 1526).

Wild hogs became a regular and dependable food source for the voyagers utilizing the island as a final landfall before heading into the open Atlantic, either en route to Europe or to the Americas. Though the island was conveniently and strategically located, the encircling expanse of coral reefs proved perilous for travelers. The island has, thus, amassed a large graveyard of shipwrecks dating from the early sixteenth century. This did not, however, deter the Spanish from considering colonization of the land, but their plan to settle the landmass was never actualized. Initially, Fernando Camelo and Captain Bartolome Carreno were commissioned by the Spanish government to assess the viability of a Spanish colony on the island (Quinn 1989:6-7).

Carreno returned to Spain with a detailed report, thoroughly describing Bermuda Cedars and other flora and fauna that could be found on the island—but his report was cautionary. Carreno claimed the soil was not suitable for substantial crop growth and described his growing

concern over a lack of a fresh water supply. He posited that any colony made to settle the island would have a difficult time thriving in such conditions, and a colonial settlement would face substantial hardships leading to its eventual demise. Carreno's conclusive report halted any further plans by the Spanish to colonize the land (Quinn 1989:6-7).



FIGURE 1. Artist's interpretation of *Sea Venture*. By Christopher Grimes, 2009. (Watts, 2014).

Bermuda would remain uninhabited until *Sea Venture* (Figure 1), a British supply ship, wrecked in 1609 on its voyage to the English colony in Virginia. This cataclysmic event encouraged Bermuda's first true colonial establishment. Admiral Sir George Somers and Captain Christopher Newport piloted *Sea Venture*, a 300-ton vessel built in 1603 for the cloth trade in the Netherlands. The ship was the newest and strongest of the relief fleet heading to the new Jamestown colony. But before reaching their destination, the fleet was swept up in a four-day struggle with a hurricane in the middle of the Atlantic Ocean, and *Sea Venture* was separated from the rest of the squadron. Land was spotted on the last day of the storm, and the men

recognized the island. By this time, Bermuda could be found in cartographic materials, having first appeared on a map drawn by Peter Martyr in his book *Legatio Babylonica* (Figure 2) (Quinn 1989: 5; NMB 2010).



FIGURE 2. Bermuda’s first cartographic and historic mention in *Legatio Babylonica*. (Martyr, 1511)

The crew of *Sea Venture* were familiar with Bermuda’s more sinister moniker, the *Isle of Devils*. Bermuda had a gruesome reputation as a place overrun by evil spirits which would devour the souls of unfortunate castaways. Spanish captain Diego Ramirez dispelled much of this myth in 1603 when he found that the cacophony of sound was due to the island’s teeming indigenous wildlife and seabirds, rather than demonic entities. The crew of *Sea Venture*, however, were superstitious, and feared the island. Out of options, they were forced to make way to the nearest land or face almost certain death on the open ocean in their heavily damaged ship.

Remarkably, not a single life was lost during the wrecking of *Sea Venture*, and this harrowing event became the impetus for permanent English colonization of the island and inspired William Shakespeare's *The Tempest*. Survivors of the wrecking spent a total of ten months constructing two new ships, the appropriately named *Patience* and *Deliverance*, out of native Bermudian Cedar and materials salvaged from *Sea Venture*. *Sea Venture*'s crew completed their original expedition to Jamestown bearing gifts of turtle, cahow, and salted pork (Jordain 1610: 108-109, 114; NMB 2010).

An Island Nation is Born

Tales of Bermuda's mystique sparked public excitement. From its reputation as the *Isle of Devils*, to contradictory descriptors as an enchanting paradise, contemporary publications transformed Bermuda's reputation by presenting a contrast to its original notoriety: "That this dangerous and enchanted place which had been shunned as a Scylla and Charybdis, and where no one had ever landed by against his will, was really the richest, healthfullest, and most pleasing land ever man set foot on" (Williams 1848: 17). The accounts of Bermuda's untapped potential piqued the interest of England's most influential men, and a plan to settle the island was conceived. After years of deliberations, the Virginia Company outfitted *Plough* with 50 passengers, supplies, and provisions to establish a settlement on Bermuda. Richard Moore was appointed commander and Governor of the new colony and left with the first settlers in April of 1612, landing on *terra firma* in early July, thus establishing the first English town in the Americas. In response to the needs of the new colony, the Sommer Islands Company was formed as a branch of the Virginia Company, later becoming the Bermuda Company (Hallett 2007: 37; Watts 2014: 14).

Governor Richard Moore served as governor for three years with varying success during his term. Much of his focus was concerned with the construction of fortifications and other public works, to the detriment of the colonists and their immediate needs. Food was scarce, and the colony often suffered from starvation, which required them to rely heavily on supplies from England. But Governor Moore did an exemplary job at fortifying the island, and within a decade of establishing a settlement, Moore and the colonists had constructed eleven fortifications. The determination to protect the archipelago came from the ever-present French and Spanish threats, as well as their vulnerable position in the middle of the Atlantic Ocean (Harris 1997: 46-47).

Tobacco was the island's first chief crop, shaping island life and local colonial development. The English were staunch in their efforts to perpetuate this burgeoning economy, while the islanders were more interested in capitalizing on their strategic central location in the Atlantic. But tobacco would cause long-term struggles for the colony. Bermuda's initial economic success was largely due to the rise in tobacco plantations and their tremendous yields, which drew hundreds of hopeful immigrants to Bermuda. When the crop lost almost the entirety of its value in the late 1620s, the people who had once found success and ample reward from the crop had to rethink and restructure their lives. The eventual overcrowding of the island coupled with economic depression led to a mass exodus of colonials in search of more fruitful lands (Jarvis 2010: 26-28).

It was during this time that the Virginia company, unsurprisingly, found the colony unprofitable and the island was handed over to the English government. After a chaotic attempt to provide leadership for the fledgling colony—which witnessed pirate intervention, kidnapping, misconduct and general debauchery—Daniel Tucker was officially named the new governor of Bermuda. Bermuda was subsequently split into eight parishes, with each parish comprising of 50

shares to be distributed to the owners of the Bermuda Company. These parishes are still recognized as established communities today (Strode 1946: 38, 41; Hallett 2007: 45, 54).

Shipwrecks were reliable occurrences and became vital to the new island nation. From early in Bermuda's history, salvaging was a way for Bermudians to make use of the cargo and materials recovered from unfortunate vessels. Those who partook in the salvaging of forsaken ships would come to be known as *wreckers*. One of the very first recorded shipwrecks on the island was a Dutch pinnace in 1619, which was left battered upon the outer reefs and then subsequently salvaged. In this same year, Governor Tucker was replaced by Captain Nathaniel Butler who made great use of salvaged materials, including the especially sought-after ship's guns which were used to arm the growing fortifications around the island. The population was estimated to be two to three thousand people in the year 1627, growing rapidly by the addition of indentured servants (Strode 1946: 43; Hallett 2007: 139).

Due to the developing trans-Atlantic slave trade, Bermuda was able to sufficiently address its initial colonial labor shortage. Early colonial records do not precisely document the evolution of slavery in the colonies, but Bermuda's history lends a hand in exploring the experiences of the first generation of blacks on the island. Indentured servitude was inherently different for whites and blacks. Hesitant to use the term "slave," blacks were branded "indentured servants" and signed to "four score and 19 years" (99 years) of servitude, in contrast to the white man's five to ten years. Though not technically a slave, the individual was freed after ninety-nine years of service, upon the stipulation "if he (or she) shall live so long" (Bernhard 1999: 49).

There is also documentation of Native Americans being shipped to Bermuda in the 17th century. Massachusetts Governor John Winthrop and the Massachusetts Bay Colony were both

instrumental in sending plenty of North American Indians to the British Bermuda colony, which included the captured Native Americans of the Pequot War. Additional slaves and indentured servants were obtained from Spanish settlements and sent to Bermuda and other North American English settlements (Bragdon 1998).

In November of 1656, Bermuda was faced with its first attempted revolt by enslaved men. Sir John Henry Lefroy writes, “there was a consulation by the Governor and all his counsell about the conspiracy and plott that the negroes in this Island had contrived for cutting off and distroieing the English in the night...” (Lefroy 1877: 95). The plot was conceived by ten men—eight enslaved blacks, one free black, and one Native American—who planned to murder their slave owners and escape Bermuda by means of a small vessel. They were caught and persecuted, however only three of the men involved were executed. The revolt had an impact on Bermudian society, and fear over its reoccurrence was felt, prompting the Governor to decree the removal of free black men and women from the colony (Bernhard 1999: 88).

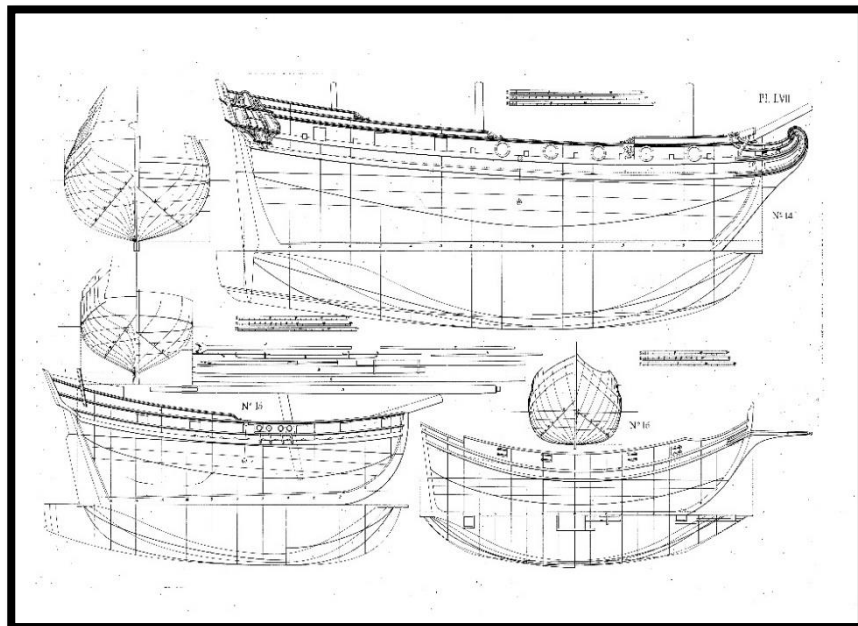


FIGURE 3. Bermuda Sloop ship design by F.H. Chapman in *Architectura Navalis Mercatoria*, 1807 (Chapman, 1807).

As an island surrounded by an expanse of ocean, maritime trade flourished, and this trade became instrumental in Bermuda's commercial success. Water craft constructed from indigenous Bermuda Cedar proved durable and resistant to common fouling, including the damage caused by marine organisms, like the *teredo navails* shipworm. In 1663, Bermuda decreed no vessel should be constructed over five tons, to regulate and control shipping and smuggling activity. But with the steady rise of their maritime trade economy, Bermuda had nearly tripled their original fleet size. More than seventy vessels were commissioned, ranging in size from 40 to 100 tons in the late seventeenth century. Bermuda had, at this time, begun constructing the *Bermuda Sloop*, characterized by its extreme deadrise and large length-to-beam ratio (Figure 3). These vessels were light and versatile, capable of carrying a large amount of cargo, yet fast and lithe enough to escape pirates. Made with the light and durable Bermuda Cedar, the Bermuda Sloop could carry more cargo than their heavier oak-constructed contemporaries. Bermuda sloops provided the primary support for the small island's maritime commerce operations, from the logwood Mexican and Central American trade, to support trade with its mother country. Shipbuilding and carpentry became a major source of employment for a vast number of Bermudians, and along with their craftsmanship they developed a singular proficiency in the art of navigation. This maritimity, Bermudian's deep connection to the sea, flourishes from their early dependency and mastery of maritime life and trade (Kerr 1936: 3; Watts 2014: 16-18).

The American Revolution and the Gunpowder Plot

Britain's North American colonies famously revolted and successfully secured their freedom in the late 18th century. In the wake of armed conflict beginning in 1775, Bermuda was thrown unceremoniously into a challenging situation. As a British island colony with compulsory ties to the North American colonies, Bermuda could not afford to lose communication and the

provisions provided to them by trade with their overseas allies; a large part of their survival depended upon the importation of American meat and vegetables. And while many Bermudians found their sympathies with the American colonists, a great deal more remained loyal to the British Crown. A delicate dance of diplomacy ensued, ensuring Bermuda's survival during the tumultuous years of war. Yet, Bermuda's involvement in the American Revolutionary war is often overlooked or altogether unknown—the 1775 “gunpowder plot,” a historic event with a significant impact on the war, is often excluded from Civil War historical accounts (Figure 4) (Kerr 1936: 46-47; Hallett and Ruffman 1996: 42).



FIGURE 4. Piece from NMB's Hall of History which depicts the 1775 Bermuda Gunpowder Plot. By Graham Foster (Jones, 2015).

Colonel Henry Tucker, a prominent Bermudian, enlisted the help of his son in encouraging the Continental Congresses to allow trade to continue with Bermuda. They also

supplied information regarding over 100 barrels of gunpowder that were stored in a hold near St. George's, albeit hesitantly, as the Bermudians still regarded themselves loyal subjects of the King. In a letter to Governor Nicholas Cook of Rhode Island, American General George Washington discussed the gunpowder: "One Harris is lately come from Bermuda, where there is a very considerable magazine of powder in a remote part of the island, and the inhabitants well-disposed not only to our cause in general, but to assist in this enterprise in particular" (Washington 1775).

Arranged between Henry Tucker and American Benjamin Franklin, the "heist", later known as the Gun Powder Plot, was successfully carried out on the night of August 14, 1775. The gunpowder was carefully extricated from the magazine located above Tabaco Bay and covertly loaded aboard *Lady Catherine* and *Charleston and Savannah Packet* to find their way safely into American hands. Their clandestine effort to provide a worthy contribution to the American cause in the name of continued trade relations paid off. The Continental Congress halted a trade embargo with Bermuda, and this unofficial agreement would carry through the entirety of the American Revolutionary War (Tucker 1813; Kerr 1936: 47-53).

Bermuda's Evolving Maritime Economy

The loss of the British North American colonies following the Revolutionary War caused a major reconfiguration of the British empire, triggering a maritime economic depression during the end of the 18th century. The Atlantic sea-lanes were overwhelmed with a high volume of vessels and for-hire sailors, causing a dramatic plummet of wages and freight rates. Bermudians were keenly affected—their shipbuilding industry suffered when the demand for Bermudian vessels dropped and they were no longer able to command high prices for their craftsmanship. Surprisingly, Bermuda's merchant fleet would remain among the largest of British America's

with over 120 vessels. Many of these would turn from maritime commerce to the more lucrative avenues of fishing and whaling, heading to northern waters in search of prosperity (Jarvis 2010: 450-455).

Great Britain heavily garrisoned the island after losing their American Naval bases. Bermuda's new status as a strategic naval base led to the first hydrographic survey of Bermuda (Figure 5). In 1791, after five years of painstaking work, Lieutenant Thomas Hurd had a completed map of the reef systems surrounding the island, noting deep channels and anchorages which would allow for the shelter of large vessels like the *HMS Resolution*, the first ship-of-the-line to dock in Bermuda's harbor. Engineer Captain Andrew Durnford was concurrently investigating the coastal areas for additional Naval and Army fortifications, in an effort to modernize Bermuda's existing defenses (Jarvis 2010: 455; Watts 2014: 20).



FIGURE 5. Lieutenant Thomas Hurd's Hydrographic Survey Map, 1797. (Hurd, 1797).

Another War in America

The secession of the American southern states in the 19th century led to a brutal civil war. As President Abraham Lincoln imposed a naval blockade of all Southern U.S. ports, the South hit back with the creation of the blockade-runner—a steam vessel specially crafted for maneuverability and speed. The Union’s “Anaconda Plan,” which sought to strangle the southern state’s economically, made it nearly impossible to export Southern cotton, tobacco, and turpentine. But with help from blockade-runners and Bermuda’s Confederate sympathies, Bermuda became a major trade hub between the blocked Southern ports and their European trade partners, allowing the South to survive (Delgado 2011).

The slow-moving transatlantic steamers that carried Confederate supplies from Europe began making their last port of call in Bermuda—the closest British colony to the most important Southern ports—where their goods were then transferred to the blockade runners. Charles Maxwell Allen, a U.S. consul to Bermuda during the Civil War, wrote a letter to his Union contact describing the types of cargo coming through Bermuda:

The steamer *Cornubia* left here last night. I was misinformed when I stated in my No. 2 that she was partly loaded with arms, ammunition. She has a cargo consisting of blankets, boots and shoes, clothing, etc. She takes a Bermuda pilot and will undoubtedly return here if successful (Allen and Wiche 2008: 76-77).

Blockade running was exceptionally dangerous, but it yielded immense rewards. The illicit trade of goods saw a 200 to 700 percent increase in price during war time, and those souls brave enough to risk capture, imprisonment, and death were the wealthier for it. Unfortunately for Bermudian mariners, the lucrative illicit trade relationship with the South deteriorated at the end of the war. Bermuda lapsed into a small economic depression, but the British Royal Navy saw an opportunity. By 1873, the Royal Navy “was responsible for more than 15 percent of

Bermuda's total income," building and expanding upon existing naval fortifications around the island (Delgado 2011; Watts 2014: 26).

Chapter 3: Theory

Three theories—*maritimity*, *stakeholder theory*, and *new museology*—have collectively been assessed to create a customized theoretical framework for use in the research design of this thesis. The employ of these three different theories working in tandem demonstrates the necessity for an interdisciplinary approach to such endeavors. This chapter discusses the individual theories and details their application and usage within a Bermuda maritime heritage trail project.

Maritimity

A theater for adventure, discovery, and prestige, the sea has a way of instilling human-kind with a sense of profound connection to something greater than oneself. The sea represents both the cruel and beautiful aspects of nature, which often leaves a significant and lasting effect upon a community and a culture. *Maritimity*, or the relationship between people and the sea, is discussed in this chapter as a theoretical approach to determining the significance of the five Bermudian case study sites of this research project (Andrews 2010: 3).

The idea of *maritimity*, coined by Christer Westerdahl in 1998 and defined more thoroughly by Heather Hatch as “identity grounded in perceived (or imagined) shared traits deriving from a community’s relationship with the maritime environment,” has come to mean a great many things to maritime archaeologists and those researching maritime cultural landscapes and communities (Westerdahl 1998; Hatch 2013: 11). While its definition may be nebulous, the approach fundamentally aids researchers and scholars in attempting to tease out the intertwined connections and relations between a community and a body of water, whether it be the sea, a lake, a river, etc.

Delineating a clear, one-size-fits-all approach to maritime cultural landscapes and the maritimity of the residing peoples is not the objective of these studies. Rather, the enigmatic tethers of a community to the water must be delicately examined and thoughtfully approached, for each relationship and culture has a distinct identity which is constructed using their own version of maritimity. In this way, the sea establishes a basis to contextualize both the identities of individuals, and communities (Hatch 2013: 11). Used as an empirical tool, the maritimity approach is employed to more appropriately and effectively relay the archaeological and historical significance of the sites using the cultural language of Bermuda's people. This will reinforce the affect and authenticity of a Bermudian maritime heritage trail.

Bermuda's maritimity has been meticulously examined with Charlotte Andrew's dissertation, *Community Uses of Maritime Heritage in Bermuda: A Heritage Ethnography with Museum Implications* (2010). She asserts the following regarding Bermuda and maritimity:

In my careful language of such separation enables an understanding of how and why these cultural processes and concepts marry; how the sea and its narratives, representations, materialities and so on exert a pull or 'affect' on Bermudians and their heritage uses, and in turn how Bermudians use heritage to build or repair their personal and collective maritime bonds. This interactive permeable view of maritimity allows for mutually-transformative relations between people and the sea while treating heritage as a specific cultural process (Andrews 2010: 3).

Heritage trails can be terrestrial, aquatic, or a marriage of the two. Since Bermuda's maritimity is fundamentally grounded in both land and water sites, it makes sense to contribute both types to a trail. Using the sub-categories under the prevailing theme of maritimity—landscape, maritime material culture, and maritime resources—each should be assessed using documented material culture and primary source historical documents, effectively establishing Bermuda's relations with the individual sites within the context of these sub-categories (Hatch 2013).

Bermuda's long history of maritimity and connection with the sea is obvious. As an island nation, dependent for centuries upon a mother country for food and necessary goods, the ocean became both their savior and a barrier to the rest of the world. Since its inception, the island has retained a strong sense of maritime culture, and further research into the connection of Bermudians and the sea is warranted. NMB's museum director Elena Strong asserts: "The economics and impact of salvage in the early settlement of Bermuda has not yet fully been explored by academics and can provide a fascinating window into how the first Bermudians survived on an isolated island" (Bennett 2018). Once the home of master shipbuilders and merchants, and characters of a more piratical nature, Bermuda now relies heavily upon their maritime tourism. Pink sand beaches and luxury yachts are now intrinsically linked with Bermuda's evolving maritime culture.

Stakeholder Theory

The creation of a heritage trail involves the cooperation, support, and engagement of a variety of organizations, businesses, and individuals. This is not only an important part of cultural heritage management for management's sake, but it further facilitates the necessary discourse between peoples of conflicting interests, differing values, and cultural differences. Moreover, governmental departments and authorities, while theoretically intended to protect such places, sometimes mandate legislation which incumbers the protection process and creates conflict between stakeholders and managers, at the expense of the actual management of heritage sites (Simengwa 2015).

With the establishment of a heritage trail, there is a necessity to acknowledge the "stakeholders" involved, which in the context of this project refers to those with interest, cultural

or commercial, in the development of the proposed trail. Heritage sites require management plans and continual conservation efforts, all of which will fall primarily upon the stakeholders. Specifically, this thesis uses *stakeholder theory* to explore how organizations, local communities, and tourists may be encouraged to identify with and protect the historical and archaeological sites along the trail.

Commonly used in business practice, *stakeholder theory* is a theory of organizational ethics and management and is distinct because it acknowledges both morality and stakeholder values as being a central theme and feature of managing an organization, or in the case of Bermuda's heritage trail, the archaeological and historic sites therein. Freeman Phillips et al. continue: "The ends of cooperative activity and the means of achieving these ends are critically examined in stakeholder theory in a way that they are not in many theories of strategic management" (2003: 481). The question arises, to whom are managers responsible? Ethically and morally concerned, stakeholder theory centers around the idea that management should seek more than a maximum return for shareholders, instead regarding the well-being and interests of those involved in the creation and sustainability of the organization, or in this case, a heritage trail (Phillips et al. 2003: 481).

This thesis outlines few of the predominant stakeholders who would, in a nation-wide Bermuda Heritage Trail, be heavily involved and lay considerable claim to its creation and influence. Stakeholders were identified based upon their current involvement in Bermuda's heritage, and their ability to provide sustainable management. The National Museum of Bermuda (NMB) was identified as a chief stakeholder because they have the resources and infrastructure already established to take over stewardship of a heritage trail. The Bermuda Tourism Authority (BTA), Island Tour Centre (ITC), the Department of Environment and Natural Resources

(Government of Bermuda), Custodian of Wrecks Dr. Philippe Rouja and others, have also expressed keen interest in being a part of this landmark national achievement. Stakeholder theory was primarily employed in examining and analyzing the qualitative data of interviews conducted during a research trip to Bermuda in the spring of 2018.

It is vital to assess the role stakeholders believe they should occupy, and their interpretation of the importance of the heritage they are promoting and protecting. In an interview with *The News & Observer*, the NMB's museum director, Elena Strong, expressed the following sentiments regarding the nation's maritime heritage:

Bermuda's rich underwater cultural heritage, which is protected by law, is not only a valuable cultural tourism asset, but also comprises a tangible archive of the interaction of African, American and European cultures over five centuries. Over the past 40 years, research on these wrecks has yielded considerable data informing historical narratives about the lives of the people who depended on these vessels to ferry goods and people to various ports along the Atlantic littoral (Bennett 2018).

As a representative of the NMB, Elena Strong's comments reflect a deep understanding of the museum's responsibility to the community and to the preservation of Bermuda's heritage. Addressing tourism's role in the cultivation and curation of heritage sites also demonstrates the museum's willingness to collaborate with other stakeholders in an educational heritage trail initiative.

Christina Aas et al. (2005) examined the role of stakeholders in a UNESCO/Norwegian government project which promoted a collaborative effort between heritage conservation and tourism through stakeholder involvement. The term "collaborative" should be emphasized, as stakeholder theory aims to create a cohesive synergy between stakeholders. Their research acknowledged that when a group of stakeholders become involved in such an endeavor, expectations beyond what can be realistically achieved may arise, and that power to make

executive decisions often resides with one distinguished “local elite” effectively silencing many of the local minorities (Aas et al. 2005: 31). Stakeholder theory was integral in the formulation of the interview questions in making sure these concerns are addressed.

Shipwrecks in particular represent interesting management case studies because of the “diverse values of the site and the relative importance placed on...values by different stakeholders” (Cuthill 1998: 33). Shipwrecks provide an array of attributes that are considered valuable to numerous stakeholders which may be historical, cultural, recreational, biological, or economic in nature. The distinct interests of various user groups often conflict, precipitating the debate about the best use of such cultural resources (Kaoru and Hoagland 1994). These types of innovative and successful resource management initiatives require increased support and improved stakeholder participation.

New Museology

Museums are a place of great wonderment and have, during the many years of their existence, given patrons the ability to experience culture, art, and science in a way which excites and compels. Those who grow up to pursue careers in art and science have often claimed they felt that first spark of ingenuity during a trip to a museum. With this kind of influence, museums also wield great power and great responsibility to the people for whom their content is exhibited. Museums are largely mediums of entertainment, built upon the bones of an educational institution. However, the modern museum has found itself faced with falling visitor numbers and a muddled understanding of self-identity. Colonial Williamsburg, one of America’s more renowned outdoor museum experiences has shown a dramatic decrease in visitation since the 1980s, recording a staggering loss of more than half a million visitors in only a few decades

(Brauchle 2017). To remain relevant, museologists have devised a new museum theory to address these concerns.

Supporting the interpretation methodology of the heritage trail project, this thesis uses the theoretical approach of *New Museology*, or the idea of the museum as an educational tool in the service of societal development, and the idea of the museum setting and institution as an educational institution in the service of society (de Varine 1985: 4). Peter Vergo explains that for museologists, the new museology denotes a shift to the study and interpretation of a museum's purpose, and for museology to be rightly seen as a theoretical and humanistic discipline (Vergo 1989: 3). New Museology allows for an interdisciplinary approach to cultural heritage and public archaeology, acknowledging the importance of the museum, and its role as an educator, facilitator and advocate for heritage. This theoretical approach applies to the interpretation of the *in situ* maritime sites along the trail, and how through public engagement and education, this interpretation can be manipulated and expanded.

Karen Charman insists, “in new museology, the role of education has not diminished but entails a self-reflexivity” (2012: 1067). While museums have largely been formulated for the well-to do, historically Anglo-majority, new museology promotes an initiative for deeper conversations surrounding moral and cultural narratives of all kinds; for discussion to be ignited, further facilitating the continual transformation of culture. New museology has become a paradigm which highlights the errors in making high culture only available to the privileged few (Jászberényi et al. 2018). Why was there a need for a paradigm shift to begin with? Pierre Mayrand, who was instrumental in the conceptualization of the theory, reflects on its necessity:

The cause must lie in the museum establishment's delay in coming to terms with a number of contemporary, cultural, social and political developments. To this must be added what we see as the cumbersome and uncommunicative nature of the bodies which

represent it, and also, of course, the underlying context of world crisis and re-evaluation of all human endeavor. But in our view the main cause is the monolithic nature of the museological establishment, the superficiality of the reforms which it proposes and the marginalization of any experiment or viewpoint which might be described as at all committed (Mayrand 2014: 115).

The concept emerged when the General Conference of International Council of Museums (ICOM) met in 1983, which led to the First International Committee for Museology, quickly developing into a movement with strong momentum, which ultimately lead to the creation of the International Movement for the New Museology (MINOM) in 1985 (Mayrand 2014: 115). The movement solidified their dogma with the *Declaration of Quebec: Basic Principles for a New Museology*. Its universal considerations include the following:

While preserving the material achievements of past civilizations and protecting the achievements characteristic of the aspirations and technology of today, the new museology—ecomuseology, community museology and all other forms of active museology—is primarily concerned with community development, reflecting the driving forces in social progress and associating them in its plans for the future (MINOM 1984).

Museums, and by extension heritage trails, are largely tourist attractions with cultural considerations. Museums must be wary of tourist trends and demands; catering to the desires and expectations of the tourist experience is necessary in order to maintain and grow attendance. In New Museology, the term *cultural tourism*, thus plays an important role. Cultural exploration has led to an increasing number of tourists looking for a more immersive and educational experience, which Jászberényi et al. have interpreted to mean “as an indicator of the advanced relevance of cultural attractions and their contribution to the tourism experience creation” (2018: 42).

A heritage trail offers a unique case study for museologists. As an appendage of the traditional brick-and-mortar institution, a trail or outdoor exhibit offers the “immersive” and “educational” experience that Jászberényi et al. have indicated that tourists are eager to see (2018: 42). While museum sponsored heritage trails are not common (heritage trails are often

government funded cultural attractions), the purpose of the trail aligns with the mission of educational institutions in promoting community discourse and development, and a discovery of a shared community heritage. Della Scott-Ireton's dissertation titled *Preserves, Parks, and Trails: Strategy and Response in Maritime Cultural Resource Management* (2005) was first to suggest that New Museology could be used as an approach to maritime heritage trail development. Scott-Ireton notes that New Museology recognizes the museum's ability to place "construction upon history," and argues that *in situ* maritime archaeological resources can be viewed as non-traditional museums which have the power to change public perception of shipwrecks. A New Museology approach to maritime heritage trails would also "encourage protection of non-renewable cultural resources" while involving "communities in the preservation and interpretation of their maritime heritage" (2005: 15). Using the theoretical framework of new museology, this thesis examines the ways in which a museum sponsored maritime heritage trail will encourage public engagement and education, and how through innovative interpretive strategies, this effort can be expanded upon for future museological endeavors.

Conclusion

Several theoretical frameworks would have suited a research project of this nature. These three were chosen as they seem most suited to assess the viability of a heritage trail as well as their ability to critically consider the cultural significance and implications associated with the implementation of one. *Stakeholder theory* works to address those involved, while *maritimity* allows for the careful dissection and authentic interpretation of the trail's cultural meaning. Finally, *New Museology* introduces an interdisciplinary approach to the curation and preservation of heritage sites for the betterment of society and for the posterity of those whose culture

deserves to be honored.

Chapter 4: Literature Review

This chapter is organized into three distinct parts—a review of the legislative, historical and maritime heritage-specific literature that is pertinent to the research goals and objectives of this thesis. Bermuda’s history is vibrant and well documented, and the historical literature provides a solid foundation in which to more thoroughly understand Bermuda’s maritime culture. Paradigm shifting legislation has changed global perspective on heritage and has raised awareness of its dire need for protection. The UNESCO 2001 Convention on the Protection of Underwater Cultural Heritage and Bermuda’s 2001 Historic Wrecks Act demonstrate the global shift towards preservation awareness and a general acknowledgement of the government’s responsibility to mitigate human destruction of cultural sites. Finally, maritime heritage trail-specific literature examines the complications inherent in trail development, and how these complications should be approached and solved. The research and academic discourse on these subjects are transforming the conversation on cultural heritage management. The amalgamation of literature presented here lays the historical groundwork and legal framework—informing and endorsing the agenda of creating a maritime heritage trail.

Historiography

Since Bermuda’s discovery in the early 16th century, it has been a subject of great fascination. Tales of its picturesque beaches, swaying palms, and magnificent waters lured the first settlers and immigrants, and continues to this day to seduce thousands of visitors annually. The island’s evolution into the small but significant nation it is today can be examined through the eyes and words of the mariner, the wrecker, and the shipbuilder—a nation built upon its

symbiotic existence with the ocean. With a trove of primary source documents available, including letters, newspapers, and royal decrees, historians have been able to pen Bermuda's tale in myriad of different and factually fascinating ways. Four books which add to the historical discourse on Bermuda have been reviewed for their ability to provide insight into Bermuda's history using a unique perspective.

Focusing on the beginning of Bermuda's historical timeline, Michael Jarvis' work *In the Eye of All Trade: Bermuda, Bermudians, and the Maritime World, 1670-1783* (2010) demonstrates Bermuda's transition from the field to the sea. After the demise of the Somers Islands Company in 1685 and with the realization that they had largely failed agriculturally, Bermudians found themselves free to embrace maritime life, which they did with alacrity. So too were they drawn by the lucrative opportunities that accompanied illicit trade and smuggling, commonly in partnership with the island's sister territories in the Caribbean. Jarvis contends that although it is well known that Bermudian ships were fast, and their freight rates were considerably low, this was only a façade for their entire maritime enterprise. Smuggling, privateering, wreck salvage, and other exploitative endeavors provided the hidden back-bone of their prowess, to which Jarvis supplements this very apt quote, "It [is] a maxim here [in Bermuda] that a man cannot get an estate by being honest" (Jarvis 2010: 160).

An Introduction to the History of Bermuda (1990) by colonial American scholar Wesley F. Craven is the result of a passion project that the author never believed would be published. Fortunately, it was, and the resultant work is an intimate account of the earliest settlers on the island, providing a context in which a discussion on Bermuda's global interconnectivity and importance in Atlantic trade relations can be better understood. Bermuda personifies the imperialistic experiment and colonial expansion of the British empire, symbolizing both the

beginning and the demise of British colonial rule. Having focused his research primarily on the early Virginia colony, Craven discovered the inherency of an intertwined historical narrative between Bermuda and the colonies. Citing the Rich Papers as a most helpful source, his research synthesizes personal letters and company documents discovering that “the story of greatest significance found in Bermuda’s early records is that of the adventures’ approach to the technical problems of colonization” (Craven 1990: 12).

Bermuda’s culture is heavily steeped in maritime culture, and *Bermuda From Sail to Steam: 1784-1901* Vol. I (1973) by Henry C. Wilkinson aims to highlight this by historically examining Bermuda through a maritime lens. Equipped with a slew of vessel facts and figures, this historical account is all about the details and the undeniable maritime dependency of the island. Bermuda’s naval history becomes paramount in dissecting the island’s political and strategic role in Great Britain’s reorganization of the empire following the Revolutionary War, and in the wake of a depressed maritime economy. Wilkinson paints a vivid picture of Bermuda’s substantial role in the Atlantic World using the fine brush strokes of the small and seemingly trivial facts of those first Bermudian settlers.

The book *Bermuda and the American Revolution: 1760-1783* (1936) by Wilfred B. Kerr takes a magnifying glass to the relationship between Bermuda and the North American colonies during their quest for liberation. Few Americans are aware of Bermuda’s involvement in the war, which notably includes the daring Gunpowder Plot of 1775. Kerr delves deep into the personnel involved in the plot and the intricate details of its execution. Still, Bermuda’s participation in the Revolutionary War extended beyond being only a gunpowder supplier. Kerr demonstrates how the revolting thirteen colonies were of tremendous economic concern to Bermuda, as they relied heavily upon their American trade relationship. Drawing from British, American, and Bermudian

primary manuscript sources, Kerr has established a thorough and yet succinct account of how Bermuda, caught between its loyalty to the Crown and its merchant relations, was largely able to maintain neutrality and secure its survival.

Legislation

Until the 20th century, shipwrecks were predominantly seen as no more than opportunities for salvage and profit, or as a means of obtaining a maritime relic. Bermuda has witnessed some of the most concentrated and vigorous salvaging activity in the world—their history as “wreckers,” or those who salvaged materials from wrecked ships, a telling prediction of what was to come. Salvagers and treasure hunters are still a major concern today and have inspired new legislation, both globally and nationally, for the protection of heritage world-wide, terrestrial and submerged, from being tampered with or destroyed. The following section examines current legislative literature (UNESCO’s 2001 Convention on the Protection of the Underwater Cultural Heritage and Bermuda’s 2001 Historic Wrecks Act) enacted to protect world heritage sites, while also exploring the evolution of heritage protection policies into what they are today. This section will also discuss the academic discourse and commentary on the legislation, providing a thorough understanding of the status of Bermuda’s sites within the context of global heritage protection policies.

Why is Protection Critical?

From treasure hunters to tourists, and the effects of political turmoil and terrorism, cultural heritage sites around the world have been under duress and at considerable risk for hundreds of years from a variety of assailants. Sites with tremendous cultural significance have been brutally destroyed in acts of terrorism or have been looted for artifacts. The artifacts are

often illegally sold or remain in the care of a novice archaeologist who lacks the knowledge or wherewithal to properly care for them. The archaic ways of antiquarianism and imperialism has led to the long and arduous path of creating more ethically and culturally sensitive ideas about cultural heritage and its ownership, particularly regarding material culture and heritage sites. When archaeological sites stand prone to significant environmental risks—global warming, rising sea levels, natural disasters, etc.—it has become a moral imperative for political intervention in mitigating human interference and destruction.

The UNESCO 2001 Convention on the Protection of the Underwater Cultural Heritage

The United Nations Educational, Scientific, and Cultural Organization, or UNESCO, outlines five reasons to protect cultural heritage (UNESCO 2014):

- (1) Evolution of human consciousness is a continuous process. History here serves as a laboratory and the past serves as a demarcation to understand the regional laws and social structures.
- (2) We are not born capable of judging fairly and wisely; learning about various cultures helps us be a good global citizen and improve our critical & analytical thinking.
- (3) Every historical site has an important story to tell, and these stories have inspired many people to strengthen their convictions and commitment to fight injustice and oppression.
- (4) Heritage sites are our connection to the past.
- (5) Heritage sites are great for economics. Heritage conservation has proven to be a thriving place for entrepreneurship & innovation.

UNESCO encourages an approach of understanding culture as a process and as precious to those who experience, witness, and live it, while also acknowledging more practical applications for heritage site protection. Fernando Armstrong-Fumero and Julio Gutierrez note, however, that complications can arise when contemporary stakeholders lay claim to archaeological sites and their related landscape features when the motivations extend beyond simple efforts of conservation and site preservation; to include controlling site visitation,

habitation, and alteration of these heritage sites (2017: 3). These are important considerations for any group conceiving a heritage trail, park, or related heritage attraction. While culture can be understood as a process, the manipulation of these sites by those who wield considerable power over them can often disrupt the organic nature of culture's evolution.

For this reason, legal statute has aided in the preservation of culture and its heritage in substantial ways. UNESCO, as a subsidiary of the United Nations, is recognized globally for its efforts in cultural heritage protection and has made tremendous strides in passing legislation for the preservation of sites all over the world. Although Bermuda was not a ratifying state member, The UNESCO 2001 Convention on the Protection of the Underwater Cultural Heritage has had considerable influence on heritage policies world-wide and has inspired Bermuda's heritage legislation. The convention raised global awareness of submerged cultural heritage and improved protection and research, allowing for scientific conversation and collaboration, while being a protective measure against omnipresent threats to such sites (UNESCO 2017). Although this thesis focuses on developing a Bermuda heritage trail, it is necessary to investigate and interpret global literature regarding heritage protection in an effort to provide a framework for future trail applications and use.

The convention, which took place in Paris, France and formally adopted in 2009, outlines a series of main principles that State Parties are meant to uphold following ratification (Dromgoole 2013). The first objective conditions that States are obligated to preserve underwater cultural heritage and act accordingly. The second main principle establishes *in situ* preservation as the first option before further excavational endeavors are considered, although individual artifacts can be removed if their study provides significant and valuable contribution to heritage preservation and knowledge. The third principle strictly prohibits commercial exploitation, and

the irretrievable dispersion of cultural material from historic sites. Finally, a collaborative effort of information exchange is encouraged between the State Parties, promoting public awareness (UNESCO 2017).

The 2001 UNESCO Convention has been ratified by 60 State Parties, including the countries of Mexico, Italy, and Egypt, among others. Surprisingly, Bermuda was not among the ratifying States. The United States, a global force and leader in legislative practice, was not among the signatory State Parties either, but has made an effort to implement its principles with separate, yet similar, rules and regulations (Varmer et al. 2010). Bermuda's Historic Wrecks Act (2001) was a direct response to the growing global awareness for the need of heritage protection, which the UNESCO 2001 Convention sought to address.

The Convention did not address wreck ownership, nor did it seek to change existing maritime zones. Beyond this, the UNESCO convention was a success, generating a template for international adoption. Consensus has been positive, and it has made a significant impact on the way the world views, engages, manages, and protects heritage sites. Since the treaty, there has been literature produced in response, analyzing the effects and implications it has had within the arena of heritage protection. Four books which reflect the academic and professional views on the new ordinance, earlier legislation, and other pertinent cultural heritage laws have been examined.

Sarah Dromgoole, a professor of maritime law at the University of Nottingham, has created two literary works which are comprehensive, insightful and highly relevant. In her work *Underwater Cultural Heritage and International Law* (2013) Dromgoole presents a study of the existing international legal milieu, including UNESCO's 2001 Convention. Her research examines the laws which regulate human meddling and interference with underwater cultural

heritage while exploring the evolution and current status of the legal framework (Dromgoole 2013). Her work is detailed and without frills, dissecting a few of the prominent articles in the 2001 UNESCO Convention, and providing arguments both for and against the convention's final regime.

Dromgoole prefaces her work by outlining the greatest challenges faced by the UNESCO 2001 convention, including wreck ownership, sovereign immunity, application of salvage laws, commercial exploitation, and the regulation of activities that occur beyond territorial sea limits. She further elucidates that deep-water technology was the primary reason for the necessity of the convention, as deep-water sites were suddenly available for looting and exploitation as a result of these technological advancements. She argues, however, that although the convention was successful in rectifying politically charged areas of contention (commercial exploitation and salvage laws), the convention could be a failed initiative (Dromgoole 2013: 366).

Legal Protection of the Underwater Cultural Heritage: National and International Perspectives (1999), edited by Sarah Dromgoole, predates the 2001 UNESCO Convention and illuminates the necessity for the convention in the following years. The book is organized in two parts—part I includes the national perspective of thirteen countries and part II is comprised of a singular international perspective. The collection of essays states that it assists in “increasing knowledge of the problems and possibilities for protecting this fragile and importance resource for cultural history” (Dromgoole 1999). A case study, the book delves into each of the thirteen countries' current legislative literature while discussing areas of reform, and the obstacles these reformations will likely face. Echoed in Dromgoole's later work, the concerns presented here revolve primarily around salvage laws and commercial exploitation. This collection of essays predicates the global desire for tougher international cultural heritage protection laws.

Champions for the 2001 UNESCO convention, Roberta Garabello and Tullio Scovazzi compiled a study and positive review of the treaty in *The Protection of the Underwater Cultural Heritage: Before and After the 2001 UNESCO Convention* (2003). Italian law faculty members at the University of Milano-Biocca, were participants in the 2001 negotiations as legal experts of the Italian delegation. Positioned against the United Nations Convention on the Law of the Sea (UNCLOS), Garabello and Scovazzi demonstrate how the 2001 UNESCO Convention was a triumph which mitigated the flawed and counterproductive language of the 1982 Convention, chiefly the preeminence of salvage laws and other rules of admiralty (Garabello and Scovazzi 1999: 9).

Craig Forrest, from the TC Beirne School of Law in Australia, authored the book *International Law and the Protection of Cultural Heritage* (2010) with the intention of “critically evaluating the extent to which these international law principles and rules provide an effective and coherent international law framework for the protection of cultural heritage.” Forrest offers up a unique perspective which is no less concerned with the legal language of a host of conventions but emphasizes the dire need for heritage protection from illicit activity, terrorism, and neglect. While the previous three works were focused primarily on underwater cultural heritage, Forrest examines a wide breadth of information regarding heritage protection. Forrest extols the efforts of the UNESCO conventions, citing their efficacy in contributing to societal development, education, and building a framework for future agendas (Forrest 2010: 424).

Bermuda's Legislation

Bermuda's salvage legacy perpetuated through the 20th century, when the government commissioned the salvage of non-ferrous metals to meet the economic needs of the country post

World War II. However, Bermuda's legislation has reflected the evolution of the country's collective view on salvage by transitioning from a material-driven salvage effort, to understanding shipwrecks and submerged cultural resources as "objects of historical value worth of exploration," to the Government's existing position of examining shipwrecks within a purely scientific context. Phillipe Rouja, Bermuda's Custodian of Historic Wrecks, writes:

The legislative changes of the 20th Century show the greatest shift in focus. In 1959 salvage legislation began treating "Historic wrecks" as a separate category with special rules managing the activities of salvors treasure hunters and explorers thereon and over the next 40 years the legislation was amended to reflect the evolving understanding of the value of shipwreck preservation and the science of shipwreck research (Rouja 2012).

The Historic Wrecks Act of 2001 set a standard for cultural heritage protection in Bermuda. With the passing of the Act, the Bermudian government took ownership of all shipwreck sites and submerged historic artifacts, allowing it to become the cultural property of the Bermudian people. A collective initiative, the Historic Wrecks Act encourages locals to preserve and cherish their submerged cultural heritage, and to adhere to the laws set forth by the Act by ceasing all looting activity. According to the legislation, artifacts that are over 50 years old and associated with a specific wreck site are protected under the Act (NMB 2019). The legislation also extends to tourists, which has been a major concern in shipwreck disruption. The law explicitly states, "No person within the waters of Bermuda should damage or remove any part of, or artefact from, a marine heritage site or shipwreck without being explicitly authorized to do so" (Government of Bermuda 2001).

The language of the Historic Wrecks Act of 2001 is clear and comprehensible. The concise document is comprised of 12 pages and 16 sections in 5 parts, outlining the new regime, notably the establishment of the Historic Wrecks Authority and the appointment of a Controller of Wrecks, under Sections 3 and 5 of the Act. Bermuda's Department of Environment and

Natural Resources has the responsibility of upholding the mandate of the Historic Wrecks Act, and this department, along with appointed Custodian of Historic Wrecks (currently Dr. Phillippe Rouja), aids in developing and implementing heritage management programs in conjunction with the Historic Wrecks Authority (Bermuda100.ucsd.edu).

The mission of the Historic Wrecks Authority and the Controller of Wrecks is specified; “to preserve, protect and safeguard Bermuda's underwater cultural heritage by making provision for the classification of wrecks and to control the archaeological and scientific examination of historic wrecks; and for purposes connected therewith,” and is enacted by the Royal power of her Majesty the Queen of Great Britian, and the Senate and House of Assembly of Bermuda (Historic Wrecks Act 2001). Additionally, as per Section 6 (1) of the Historic Wrecks Act, the Ministry of the Environment, Telecommunications and E-Commerce released a document designating open and restricted wreck sites (Appendix B). Specifying serious consequences, the document states that there is a fine of \$25,000 or a one-year prison sentence, or both, if found guilty of disturbing these sites or removing material (Government of Bermuda 2001).

The wreck sites text is an important legislative document that designates several Bermuda dive-accessible wrecks to be enjoyed (responsibly) by tourists and locals alike, while demarcating the off-limits sites. The restricted wrecks listed on the document—including two of this research project’s case study sites *Sea Venture* and *Warwick*—are important to discuss in understanding how Bermuda mitigates vulnerable cultural sites. While it is understandable to have these sites largely off limits, other than for sanctioned archaeological or scientific work, it presents the opportunity to question how people are then able to experience these culturally important wrecks in a significant, educational, and appealing way? The interpretative strategies examined in Chapter 5 will provide possible answers to this query.

The act further demands any industrial, private or government organizations which seek to develop or work within Bermuda's maritime zone are required by law to do an Historical Resources Overview (HRO) and therein may be required to do an additional Underwater Cultural Heritage Impact Assessment (UCHIA) to "assist in the protection and understanding of historical resources on affected undersea or coastal areas" (Government of Bermuda 2014: 1). By mandating cultural assessments within their maritime zone, the government can not only discover new cultural heritage sites, but can more effectively protect established sites, ensuring they are no longer subject to potential exploitation or mutilation at the hands of commercial interests.

The Historic Wrecks Act was modified in 2004 with four amendments to its original language. Beyond this, the Act has remained staunchly the same, and has wielded considerable influence over Bermuda's control of marine cultural heritage sites. In 2012, the Wrecks Authority released a document of project objectives titled, "Marine Heritage Policy," which outlines its plans to continue mapping shipwrecks to develop the most advanced and effective management plans. It acknowledges that with the proliferation of technical innovation in the past few decades, shipwreck exploration has become "shipwreck science," and their management strategies must also evolve. Finally, "From Salvage to Science," written by current Custodian of Historic Wrecks Phillippe Rouja, outlines Bermuda's legislative history, as well as why it needed to evolve. He summarizes:

In 2001 the legislation concerning shipwrecks was separated completely from that of salvage. This Legislation was formulated expressly to guarantee that all exploration on shipwrecks be carried out to the highest scientific archaeological standard, with direct Government oversight, and with all information being shared with the public. This new Legislation reflects today's overriding concern with the historical value of historic wreck sites and the preservation of Bermuda's maritime heritage (Rouja 2012).

Maritime Heritage Trail Development

All types of heritage trails have sprung into existence around the world, but maritime heritage trails in particular present very specific challenges. The cultural resources are often submerged, hard to reach, and in poor condition. For these reasons, researchers in the field of submerged cultural resources have been asking for decades, “how do we make these sites visible, relevant, and authentically represented?” Maritime parks, preserves, and trails have been developed internationally since the 1980s as a response to these questions. Canada and Australia were some of the earliest adopters of this form of heritage management with the development of the Rottneest Island trail in Western Australia in 1981, and Fathom Five Provincial Park in Lake Huron, which would become Canada’s first National Marine park in 1987 (McClellan 1984; Smith 2003). The States of Florida, South Carolina, and Wisconsin incorporated heritage parks, preserves, and trails as a part of their maritime heritage management plan from the 1980s-2000s—including the establishment of Florida’s program of Underwater Archaeological Preserves in 1987 with the 1715 Spanish plate fleet wrecks, and Wisconsin’s system of designated maritime heritage trails which employed the help from volunteers and avocational groups to preform initial data recovery (Cooper 1991; Smith 1988).

The development of heritage protection programs through heritage preserves and trails continues to this day in original and progressive ways. Historic England’s Iona II dive trail, established in 2014, was designed using the methodology of dive trails as a model for protecting wrecks using community involvement which led to the community’s significant contribution to supplemental materials, and California’s Emerald Bay Maritime Heritage trail, which opened in 2018, heavily marketed their dive trail using creative media strategies and a social media hashtag, #DiveIntoEmeraldBay (Cooper and Knott 2016; California State Parks, California

Department of Parks and Recreation 2019). The following section analyzes four works of literature which examine the obstacles often faced when conceptualizing a maritime heritage trail, and the pitfalls and successes observed after careful research and thoughtful execution.

In what was one of the first works of literature which advocated the use of New Museology in Maritime Heritage resource management, Della Scott-Ireton's dissertation, *Preserves, Parks, and Trails: Strategy and Response in Maritime Cultural Resource Management* (2005) has set a standard for maritime archaeologists who seek to replicate her maritime heritage trail development strategies. The culmination of her research led to the creation and case study of the Cayman Islands Maritime Heritage Trail, a project very similar in scope and nature to a trail development project in Bermuda. Due to budgetary concerns, the trail was initially conceived as a land-based heritage trail, to be followed in the future by shipwreck preserves. The Cayman Islands mirror the tourism-heavy economy of Bermuda, which supports the establishment of a heritage trail that would allow visitors an opportunity to "learn about the Islands and to appreciate them as more than just a cruise-line port call" and for the locals to discover "elements of their history that they otherwise might not know existed or perhaps thought were lost" (2005: 81).

Scott-Ireton and partners decided the best interpretation strategies of the heritage trail would be to print double-sided brochures with images and information, as well as erect signs to signify the next stop along the driving trail. Unfortunately, her research stops short at developing further interpretation strategies that would allow for distance-learning opportunities. After the trail was officially opened to the public in May of 2003, the author was able to reflect upon the perceived success, and objectives met, by the unveiling of the Cayman Islands Maritime

Heritage Trail. The author's application of New Museology enforced the idea of community ownership and participation which proved successful. Scott-Ireton explains:

By publicizing the Islands' diverse array of maritime heritage sites, focusing public attention on the need for preservation, and encouraging community participation in development and management, the Cayman Islands Maritime Heritage Trail helps to secure the protection of all Caymanian historic sites, both submerged and terrestrial (2003: 92).

The Cayman Islands trail project outlined in Scott-Ireton's dissertation should provide the initial blue-prints for the development of a Bermudian heritage trail project. The project's success at identifying and earning the support of four prominent stakeholders addressed concerns of ownership, manageability, and sustainability. Furthermore, the development of criteria for site selection was used purposefully to address the complex maritime heritage of the islands. However, the author would hope to see in future endeavors a greater emphasis placed upon the interpretation methods and technologies, as brochures and posters do not provide an engaging or interactive educational experience.

James Bender penned the research paper titled "Conceptual Development of the Trail Methodology for the Preservation of Intangible Maritime Heritage: A Case for the Adriatic Coast and Islands" in 2015, in which he outlines a heritage trail interpretive strategy. He formulates his perspective after what he perceived was a missed opportunity by the Adriatic countries who often eschew cultural projects in lieu of leisure-based tourism. He posits further that a heritage trail must find a natural balance between "the preservation of local tangible and intangible heritage" and the creation of tourist offerings (2015: 60). Bender expands that "in order to facilitate the development of a heritage trail effectively, a discussion must include what these offerings are, who views them, and how they will be presented and understood by the people

who present them” (2015: 60). By asking these seemingly obvious first questions, stakeholders are identified, and the project is able to then clearly outline objectives and goals to be met.

Bender concludes his research by noting that one of the biggest challenges faced by trail developers is the ability to present heritage sites as cultural tourism without comprising their authenticity. In response, Bender presents a solution; “ a web based platform that allows boat owners to be in direct contact with tourists could be a possible solution to bridge the gap between tourist and boat owners eliminating the marketing and manipulation of local symbols by outsiders” thereby ensuring the authenticity of the heritage being displayed and experienced (2015: 63). Bender’s research is timely and highly considerate of the necessary tourism angle that must accompany any public heritage project. He understands the importance of authentically representing culturally significant sites and materials but presents alternative methods (using technological interpretative strategies) to bridge the gap between one-dimensional tourism, and a truly significant cultural experience.

Mark Staniforth and Cassandra Philippou contributed a chapter titled “Maritime Heritage Trails in Australia: An Overview and Critique of the Interpretive Programs” in the book *Submerged Cultural Resource Management: Preserving and Interpreting our Sunken Maritime Heritage* (2003) which analyzes the ways in which different heritage trails have been implemented throughout Australia. Their first area of contention focuses on the marketing materials used to advertise the heritage trail. The authors acknowledge that the most successful examples of heritage marketing materials are often consistently branded with other cultural and tourism initiatives in the region, promoting a sense of unity and cultural understanding. Additionally, Staniforth and Philippou assert that maritime archaeologists as a whole have

become “complacent and somewhat possessive in their presentation of maritime archaeology” which does a great disservice to the public (2003: 136).

Staniforth and Phillipou’s recommend encouraging community involvement, noting that “community ownership of the trail is just as important as community stewardship... these two objectives can be circular and self-affirming” (2003: 146). Viewing the public as perhaps one of the most important project stakeholders would benefit the trail not only during its construction but would work to ensure its survival and legacy. Finally, the authors explain that maritime heritage trails are rarely “provocative and challenging” and do not convey the material in a way that makes the cultural significance of the sites evident to the public (2003: 145). Staniforth and Phillipou’s comments reveal the harried nature of such an undertaking but assures that with careful consideration of not only what to include, but who to include, stakeholders can produce a meaningful heritage attraction.

Jennifer McKinnon penned a chapter in *Between the Devil and the Deep: Meeting Challenges in the Interpretation of Maritime Cultural Heritage* titled “Difficult Heritage: Interpreting Underwater Battlefield Sites” (2013) which turns a penetrating eye upon the social and political implications of interpreting heritage sites. McKinnon’s research and conceptualization of the WWII Battle of Saipan Heritage trail based in the Mariana Islands, was carried out with sensitivity towards the colonial invasions and power struggles which plagued the chain of islands, and which she addressed by prioritizing post-colonial narratives. This is especially poignant within the context of this thesis considering Bermuda existed as a colony for much of its existence, likely greatly affecting the people of Bermuda’s now post-colonial view of their heritage. McKinnon explains that the project included first-hand accounts of the battle to

convey the more emotional content of the trail, allowing these accounts to be communicated with respect and with understanding.

McKinnon also raises the issue of funding, and the complications that can arise with multiple stakeholders. The struggle to secure funding for cultural heritage projects is a common one, which may greatly affect the trail's ability to advertise itself. She acknowledges that without further funding, the trail will not be able to produce more collateral material once it runs out. Without the materials to educate and promote the attraction, the trail may as well not exist. Finally, the author outlines how different stakeholders with a variety of cultural identities may create an obstacle. She expounds that different cultures honor and remember their past in highly specialized, and often sacred, ways. In her case, the submerged sites were at considerable risk for human destruction as multi-cultural visitors were prone to erect monuments and to rearrange the cultural material. But McKinnon firmly asserts that stakeholders may "reserve strong feelings about memorializing sites, ways of remembering victims, and who should have the ability to commemorate their heritage" (2015: 183). Thus, it follows that Bermuda should as well seek to understand the social, political, and emotional implications of creating a trail, and how they would address their historical themes of colonial rule, slavery, and military history.

Chapter 5: Interpretative Strategies

Interpreting the past is a historian and archaeologist's chief objective—doing so accurately and authentically are important goals. The classically androcentric and Western interpretations of past societies and cultures have been acknowledged as a fault in the discipline of anthropology and archaeology, supporting the idea that there are at times a lack of different perspectives during the interpretation and presentation of a nation's heritage (Best 2016: 1). Along with many of the other social sciences, these disciplines have inclined to shift their efforts to rectifying and reinterpreting the past within more appropriate theoretical frameworks. The methodological approach to this thesis will focus around the idea of *interpretation as a methodology* and will endeavor to ensure the sites along the trail are conveying the most authentic representation of the native people of Bermuda and their cultural heritage.

Museums provide a medium in which expert interpretation is translated to the public, in a way that is simultaneously engaging and educational. In the age of rapid innovation and a relentless need for stimulation, the traditional museum experience has unfortunately become archaic and uninteresting to some. To remain current and relevant, “visual interpretation” emerged as a new framework for museum curators and their critics (Noussia 1997). This collaborative and interdisciplinary approach to the museum experience has led to some of the most transformative and advanced museological endeavors of modern time. Interaction with artifacts, new technologies, and a fundamental core of a pedagogical nature have brought the museum establishment into a new age, becoming a successor to the 19th and 20th century institutions (Hooper-Greenhill 2000).

The creation and implementation of a heritage trail brings with it a slew of more complex considerations in regard to interpretation. Effectively an assemblage of contextual and relevant outdoor exhibits, sites along a heritage trail must also be regarded with intention towards spatial significance perceived and interpreted by visitors. Julia Noussia's dissertation, *Constructing Spaces, Representing Places: A Comparative Analysis of Open-Air Museums in England*, effectively offers a clear distinction between a traditional museum, and the unique open-air site experience:

In museums, artefacts are arranged in a certain order to create a particular narrative which reveals the dominant role of the institution as represented by the curators. In open air museums, these narratives are translated into secluded landscapes which have many characteristics in common with public open spaces and parks. Open air museums are hybrids, a unique fusion of elements of conventional museums which aim to collect, preserve and display artefacts, and open spaces which have been constructed so as to create a sense of place. This dual identity of combining museum practices and landscape design gives them their complex and unique character (Noussia 1997: 10).

It is with these considerations that the following interpretative strategies are critically assessed for their efficacy in accurately portraying the historical significance of Bermuda's cultural sites, while revolutionizing the experience for visitors. Whether through a museum, an interactive website, or an island-wide heritage trail, the applicability of these approaches is diverse, and they deserve serious consideration for future implementation.

Interpretation Technologies

1. Photogrammetry and 3D Printing

In order to meet the evolving needs of cultural heritage, advanced forms of digital technologies have been introduced as a supplement to more traditional methods of preservation,

management, and protection. Gomes et al. outline the main objectives of digital technology in cultural heritage (Gomes et al. 2014; Georgiou et al. 2017):

- Ensure that the information regarding the significant historical characteristics (shape, appearance) of cultural heritage entity will be reserved in case of natural or other damages
- Allow the dissemination of digital representations i.e. for virtual museums purposes
- Uncover art forgery
- Collect and study information that is difficult to perform in the real object

As the public cannot value what they do not see, creating a heritage trail becomes much more dependent on digital and model representation for difficult-to-reach and concealed sites. Furthermore, the introduction and implementation of digital media in museum projects can present an opportunity to reinvent itself and ensure its own survival into the twenty-first century. Research has also pointed to the importance of digital tools in an exhibition experience. The use of Computer Vision Photogrammetry with Agisoft PhotoScan[®] has been researched as a method of interpretation for use in mobile apps, museum exhibits, and digital kiosks, and this program should be considered for use in Bermuda's Maritime Heritage trail. This digital method is readily available and relatively simple to use and can be one of the most effective ways to accurately represent submerged cultural heritage sites (Cameron and Kenderdine 2007: 35; Yamafune et al. 2016: 721).

Bermuda is home to hundreds of historically significant aqueous sites that pose great difficulty of viewership from the public. Submerged cultural sites along the heritage trail may be suitable for those capable of adventure experiences, however, patrons with disabilities and those with small children are generally excluded. An archaeological museum is responsible for curating an array of specimens and artifacts that will educate and fascinate in a safe and practical location. Thomas Kersten et al. continue; "In accordance with their educational mission,

museums must constantly present and represent complex issues in ways that are both informative and entertaining, thus providing access to a wide target audience” (Kersten et al. 2017: 361). This curatorial experience extends to the conception of a maritime heritage trail and outdoor exhibits. By an accompaniment of in-house displays and digitally retrieved material of less accessible sites, the museum ensures all patrons are granted the experience.

Photogrammetry permits the museum to produce authentic and accurate three-dimensional digital replications of the sites. These digital images can be used to reproduce small-scale models with three-dimensional printing, a technology which has proliferated in recent years. Researchers have claimed that 3D printing offers museum visitors an effective way to “increase perception, understanding and engagement through a tactile embodied experience” with printed artifacts which certainly extends to small-scale ship models and replicated artifacts (Giuseppantonio Di Franco et al. 2015: 37). With three-dimensional printing now a feasible means of site interpretation, a heritage trail could be made more effective and enjoyable by the inclusion of 3D printed ship models, to represent key sites along the trail. Tactile and visual methods of teaching are known to be highly effective, especially in children, and will thus enhance the museum experience and success of the trail, or outdoor exhibit.

Agisoft PhotoScan[®], a photogrammetric modeling program, defines itself as “...a stand-alone software product that performs photogrammetric processing of digital images and generates 3D spatial data to be used in GIS applications, cultural heritage documentation, and visual effects production as well as for indirect measurements of objects of various scales” (Agisoft 2019). Originally derived for use in a topographic terrain study using satellite imagery in 1984, photogrammetry has evolved into an economic, practical, and accurate 3D measurement technology based on digital images (Ahmed et al. 2012; Wheeler 2016). A simple point-and-

shoot camera suffices in many cases for procurement of data. In generating dense point clouds from numerous pictures taken of a site or an object, the program can develop an accurate 3D display, which is visually striking.

2. Virtual and Augmented Reality

Public archaeology seeks to create a connection between people and their past. In the age of rapid technological evolution, the methods in which to bridge these two seem to multiply every day, providing an exciting opportunity for modernization in the field of public archaeology. However, challenges persist—obtaining and maintaining relevance being chief among them. Virtual and augmented reality applications show promise in inspiring “empathy and focus” within the short interactions museums provide. Virtual reality (VR) and augmented reality (AR) are universally understood as visual technologies working with displays of images and environments that “sit along a spectrum of constructed realities” (Ellenberger 2017: 305).

Virtual reality (VR) refers to an experience conceived in an entirely virtual world constructed by computer graphics, in a space where the physical body and its surroundings are not present. The Oculus Rift headset and other VR apparatus manufacturers have made affordable VR experiences accessible to the public, enabling users to play video games or explore virtual worlds in a fully immersive way. These technologies provide a unique opportunity for use in museums, as they are generally economical and elevate the standard museum exhibit experience. As a supplementary addition, or a completely independent exhibit itself, VR technologies need to be considered as a way of maintaining visibility and relevance going forward.



FIGURE 6. Pokémon Go AR mobile application, screen grab. (Photo by Author, 2019).

Additionally, *augmented reality* (AR) is a term that describes the act of augmenting, or enhancing, our physical reality with digitally constructed elements and computer-generated sensory inputs using a device. This technology synthesizes our real world with 3D models, animations, and social media. And as opposed to VR, AR's objective is to change or add to the human sensory experience, instead of replacing it entirely (Ellenberger 2017: 305). A popular example of AR is the smart phone application Pokémon GO (Figure 6), whose initial launch was incredibly successful due to its revolutionary interface and easy game-play. The social phenomenon, which reached peak popularity in 2016, superimposes animated characters to the physical world using a smartphone camera.

AR and VR have only recently been considered for archaeological purposes. However, the archaeological applications seem to be lacking, as these technologies are often limited to gaming, tourism, and entertainment, and are often considered “insufficient for scientific use in the visualization of scaled, detailed and metrically correct objects” (Jiménez Fernández-Palacios

et al. 2015: 252). Fortunately, the NMB's heritage trail endeavor will present an opportunity to coalesce the archaeological applications and the tourism advantages of these technologies.

Moreover, the possibility of creating a digital heritage trail will allow for a distance learning experience, offering a non-destructive way for scholars, including archaeologists and young students, to examine artifacts and heritage sites without damaging or altering them. This can facilitate data sharing between researchers, and foster collaborative and on-going relationships with scholars around the world. This will ultimately also enrich the museum experience for visitors, as it provides a unique way of interacting with the material (Jiménez Fernández-Palacios et al. 2015). VR and AR technologies likewise aide with the preservation and management of cultural sites, allowing researchers to compare detailed images and scale models to previous renderings, while continuing to make the sites available to people in a safe way.

The Virtual Curation Laboratory at Virginia Common Wealth University (VCU) is another example of how VR and 3D technologies have been used in the curation of archaeological material, in a unique and accessible way. In a partnership with the U.S. Department of Defense's Legacy Program, the Virtual Curation Lab has developed a digital data project, using a 3D scanner to record artifacts for analysis and conservation (Virtual Curation Laboratory 2018). For smaller artifacts, the use of a 3D scanner to curate an archaeological collection would require little more than a general understanding of the technology, and time. Skilled technicians or instructed interns would be able to transfer this data to a virtual platform, giving the public instant access. Virtual artifact curation is a recent development in the field, yet it has tremendous potential for educational and research purposes.

A myriad of historically significant artifacts and sites have already been virtually constructed. Daniel Guttentag (2010: 643) provides the following list of digitally rendered objects:

- Michelangelo's statues of David
- The Florentine Pietà
- Over 150 sculptures from the Parthenon
- The Great Buddha carving from Afghanistan
- Assorted Angkor temples in Cambodia
- Terra Cotta Warrior statues from China
- A Byzantine crypt in Italy
- Frescoes from the House of the Vettii in Pompeii
- The Hagia Sophia Mosque of Istanbul

Guttentag notes, however, that many of these digitized models are not available for public consumption. Bermuda's maritime trail would present an opportunity to generate international buzz for creating an immersive cultural experience that extends not only to the tourists and locals in Bermuda, but also to those around the world who wish to experience the trail. By enhancing the trail with an online component, the museum creates greater exposure for public outreach. The museum then has a trifecta which includes the trail itself, an in-house representational trail exhibit with experimental technologies like VR and AR, and a fully immersive online experience.

3. Beacon and Sensor Technology

Bluetooth Low Energy beacons, or BLE beacons, provide an opportunity for museums to initially gather data, and then to implement a highly-targeted communication strategy for one of the most efficient and effective ways of facilitating engagement and personalized learning. In a shift towards what has been called "U-learning," or context-aware ubiquitous learning, museums have seen the benefit of multi-sensory, interactive education (Liu and Hwang 2010). BLE

beacons enhance this form of learning. A proximity-based technology, and essentially a small Bluetooth equipped computer, BLE beacons track the movement of patrons through the physical space of the museum (using geo-location) during a period of time. This allows the museum to identify the popularity of their exhibits and to understand their visitors' movement patterns to address areas of confusion, or to better direct the flow of traffic. Finally, the beacons are able to provide to the museum patron more individualized information based upon their location and movements (including previously visited exhibits), as well as facilitate language services and more convenient payment options directly to their mobile devices (Skårberg and Sletten 2016: 5).

4. Websites and Mobile Applications

The capacity of a museum as an educational tool also extends to online multimedia, albeit with different social and educational implications. Online sites enter the space of the user, as opposed to the constructed spatial contexts of the brick-and-mortar museum, which prevents control over the physicality of the user's surroundings (Cameron and Kenderdine 2007). This is not necessarily a bad thing, but by understanding the difference in experience, museums can evolve their content to more successfully convey the material in this contextually new setting.

The capability of these web technologies to reach beyond the traditional method of one-way communication allows visitors to become more invested and permits them to tailor their experience. Since the World Wide Web's debut in 1990, its applicability has been endless. Numerous world-famous museums have created their own interactive web experiences, including Paris' Louvre and Washington D.C.'s Smithsonian National Museum of Natural History (Figure 7). These distinguished institutions have adopted virtual reality technologies in

capturing the essence of their experiences, while giving users the flexibility to focus on their own interests and curiosities.

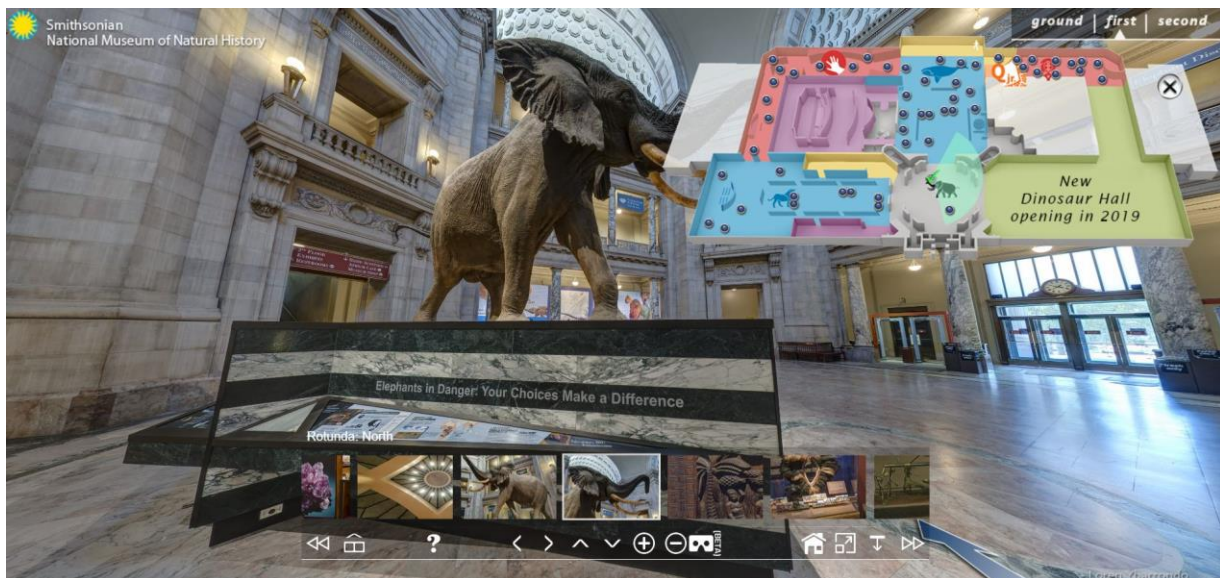


FIGURE 7. Smithsonian National Museum of Natural History Virtual Reality Tour. (Smithsonian National Museum of Natural History, 2019).

Smartphones and mobile applications have been around for only a few decades but have rapidly proliferated modern society. According to the Pew Research Center, 77% of Americans, 71% of Canadians and 72% of British citizens owned a smartphone in 2017, and growth is projected to increase in the years to come (Poushter et al. 2018). Mobile apps are now being critically evaluated, designed, and used for cultural and public archaeology purposes, as they provide a platform for a truly personalized experience and *in situ* access to cultural heritage (McGookin 2019). Additionally, applications allow users to create nonlinear tour paths, “wayfinding” or the orientation of oneself within a physical space, and the ability to bookmark exhibits and sites, this made possible by the previously discussed BLE beacons (Tsai and Sung 2012: 95).

Whether used in conjunction with a museum, or to explore a heritage site or town, mobile applications have tremendous potential to revitalize cultural tourism and museum engagement. Videos, audio recordings, photogrammetry models, interactive maps and plenty of pictures optimize the fit-in-your-pocket, multi-sensory experience. Institutions have expressed, however, their interest in focusing on using mobile apps to augment the museum experience, instead of replacing or imitating it. But mobile applications can be a powerful tool for interpretation. Lauren Messenger writes, “Mobile technology possesses unique capacities as an interpretive tool to bridge and connect museum space and non-museum space, connecting exhibit content with the wider day-to-day experience of the visitor” (Messenger 2015: 5).

Additional Considerations

1. Downloadable Content/Itineraries

Beyond providing an interactive online platform, another option for disseminating heritage trail information would be to create downloadable “itineraries.” This method would allow for customization based on the specific interests of the audience. Go To Bermuda, Bermuda’s “official travel resource” (Go To Bermuda 2019) has plenty of itineraries to choose from. Their itineraries generally follow a day-by-day schedule or present a localized attraction tour, which, after the author’s personal experience traversing the island in search of historic sites, makes much more sense than attempting a one-day, full-island tour. Go To Bermuda’s current selection, is varied and offers something for everyone, including itineraries geared towards heritage and culture tourism. By using this method, users would be able to curate their own experience by picking from a list of offered sites and attractions. Itineraries that involve shipwreck sites and outdoor exhibits would be a simple addition to the materials currently

offered on the site, and could lead to partner involvement, which would increase tourism and promote local business development. Furthermore, this method would allow patrons without access to a smartphone or cellular data the ability to print full itineraries in advance.

2. Stationary Signage

People most often associate the museum environment with traditional signage methods, which have been effective for years, and remain so in many circumstances. They are simple to fabricate and easy to execute. Fixed museum exhibits and informational signs are often a direct means of conveying the material to the audience. Permanent signage at trail locations or outdoor exhibits offer concise information in a durable and economical way. Tobacco Bay, the site of the Bermuda Gunpowder Plot of 1775, is currently designated with a large informational sign with pictures and historical information about the plot. The information is easy to digest, and although it may not be as exciting to interact with as other interpretative strategies, it is informative and educational.

Bermuda 100 Challenge

It would be a gross negligence to discuss Bermuda's submerged cultural heritage, interpretative technologies, and the interdisciplinary approach of developing such an endeavor without mentioning the *Bermuda 100 Challenge*. A project conceived by University of California San Diego (UCSD), Bermuda's Department of Environment and Natural Resources, Look Bermuda and Nonsuch Expeditions, the Bermuda 100 Challenge "aims to document 100 or more historic shipwrecks and distinct natural habitats in the waters surrounding Bermuda in order to enhance conservation efforts and open the sites to both real and 'virtual' tourism from interested students, researchers and travelers from around the world" (Bermuda 100 Challenge

2017). A deeply collaborative and interdisciplinary project, the challenge has enlisted the help of local divers, archaeologists, scientist and visual media specialists in collecting data in order to analyze and showcase Bermuda’s famous shipwreck sites. The resultant website is visually striking and aesthetically pleasing.

There are currently thirty-five cultural dive sites represented on the website. Each site’s webpage offers a brief description and history, as well as the site’s current condition and its statistics (location, measurements, depth of site, etc.). Supplementary material in the form of videos, 3D models, and relevant journal articles are also provided, making the website a robust educational resource. They have relied upon a few of the technologies presented in this chapter, including photogrammetry and 3D printing, in bringing their cultural project to life which adds validity to this thesis’ justification. Interestingly, this unique resource has earned very little publicity, save for their accolade as the 2018 “Innovation of the Year” at the annual Bermuda TechAwards. Conceivably with a more focused marketing effort and a collaboration with a few additional Bermudian stakeholders, the *Bermuda 100 Challenge* may develop into Bermuda’s first virtual nation-wide maritime heritage trail.

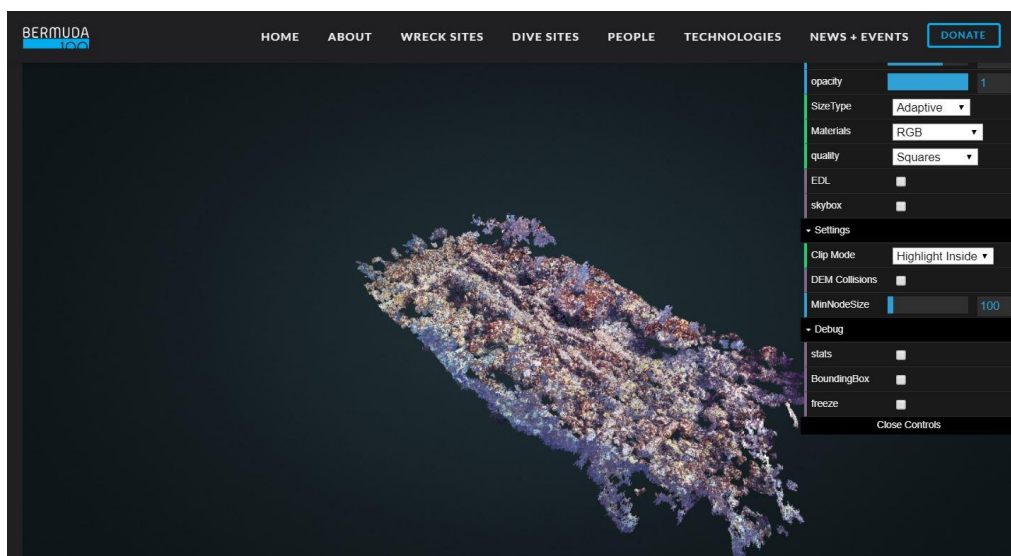


FIGURE 8. *Manilla* Wreck Site 3D model. (Bermuda 100 Challenge, 2018).

Discussion

There are many ways a museum exhibit or cultural attraction can facilitate an educational and inspiring experience. The exploratory nature of this chapter was an effort to discuss ways in which cultural sites and materials could be more effectively distributed and more intimately experienced using innovative technologies. But as noted, sometimes the best methods are tried-and-true. The often-marginalized audience of people who are unable to travel to overseas locations or are not yet old enough to dive on shipwrecks, are acknowledged and catered to with the interpretative strategies discussed in this chapter. This thesis proposes a multidisciplinary approach in bridging the gap between those who can and those who cannot.

Chapter 6: Case Study

This chapter is a curation of five historical sites in Bermuda. The sites have been chosen to represent a wide variety of factors that would need to be addressed in the creation of a maritime heritage trail, which include sites that are easily accessible, and sites restricted from public access. Each site adds to the maritime cultural heritage of Bermuda and tells a fascinating story of the island's deep maritimity, or connection with the sea. *Warwick*, *Mary Celestia*, *Sea Venture*, and Morgan's Island Wreck, as well as the consideration of an interactive exhibit using the remains of the Western Ledge Reef wreck will be analyzed both historically and archaeologically. Interpretative strategies which may help to convey the material to the public in stimulating, authentic, and accessible ways are also examined. The heritage sites discussed in this chapter represent a limited sample of Bermuda's innumerable historic sites and is done so as a concise means of providing a rubric for future development of a nation-wide heritage trail.

Additionally, The Bermuda 100 Challenge, which was discussed in Chapter 5, touches upon the significance of a plethora of shipwreck sites in Bermuda, including *Warwick*, *Mary Celeste* and *Sea Venture*, but stops short of exploring the unique ability of interpretive technologies to connect sites to the public. This chapter explores the potential of the Bermuda 100 Challenge by expanding upon the archaeological and historical significance of the five sites using interpretative technologies to create a thoroughly educational and unique experience.

1. *Morgan's Island Wreck*

History

The Morgan's Island Wreck was known to locals as only a scatter of timbers, which they believed belonged to an old barge run aground in a storm. It had been there for years, they assert, but no one truly believed it was the remnants of anything remotely important, or all that old. Due to this assumption, the site remained unresearched until Bradley Rodgers of ECU noticed a small collection of key diagnostic features that alluded to a potentially significant site. Interest piqued, he returned in May of 2017 to conduct an archaeological field school that produced a site map and archaeological report (Rodgers 2017).

Through archaeological investigation, Rodgers has been able to postulate the vessel's history. However, the site largely remains a mystery as the investigation is on-going and has not yet been definitively linked to a specific vessel. Through both the archaeological data and historical references, Rodgers has suggested a strong likelihood that the remains of the Morgan's Island Wreck are that of a 16th or early 17th century Dutch pinnace which may have been involved in privateering. Nathaniel Butler, an English privateer and one of Bermuda's early governors, wrote in his historical account about a wrecking event that Rodgers speculates could be associated with the site (Rodgers 2017).

Written in 1622, Butler's history of Bermuda describes a privateer vessel with a predominately Dutch crew headed to Bermuda to restock their supplies. Described as a "handsome pinnace," the ship was said to have wrecked on the rocks of the West Reef. (Hallett 2007, Rodgers 2017). Rodgers notes that *pirate* and *privateer* were interchangeable labels at this time, the only notable difference was the government sponsored letter of marque carried by privateers which made their illicit activity "legal," though letters of marque were often forged. Butler further explains that the crew was recovered from the wreckage by the islanders but speculated that the Bermudians allowed the wreckage to happen in order to salvage what

remained for personal gain. The ship was then said to have been swept away in the next storm (Hallett 2007: 118). Salvage operations are substantiated within the archaeological assemblage of the Morgan's Island wreck in the form of extensive salvage marks, which will be discussed in the next section.

The Flemish Wreck provides a second plausible explanation for the Morgan's Island Wreck assemblage. In a letter to Sir Nathaniel Rich on the 12th of August 1619, Lewis Hughes penned a description of a Dutch vessel wrecking on the "shoals near Summerset" (Rich and Ives 1984: 138). He postscripts his letter with the following:

Since the writing of this letter, news came of a Flemish man of warre set forth. By him that set forth Cap[tain] Powell with letteres of marke from the Prance Moris [Prince Maurice of Orange] ... in a small boat of 30 tunnes, cast away upon the sholes nere Summerset. And for safetie of their lives came [ashore] upon a raft driven with the winde to Summerset, and left their boat riding at an acre [anchor] and readie to sinke... through carelessness their owne ship was set on fire so they were forced to forsake her, and to goe into the boate that's now cast away (Rich and Ives 1984: 138).

There are a few important takeaways from this passage. Hughes describes the vessel as a "man of warre" but asserts it was a "boat of 30 tunnes", which could have been Hughes' interpretation and description of a Dutch pinnace. The "sholes nere Summerset" designates a small geographical area on the Western end of Bermuda, now called "Wreck Hill", most likely named for this singular wrecking event. The Flemish Wreck also makes an appearance in Richard Norwood's 1626 map located outside of Ely's Harbor, where the scantlings of Morgan's Island Wreck lay (Figure 9).

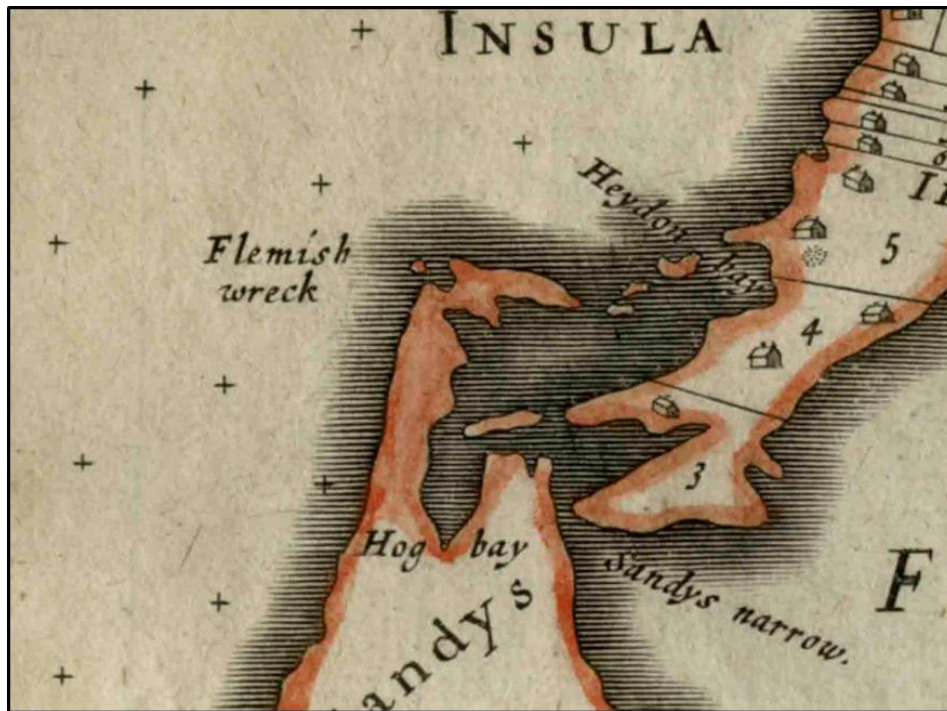


FIGURE 9. Map of Bermuda showing the Flemish Wreck, by Richard Norwood in 1626. (Rodgers, 2017).

Rodgers curtails his historical research to these two predominant theories but presents a few more additional hypotheses to consider, including: the site may have been the location of heavy salvage operations; the site may be the remains of a 20th century barge (as told by locals); and the site represents the remains of a 20th century replica ship. Until more archaeological and historical research is conducted the true history of the ship that resides within Ely's harbor will remain a mystery (Rodgers 2017).

Archaeology

In May 2017, ECU's Program in Maritime Studies, in partnership with the NMB, conducted field research at the site, which was funded by a Research Initiation Grant from ECU's Thomas Harriot College of Arts and Sciences. The wreckage, located off the small

uninhabited Morgan's Island and within the shallow waters of Ely's Harbor (Figure 10), can be seen with aerial footage, and largely required only snorkel gear to investigate. The project exposed numerous ship timbers and diagnostic features, which were documented in detail, culminating in a comprehensive site map (Figure 11). Graduate students in the Maritime Studies program at ECU thoroughly measured and drew each of the exposed scantlings which were then examined for telling marks of shipbuilding techniques or a possible origin.

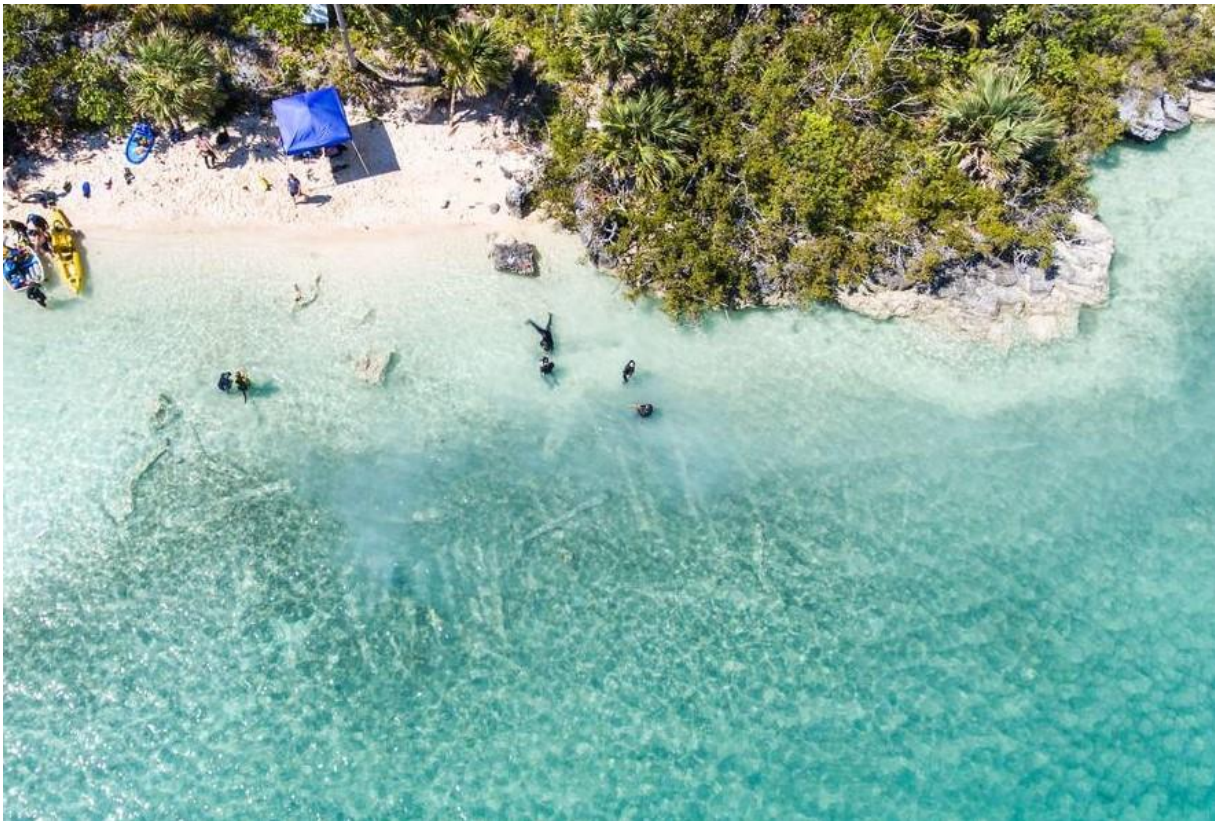


FIGURE 10. ECU Graduate Students investigate the Morgan's Island Wreck Site. (Rodgers, 2017).

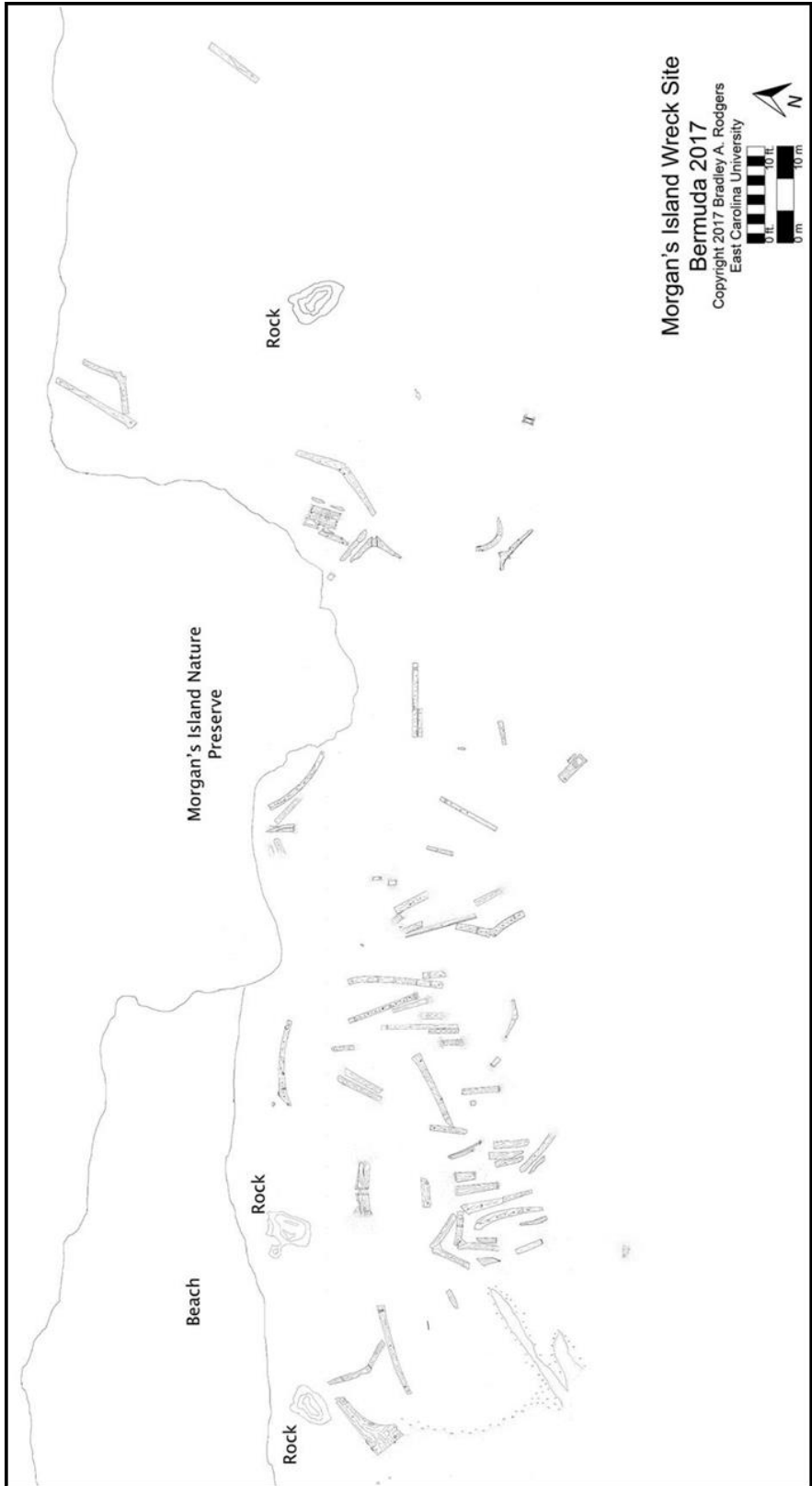


FIGURE 11. Morgan's Island Wreck Site Map, 2017. (Rodgers, 2017).

The site, located on the Western end of Bermuda in Ely's Harbor measures approximately 250 ft. (76.2 m) by 150 ft. (45.7 m) within 2-7 ft. of water, consisting of numerous disarticulated ship timbers which inspired Rodgers to refer to the site as the "blender wreck" (Rodgers 2017). Over the course of three weeks, the team of researchers meticulously measured and recorded all visible timbers, designated with either a "P" for port, or "S" for starboard, correlating to a side of the steel baseline. Rodgers explains the project's methodology:

The methodology employed for recording the site included non-invasive, phase one procedures which are standard for pre-disturbance surveys. No excavation was undertaken at the site and only hand fanning of individual timbers was allowed. Non-invasive techniques included drawing, photographing, and mapping the entire site using a datum point set up on the shore of Morgan's Island (Rodgers 2017:10).

Of the recorded features a few diagnostic pieces and artifacts stand out, which have helped substantiate the researcher's leading hypothesis. The features include two buttressed mast steps, a rudder, a piece of lead sheathing and futtock timbers, in addition to the timbers' wood type. After critical examination of the timbers, Rodgers assessed that the scantlings represented a flat-bottom constructed vessel—a ship type typical of 16th century Dutch construction. This type of ship was unique to the northern Dutch shipwrights and has seldom since turned up in the Mid-Atlantic archaeological record, making the Morgan's Island Wreck even more of a puzzle. The two buttressed mast steps have tremendous evidentiary value in dating the ship remains to the 16th century. Buttressed mast steps (Figure 13), or the foundations of a large mast post, were introduced in the 15th century but were replaced by more advanced technologies at the end of the 16th century (Rodgers 2017: 12).

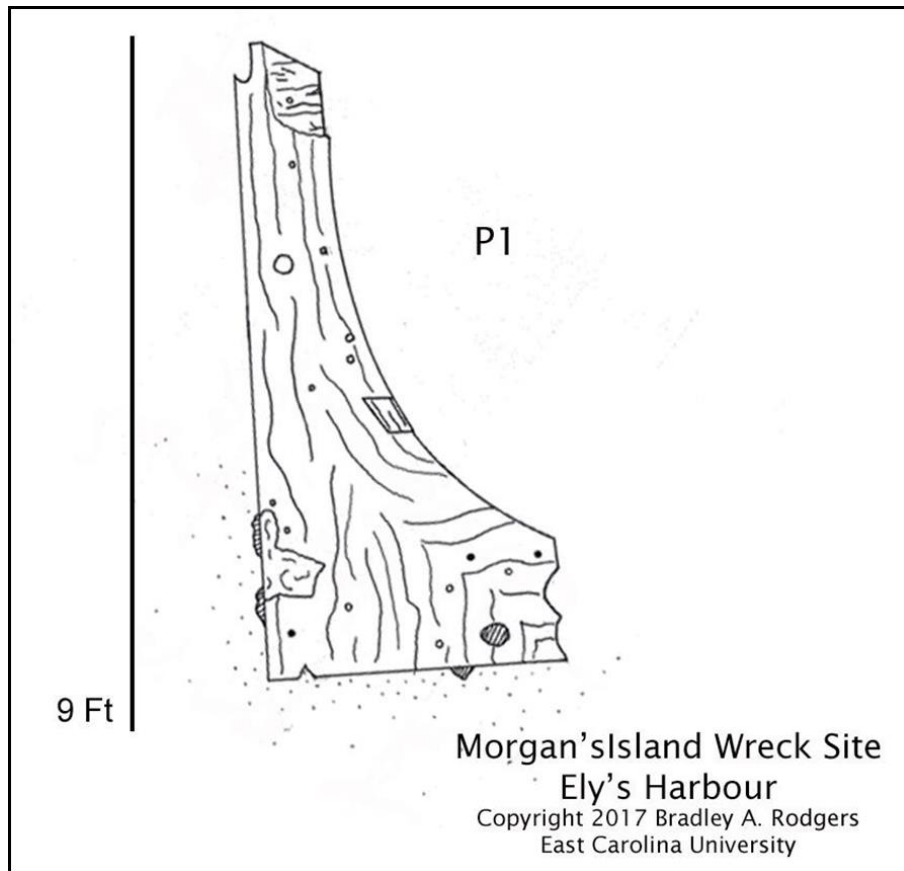


FIGURE 12. Morgan's Island Wreck timber P1, Ship rudder.
(Rodgers, 2017).

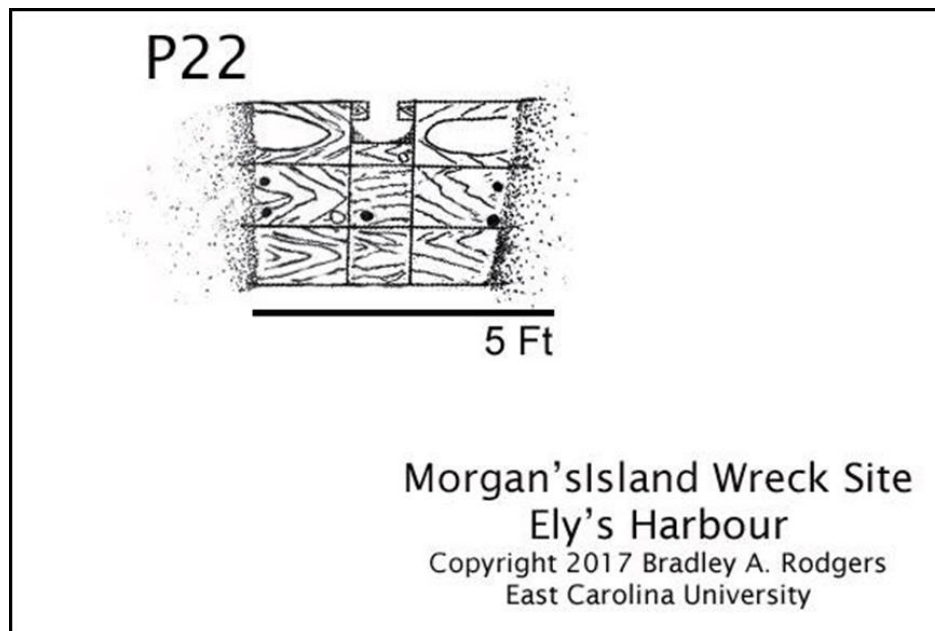


FIGURE 13. Morgan's Island Wreck timber P22, buttressed mast step.
(Rodgers, 2017).

The ship's rudder (Figure 12) and the piece of lead sheathing gives a temporal indication of the ship's construction within a few hundred years. The rudder, which showed signs of lead staining, and the piece of lead sheathing demonstrated the vessel's hull was sheathed in lead, which had a short span of use historically. Sheathing, the practice of protecting the wooden hull of the ship from biological and environmental assaulters, was executed in a variety of ways—from wooden pine sheathing to lead and copper sheathing. The Dutch East India Company (VOC), provided historical accounts of lead sheathing being used on their ships, having applied it to all ships in the service of the VOC in the first four years after its establishment, but were quick to abandon it during the early 1600s (Van Duivenvoorde 2015: 349). Using Witsen's shipbuilding formula (Hoving et al. 2012) with the rudder size (4.4 ft.[1.3m]), Rodgers concluded the ship was likely 120 ft. (36.5 m) long with a 30 ft. (9 m) beam, a substantial size for the time (Rodgers 2017: 16).

During the investigation a wood sample was taken and analyzed. The wood was identified as "greenheart," a hard and durable substance which would account for the incredible preservation of the wooden timbers still on the site. Greenheart, or *ocotea reodiei*, is native to tropical regions, and due to its poisonous nature, is known to survive virtually unchanged for hundreds of years. Rodgers notes that both the Dutch and Portuguese had a substantial claim over the areas of greenheart growth in the 16th century (Paasman 1984: 170, Rodgers 2017:17-18).

Michael Schiffer's concepts of natural and cultural transformations (N transforms and C transforms respectively) aid in the interpretation of the Morgan's Island Wreck Site (Schiffer 1987, Rodgers 2017). Overwhelmingly, the evidence points to cultural transformations in the form of salvage operations. Salvaging wrecked vessels became economically vital for islanders

who saw opportunity within the debris. Timbers and floor planking were used to build island infrastructure (houses, fences, etc.), and any cargo or victual supplies would have fetched substantial prices. The location of the site in the shallow protected waters of Ely's Harbor coupled with the evidence of human intervention as seen in the extant salvage marks gives credence to the story told by Governor Butler of a wrecked vessel brought into a safe harbor to be salvaged for considerable financial gain (Rodgers 2017).

Interpretation and Implementation

The Morgan's Island Wreck Site was selected for examination because of its accessible location and mysterious origins. It provides an opportunity for an outdoor exhibit that demonstrates on-going archaeological work. Its location within the protected Ely's harbor and position in relatively shallow waters presents the chance to incorporate boat tours, and on-site exhibit infrastructure with stationary signage and viewing stands. The site has experienced a tremendous amount of traffic due to tourist groups who have used the site (unknowing of its archaeological significance) as a snorkel spot. The durable greenheart wood timbers have proven resilient against minimal to moderate human interaction and could therefore be a low-risk site.

The wreck is still being researched and no definite conclusion has been reached as to its historical significance or origin but outlining plausible ideas and current hypotheses on signage would be beneficial and viable. As a part of the maritime heritage trail, this site would be a desirable activity for those looking for more of an active experience, especially those looking for activities on the water that combine both adventure and history. There are clear ship construction features on the extant remains and identifying and labeling them could be a possible modification to present accurate archaeological data. As the archaeological evidence suggests a salvage

operation, this site provides a unique perspective into the socioeconomic importance of wrecking events in Bermuda.

2. *Sea Venture*

History

In 1609, a group of English colonists wrecked on the reefs surrounding Bermuda. Astonishingly, not a single life was lost, and their interim stay on the uninhabited island led to the permanent settlement of Bermuda. But *Sea Venture*, part of a seven-ship squadron embarking on the third supply mission to the Jamestown colony, would never sail again. Built by the London Company, the flagship of the supply run was 300 tons and carried supplies and personnel for the new colony in America and carried the greater colonial aspirations of England. Six hundred English colonists were ushered aboard “seven good ships and two pinnaces,” but a brutal Atlantic storm tore the flagship from its squadron, and those aboard *Sea Venture*, captained by Christopher Newport, only just barely survived, finding refuge among the wild vegetation of Bermuda (Adams 1985; Strachey and Jourdain 2013: 3; Watts 2014: 12).

The wrecking event was recounted in detail by William Strachey, a ship’s passenger, in his letter to an anonymous noble lady. On July 24, 1609, *Sea Venture* battled a tempest for three days; both crew and passengers having never imagined “any possibility of greater violence.” Strachey’s account tells a harrowingly vivid tale of distress and divine providence. The crew and passengers worked around the clock to steer the vessel and keep it afloat, all the while being lashed and battered by torrents of wind and rain, which Strachey describes as “the waters like rivers did flood in the air” (Strachey and Jourdain 2013: 6, 8).

After discovering a leak in the hold, the crew worked tirelessly to remove the incoming water while supplies, ordnance, personal belongings and food stores were thrown overboard to lighten the burden upon the ship. *Sea Venture* was too heavily battered to continue and upon sighting land, was run aground about a third of a mile from shore. All 150 passengers made it safely to the island. After ten months of living off of the vegetation and wild hogs, the surviving passengers and crew members of *Sea Venture* were able to complete their original journey to Jamestown aboard their newly constructed vessels, *Patience* and *Deliverance* (NMB 2010; Strachey and Jourdain 2013: 14, 16).

Archaeology

Sea Venture is arguably the most famous Bermudian wreck due to its historical significance as the catalyst for English colonization of the island. Familial ties and an ardent appreciation for maritime history led Edmund Downing, an American working at the US Naval base on Bermuda, to the discovery of the final resting place of *Sea Venture* in 1958. Christened the “ship of destiny,” *Sea Venture* was found just short of a mile off-shore, nestled between two large coral heads. Encouraged by his thorough historical research, Downing retraced the final leg of *Sea Venture*’s journey and found on his initial dive a ballast pile of stone along with what seemed to be articulated ship timbers from a very old wreck. Downing enlisted the help of Bob and Donald Canton as well as Teddy Tucker to undertake an archeological investigation of the remains. Under the advisement and benefaction of the Bermudian government, Downing and his team of researchers provided their preliminary findings, which seemed to positively identify the wreck (New York Herald Tribune 1959; Wingood 1982; Watts 2014:100).

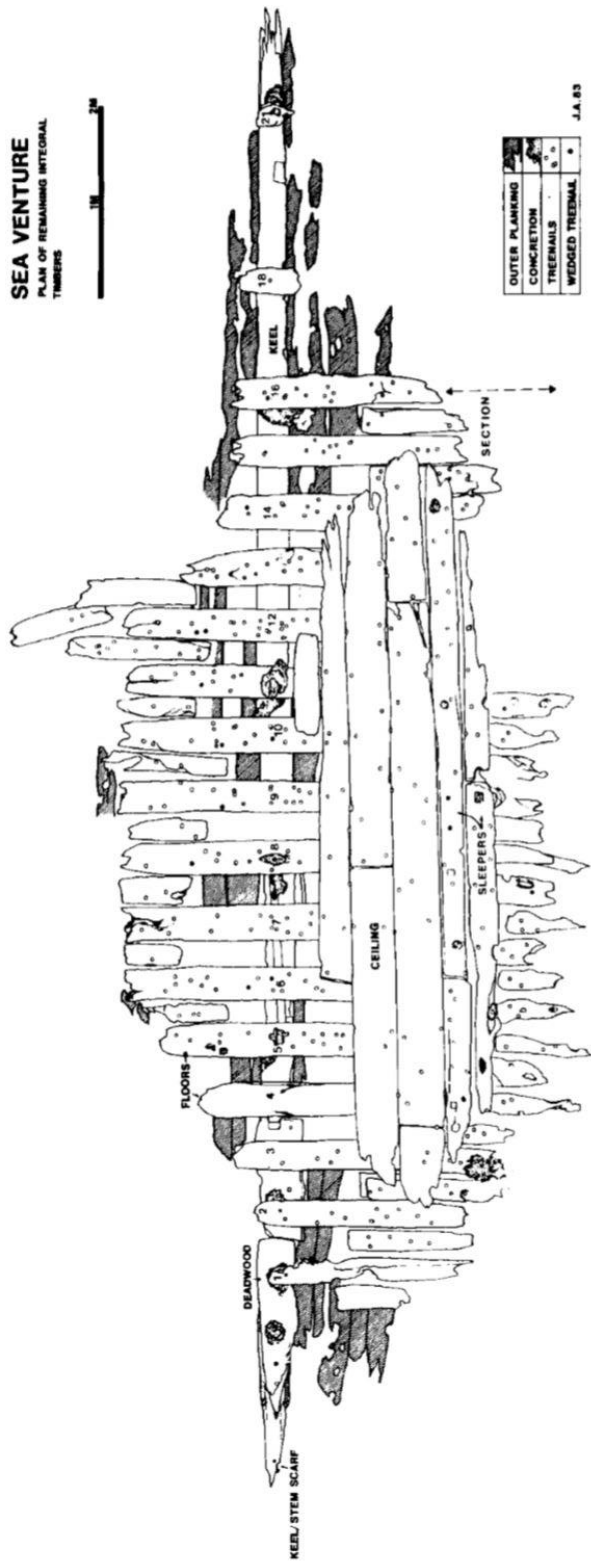


FIGURE 14. *Sea Venture* Site Map. (Adams, 1985).

Doubt was cast upon the preliminary findings which regrettably halted further examination of the site. A 7ft. (2.1 m) long iron cannon (Figure 15) became the artifact in question when researchers at the Tower of London surmised the cannon type was produced much too recently to be found aboard a vessel in the early 1600s. Initially attributing the cannon manufacturer to prolific English founder Richard Phillips, the researchers at the Tower of London opined they could not find substantial evidence that Richard Phillips had ever made large cast-iron guns. Coupled with the considerable financial burden required for further exploration, this convinced the government to discontinue excavation and conservation

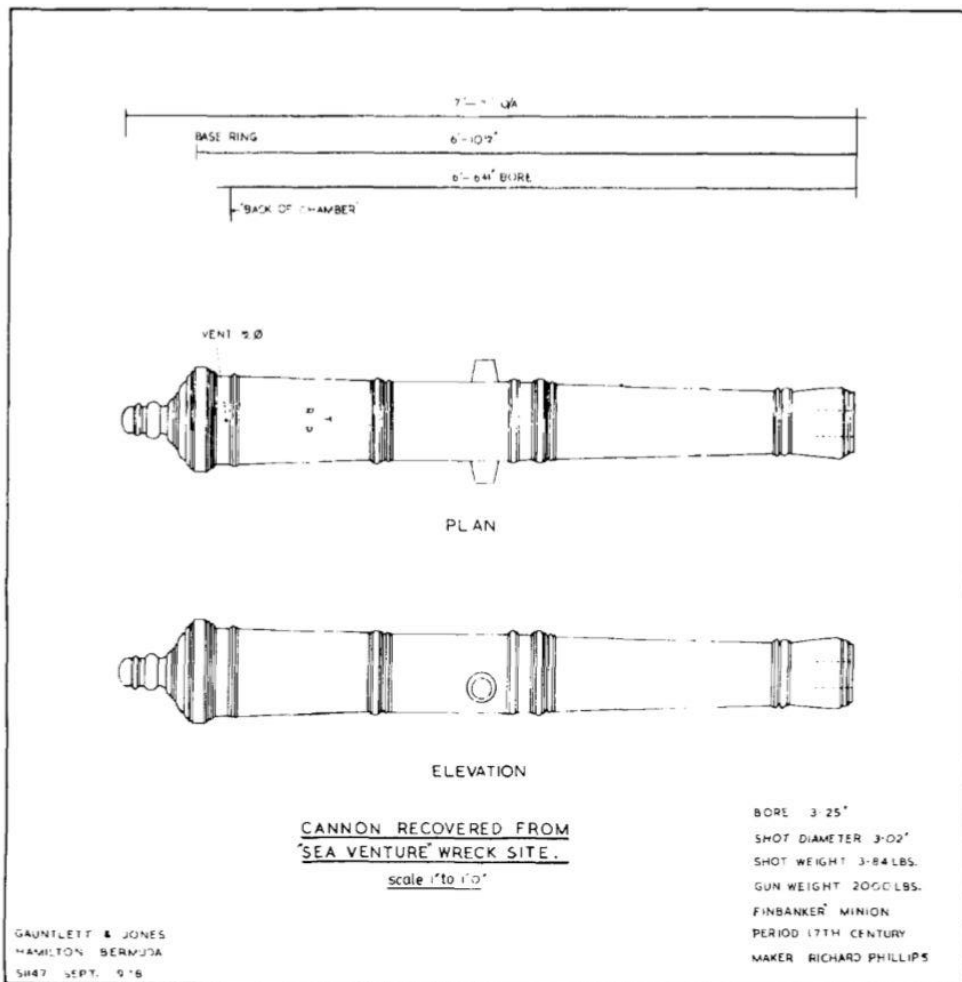


FIGURE 15. *Sea Venture* Canon. (Wingood, 1982).

operations, only for interest to pique again in 1978 in the face of new legislation (Wingood 1982: 334; Watts 2014: 101).

The new team of researchers, led this time by experienced diver and Director of Bermuda's Maritime Museum Allan Wingood, undertook a systematic and organized excavation in 1978, and would continue their research in the following years. Their objective was simple; via photography, stratigraphy, and meticulous extant material mapping, they planned to record the wreck site found just off Bermuda's Eastern shore to delineate whether it was *Sea Venture*. Their endeavor was fruitful. A trove of artifacts was discovered, recorded, and critically examined to supplement their origin hypothesis. The remaining ship's hull and ship construction features further qualified their claim, and it was henceforth identified with confidence as the wrecking site of *Sea Venture* (Watts 2014: 101).

The hull was instrumental in identifying the wreck (Figure 14). For hundreds of years, the remaining structure was buried beneath flint ballast stone, sand and mud, which protected the ship remains from some of the most common biological fouling culprits (Wingood 1982: 335). In the 1982 interim site report Wingood details the measurements of the remaining hull remnants:

Approximately 54 ft (16.45 m) of keel remain with a corresponding number of floor timbers. These measure 0.30 m square and average 0.61 m on centers, and although there are a few first futtocks, none of them are long enough to indicate the turn of the bilge. The flooring was found to be pegged and tree nailed with split and wedged treenails, and the measurement of four of the planks uncovered was 0-064 m thick, by 0.26, 0.35, 0.44 and 0-49 m, respectively. A horizontal stringer still in position on the port side indicates a strong, heavily built ship. Beyond 54 ft (16.45 m) aft no wooden remains of the keel exist, but there is evidence from worm casts and concreted keel bolts that the original keel could have been as long as 75 ft (22.86 m) (1982: 335).

This “heavily built ship” demonstrates English shipbuilding of the time. Shipwrights in the early 17th century were developing ship technology for greater trans-Atlantic and open-ocean travel, which was instrumental in their colonial aspirations for the New World and beyond. Wingood’s team also discovered oakum (a type of caulking) along the garboard strake which Strachey specifically recalls in his accounts exclaiming, “And the ship, in every joint almost having spewed out her oakum” (Wingood 1982: 338; Strachey and Jourdain 2013: 8; Watts 2014: 103).

The *Sea Venture* Trust was established in 1982 by Wingood and his associates which led to further investigation of the site under the direction of British archaeologist Johnathon Adams in 1982 and 1983. These investigations and the ones prior produced several artifacts which helped to substantiate the ship’s identity. Lead weights stamped with “EL” for Queen Elizabeth I and a crowned “I” for King James I were found buried on the site. A number of ceramics were also found; West of England plain pottery, a Surrey ware brown pitcher and clay smoking pipes pointed to a strong affiliation with the Elizabethan age (Wingood 1986: 152; Watts 2014: 101). According to Strachey’s eyewitness account, the crew members threw ordnance overboard, corresponding with the large amount of bar-shot and cannon balls discovered on the site. A cast iron grenade was also discovered and positively dated to the 16th century (Figure 16). The NMB’s Shipwreck Island exhibit currently has a number of *Sea Venture* artifacts on display, including a pristine Bellarmine jug (Figure 17), a stylized jug from Germany which was imported to England in the late 16th century (Wingood 1982; Wingood 1986; NMB 2019).



FIGURE 16. Cast iron grenade. (Wingood 1982).



FIGURE 17. Bellarmine jug. (NMB 2019).

Interpretation and Implementation

The *Sea Venture* wreck site falls under the “protected wrecks” category under the Historic Wrecks Act of 2001 which prevents any public interaction with the site (Appendix B). The wreck has considerable historic significance to the island and its people and should therefore be available to its inhabitants and others who have an interest in the ship’s origins; and as a component of the maritime heritage trail, *Sea Venture* would have to exist as only a distance experience. The site was chosen for its potential to be turned into an originaive exhibit or online experience that involves videos, models, and virtual reality.

The site’s visible and articulated ship features would translate well in a 3D photogrammetric model or VR exhibit. Additionally, historic accounts and what is known from the archaeological evidence would contribute to the construction of a 3D-printed scaled interpretation of *Sea Venture* in its entirety, showcasing the English shipbuilding which allowed for the impressive exploration and colonial expansion of the time. The deployment of these interpretative technologies to display the *Sea Venture* wreck site delivers more accessibility to the wreck which has made one of the most significant contributions to Bermuda’s larger heritage legacy. *Sea Venture* tells the incredible story of more than 150 people who survived not only a formidable wrecking event, but who found refuge upon the uninhabited island landmass in the middle of the Atlantic. Their fortitude and ingenuity kept them alive, and *Sea Venture* is the last true testament to their story.

3. *Warwick*

History

The victim of another tempest, the English merchantman *Warwick* was led to its watery grave by a brutal Atlantic hurricane which caused considerable damage to the new Bermuda colony in 1619. Crops were destroyed, much of the newly constructed island infrastructure was unable to withstand the winds and torrent of rain, and a number of colonists were drowned (Rich and Ives, 1984: 161; Hallett 2007: 128; Bojakowski and Custer- Bojakowski 2017: 285). *Warwick* and the few other vessels at anchor in Castle Bay Harbor played a significant role in the sustainability of the colony in its early years, but the storm-damaged moored vessels translated to the loss of a year's worth of tobacco crop, which dealt a deadly blow to the colony's early economy. Ready for a voyage to the struggling colony of Jamestown in North America, *Warwick's* crew braced for the hurricane in what they had hoped was the safe harbor of Castle Bay, Bermuda. But extreme winds dislodged *Warwick's* anchor, battering the vessel against the shallow reefs of the harbor causing the ship to keel starboard and slide beneath the dense ocean silt, preserving the vessel until its rediscovery in 1966 (Watts 2014: 105; Bojakowski and Custer-Bojakowski 2017: 285-286).

Before its premature demise, *Warwick* was tasked with the important delivery of government and administrative officials, along with colonial supplies, to Bermuda. Historical documents note that the newly appointed Governor of Bermuda, Nathaniel Butler, was among the officials headed to the island from. Labeled as a "magazine" ship, *Warwick* was owned by its namesake, the Second Earl of Warwick Sir Robert Rich, but was under contract by the Somers Isles Company during its 1619 expedition. Piotr Bojakowski and Katie Custer- Bojakowski explain that magazine ships were so named for their function as carriers of officials and supplies while returning with letters and tobacco crop. Magazine vessels were financed by powerful

investors, like Sir Robert Rich, who were daring enough to invest in the risky business of maritime trade with the New World (Bojakowski and Custer- Bojakowski 2017: 284).

Archaeology

Using a magnetometer, prolific Bermudian wreck-finder Teddy Tucker and Researcher Mendel Peterson of the Explorers Club of New York located the Warwick's remains in 1966 along the limestone cliffs of Castle Bay, and investigated further in 1967 and 1979, exposing more than half of the vessel's hull structure. Located at 32°28'58.91"N, 64°42'17.64"W, the wreck was the most complete wooden-hulled English merchantman discovered at the time (Bermuda100.ucsd.edu). Tucker and Peterson's team of researchers discovered a handful of artifacts, including a gourd filled with seeds, and a barrel of flour (Watts 2014: 105).



FIGURE 18. Location of the *Warwick* wreck site. (Google Maps, 2019).

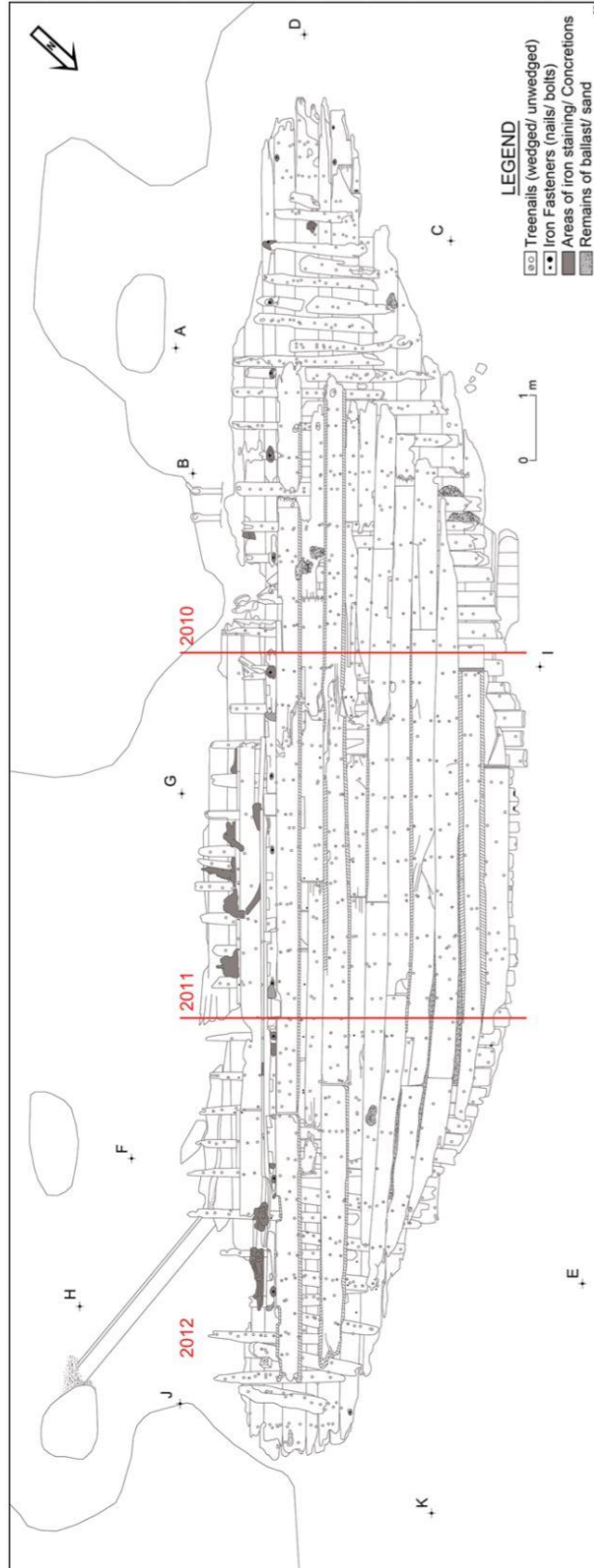


FIGURE 19. Warwick Site Map. (Watts, 2014).

Tucker, now sponsored by the Philadelphia Maritime Museum, continued the excavation of *Warwick* in 1979, where they raised three cannons, a variety of shot, and artifacts ranging from rigging elements and a collection of tools, to smoking pipes and pewter utensils, many of which are on display in the NMB (Bojakowski and Custer- Bojakowski 2017: 286). After being nationally recognized and confirmed as the remains of *Warwick* in 2008, a complete excavation was called for. A detailed site plan was produced over the course of three years from 2010 to 2012 (Figure 19) in a joint effort between the NMB, the Institute of Nautical Archaeology, and the Center for Maritime Archaeology and Conservation at Texas A&M University (Watts 2015: 105).

Divided into three parts over three years, *Warwick*'s hull was exposed and the visible timbers were recorded. The site covers roughly a 21 m (68.8 ft.) x 6 m (19.7 ft.) rectangular section of the starboard side, where a total of 92 complete and partial timbers were found, which included hull planking, floors, futtocks and ceiling which were all visible in the remains, as was the turn of the bilge (Figure 20). Bojakowski and Custer- Bojakowski detail further; "The floor timbers range between 0.20 m (0.6 ft.) and 0.25 m (0.8 ft.) (average 0.25 m [0.8 ft.]) sided, and between 0.18 m (0.6 ft.) and 0.22 m (0.7 ft.) (average 0.19 m [0.6 ft.]) molded" (Bojakowski and Custer- Bojakowski 2017: 286-288). Dendrochronology, or tree ring analysis, helped the researchers in dating the vessel, which matched the historical record of the 160-ton *Warwick*. The evidence showed that the timber used to build the vessel was harvested in the winter of 1616 and summer of 1617 (Watts 2014: 105).

In the 2017 report of the *Warwick*'s full-scale excavation, the researchers claim, "for the first time, it was verified beyond reasonable doubt that the ship was new and on its first transatlantic voyage". Their research was translated into 3D modeling program and graphics

software Rhinoceros[®], which gave them a better understanding of the ship's original design and form. They found a close resemblance to late 16th-century designs, and a kinship to one of England's most famous 16th century warships, *Mary Rose* (Bojakowski and Custer-Bojakowski 2017: 301). *Warwick* continues to be an excellent example of 16th and 17th century Atlantic merchantmen, a ship type which considerably influenced and fostered the commercial success of the trans-Atlantic trade economy.

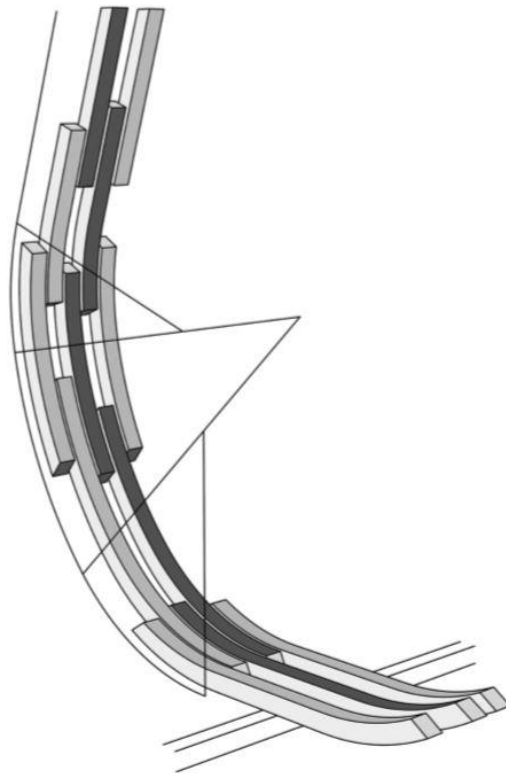


FIGURE 20. Interpretation of *Warwick's* framing system, demonstrating the turn of the bilge. (Bojakowski, 2017).

Interpretation and Implementation

Warwick, like *Sea Venture*, is restricted from any diving activity. And as a contemporary of *Sea Venture*, *Warwick* shares similar ship construction technologies. However, *Warwick*, when found, was the most complete wooden-hulled English merchantman to have been discovered, and the analysis and research done on the vessel has been extensive, resulting in a 3D replication of the vessel using the software Rhinoceros® (Figure 21) (Bermuda 100 Challenge 2017). The detailed replication of the ship's original curvature and form allow for a very accurate portrayal of the original magazine vessel and provides valuable insight into the merchantman class of ship which largely carried the trans-Atlantic trade economy.

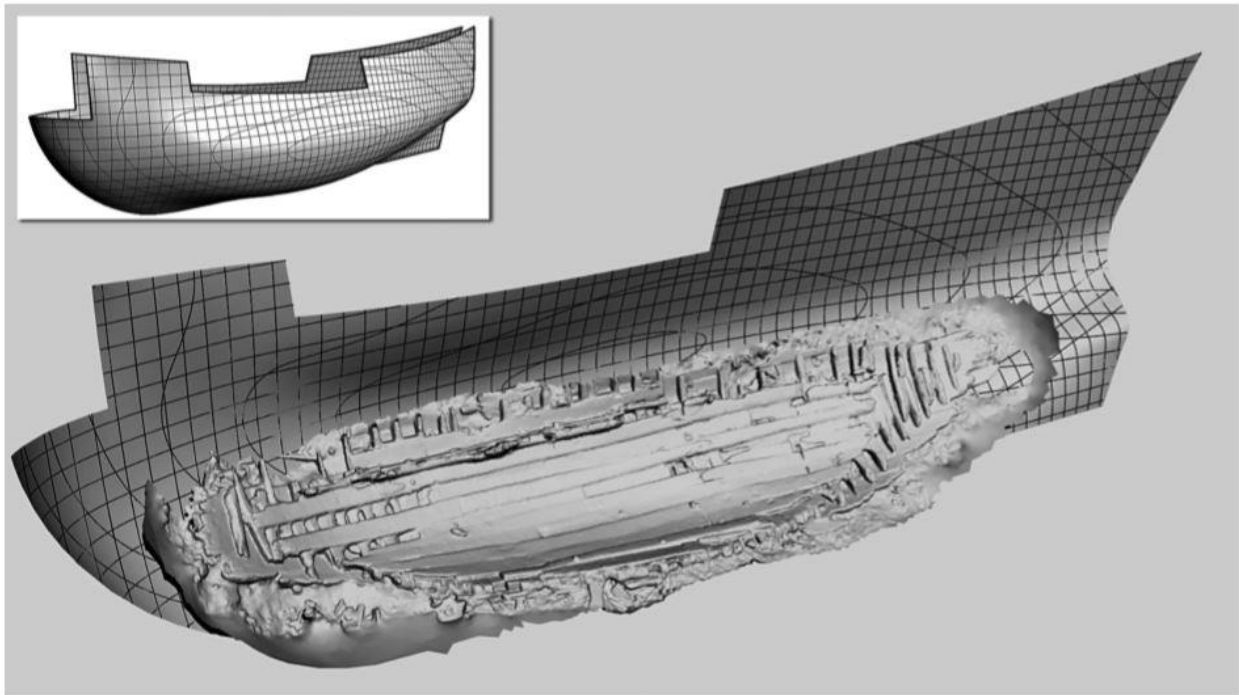


FIGURE 21. 3D digital reconstruction of *Warwick's* lines using Rhinoceros® Illustration by P. Bojakowski. (Bojakowski and Custer-Bojakowski, 2017).

Warwick also helps tell the story of the Somers Isle Company and the immense pressure upon the small colony to produce tobacco crop during its early years. The sociopolitical intrigue of the Somers Isle Company was a large part of Bermuda's evolution in the early years, and *Warwick* represents a period of infighting within the company, amidst the appointment of a new Governor (Rich and Ives, 1984: 156). Shipwrecks, often called "time capsules," contribute to the much larger narrative of the time and origin from which it belongs, and *Warwick* is no exception. With 3D renderings having already been developed, the implementation of them into a heritage project—like a heritage trail—seems the logical next step.

4. *Mary Celestia*

History

Arriving in St. George's, Bermuda in May of 1864, *Mary Celestia* was prepared to take a very active role in the American Civil war. *Mary Celestia* was one of many blockade runners using Bermuda's strategic Atlantic location as an Anglo-Confederate trade hub. Bermuda's sympathies lay primarily with the confederate Southern states which, when bolstered by England's expressed "neutrality," enabled a lucrative trade relationship to develop. American President Abraham Lincoln's plan to "economically strangle" the Confederacy by imposing a naval blockade from the eastern American states to the southern state of Texas triggered a surge in construction of swift and sturdy blockade-running vessels which continued the exportation of predominant Southern crops—tobacco, cotton and turpentine (Delgado 2011; Watts 2014: 213).

Mary Celestia was smaller than some of its contemporaries. Reported at 207 tons, the steam-engine paddleboat was designed and constructed by William C. Miller & Sons in Liverpool and was contracted under Crenshaw and Company explicitly for a blockade running mission (Delgado 2011). The Royal Gazette makes note of *Mary Celestia*'s arrival in Bermuda on May 16, clearing customs a few days later to head to the North Carolina port of Wilmington. The vessel would complete up to four successful roundtrip excursions to this Southern port in the following months (Delgado 2011; Watts 2014: 213).

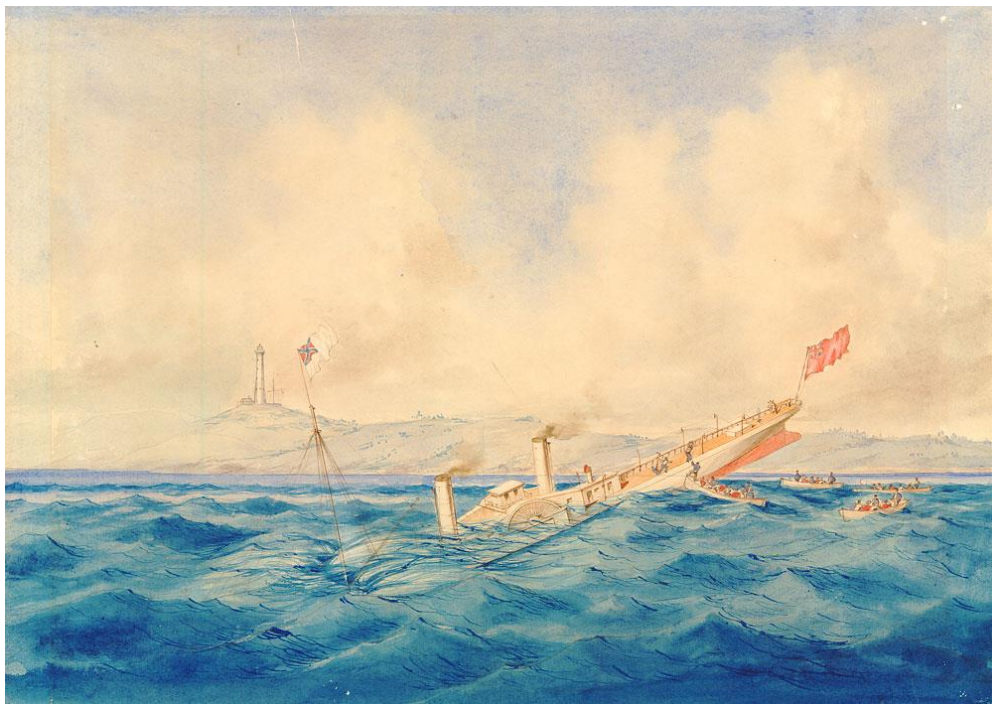


FIGURE 22. Illustration of *Mary Celestia* by Edward James. (Watts, 2014).

“It is our painful duty to record the loss of that beautiful little steamer ‘*Mary Celestia*’ so long and favorably known as one of the swiftest and most fortunate of her class” (1864) reads the grave report in the Royal Gazette of the unfortunate “little steamer” *Mary Celestia*. On its way to Nassau in the Bahamas with a full cargo of bacon and “general merchandise,” the vessel struck

coral reef near Biggs Hill lighthouse and sunk within eight minutes (Royal Gazette 1864; Watts 2014: 213). The article in the Royal Gazette details the wrecking event:

At six o'clock, everything apparently in readiness, the ship was headed for the shore for the purpose of allowing her gentlemanly owner, Colonel Crenshaw, and the Pilot, to disembark in the vicinity of the Light House. After running in this direction a few minutes, the First Officer, Mr. Stuart, politely called the Pilot's attention to some breakers which he saw ahead to which it seems the Pilot replied, "I know every rock about here as well as I know my own house." No further notice being taken of the warning, and Mr. Stuart seeing the danger, immediately ordered the helm to be put hard down, but scarcely had this order been given when the vessel struck, drove on to a rock and in from six to eight minutes afterwards sunk in about seven fathoms water (1864).

Archaeology

Mary Celestia now lies in approximately 60 ft. (18.3 m) of water near Southampton Parish Bermuda, roughly supporting the description in the Royal Gazette of "7 fathoms" (42 ft.) near Gibbs Hill Lighthouse (1864). The wreck lies geographically at 32°12'10" north latitude; 64°42'15" west longitude (Bermuda 100 Challenge 2017). Gordon Watts, the NMB (then the Bermuda Maritime Museum) and ECU employed a team of archaeologists and students to map and document the exposed remains of *Mary Celestia* in 1983. Watts explains that the documentation concentrated on exposed vessel structure, which included what remained of an articulated bow, the ship's port paddle wheel, and the vessel's engineering space (Watts 2014: 213).

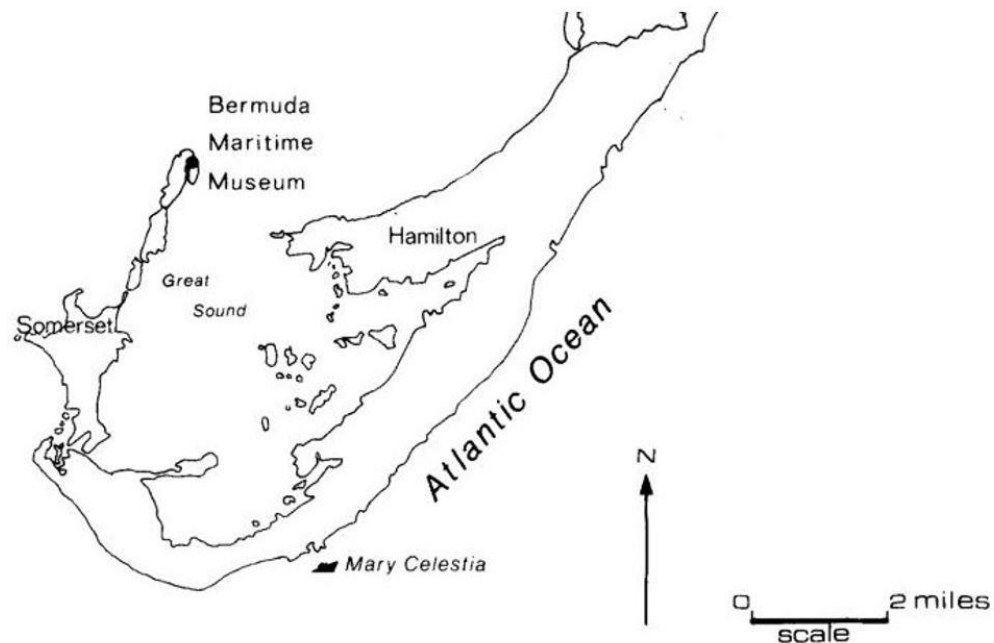


FIGURE 23. Location of *Mary Celestia*. (Watts, 1988).

Using a baseline to connect the stern and bow, the team of researchers mapped the structural remains of the site using trilateration (Figure 24). Deteriorated wooden decking, iron deck beams, and a partially buried anchor off the starboard side were recorded. A large portion of the site was still covered in sand and probing measures indicated that the cargo hold was buried beneath 3 ft. (0.9 m) of sediment. The excavation focused on three primary sections of the hull—bow, engineering space, and stern (Watts 2014: 215).

Late 19th century shipwrights were using iron to construct their vessels, preferring the durable material for ship components over the more traditional wood. *Mary Celestia* is an example of this technology and of the continual evolution of shipbuilding. Watts and his team of researchers exposed deck beam fragments, knees and iron frames, as well as boilers, and smoke pipes which expelled exhaust from the steam engines. The vessel's two paddle wheels were still

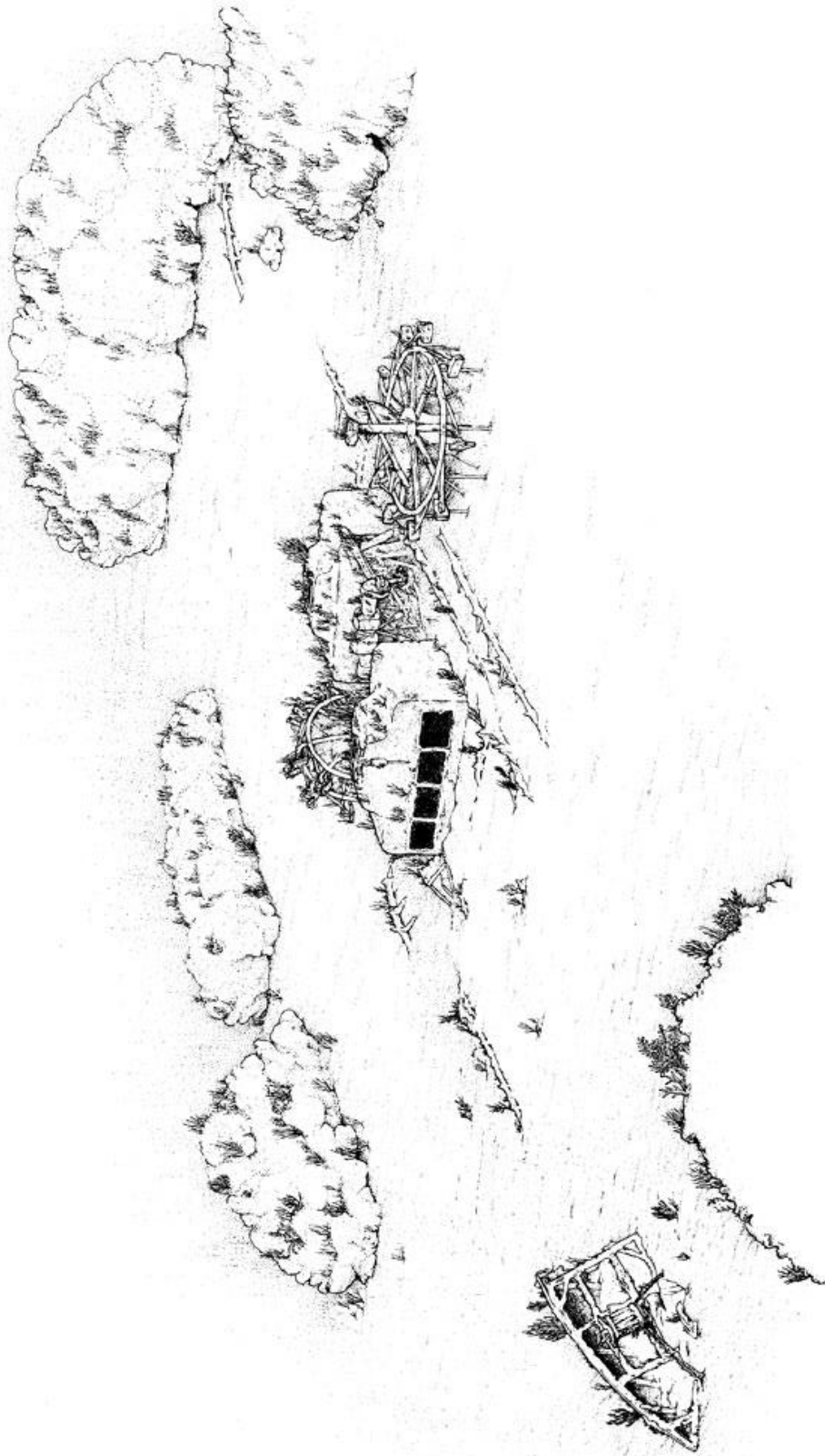


FIGURE 24. *Mary Celestia* Site Illustration. (Watts, 1988).

intact but disconnected from the articulated structure of the wreck. The composite wheels were fitted with eccentric-operated feathering buckets, and the wheel shaft “formed offset bell cranks for two air pumps amidships and tow steam cylinder pistons. Each piston operated in an inverted oscillating cylinder” (Watts 2014: 215).

Bermuda has long been a victim to hurricanes, and when in 2009 Hurricane Bill tore through the island, *Mary Celestia* became substantially more exposed, which led to new discoveries. Within the bow, the storm revealed a full bottle of wine, cork still intact, and a perfume bottle, also still intact (Figure 26). This encouraged Dr. Phillippe Rouja, Bermuda’s Custodian of Wrecks, to investigate further. He organized a short expedition with a film crew to document *Mary Celestia* to collect footage that would contribute to a film about Bermuda’s role in the American Civil War (Delgado 2011).



FIGURE 25. Dredge operations on *Mary Celestia*. (Bermuda 100 Challenge 2017).



FIGURE 26. Full bottle of perfume found in the bow of *Mary Celestia*. (Bermuda 100 Challenge 2017).

Interpretation and Implementation

Listed among the accessible wrecks (Appendix B), *Mary Celestia* is among the top ten dive sites in Bermuda, making it a popular tourist destination (Delgado 2011). This would make the site a tremendous addition to the heritage trail. Patrons looking to dive on a historically significant site will be able to experience the wreckage up close and learn, through supplemental materials, about its history. Many of Bermuda's dive shops currently lead dives to this popular site. By partnering with dive shops and educating them on the archaeology and history of blockade-runners, those who choose to dive on *Mary Celestia* will gain a deeper understanding of its historical significance, while learning more about Bermuda's role in the American Civil War. Informational booklets and courses on the history of the trail's dive sites should be offered

to tour guides and dive operators, and the author suggests this as a course for future action. Additionally, the Bermuda 100 project has created a detailed photogrammetric model which is publicly available on their website, bermuda100.ucsd.edu (Figure 27). The ability to visually self-explore the vessel would be a stimulating feature for a heritage trail website and would supplement or replace the experience of visiting the wreck in person.



FIGURE 27. Virtual model of *Mary Celestia*. (Bermuda 100 Challenge 2017).

5. *Western Ledge Reef Wreck*

History

The Western Ledge Reef Wreck, discovered in 1988 on a survey project by ECU and the NMB (then the Bermuda Maritime Museum), has remained unidentified. Like the Morgan's Island wreck, the extant material located on Bermuda's western reefs provides evidence of a late 16th century Spanish ship, likely a *nao*, which may have been built in the Basque region of Spain

(Watts 2014: 77). Encouraged by 16th century diagnostic features, researchers turned to the historic record for any mention of Spanish vessels running aground in the corresponding geographical location.

The research turned up two historical accounts of ships that were lost during a time and at a location coinciding with the evidence found among the remains on the island's western reefs. An unnamed Spanish vessel was recorded to have run aground upon the reefs in 1582, and only two years later a ship named *Santa Lucia* also wrecked upon the same reefs (Watts 2014: 79). Piotr Bojakowski, whose dissertation focused on the examination of the Western Ledge wreck, discusses the difference between Spanish *naos*, *navíos* and *pataches*, vessel types which fit the description of the structural remains of Western Ledge:

For example, in certain contexts the words *nao* and *navío*, and less frequently the word *nave*, were used interchangeably and refer to “a ship”...Both *nao* and *navío* are generally associated with poorly understood merchantmen-class vessels. Based on rather limited sources detailing the structure of the *naos*, these are often described as seaworthy full rigged ships capable of making extended round-trip voyages... Only a few are classified by their respective function - within the convoys as *navíos de aviso* (dispatch ships), *navíos patache* (also spelled *pataxe* or *pataxo*) (tenders), or *navíos* operating as a vaguely defined variety of *fregatas* (2012: 29-35).

Additional historical research has produced no further evidence, and the true origin of the wreckage remains a mystery.

Archaeology

Fortunately, archaeology can often help fill the holes in the historical record. And in the case of the Western Ledge Reef Wreck, intensive archaeological investigation allowed the researchers to more confidently postulate the origins of the ship. The wreck was found serendipitously in 1964 by a Douglas Roberts, Dick Bouchard, and Kenneth Stark in about 8 m

(26.2 ft.) -10 m (32 ft.) of water inside just inside the Western Reefs Barrier (Figure 28). Upon finding a collection of olive jars, the divers applied for a salvage permit with the Government of Bermuda and was granted access to the site between the years of 1965-1988. Little documentation was done during their excavations of the site, but a great deal of material cultural was produced which included a cast iron cannon stamped with the year 1577 (Figure 30), which the original salvagers used to date the wreck (Bojakowski 2011: 18).

Unaware of its discovery, the NMB (then Bermuda Maritime Museum) and ECU stumbled upon the wreck in 1988. Parts of the hull structure were visible, and what they examined showed evidence of 16th century Iberian ship design elements, including a six-buttressed mast step, not unlike the mast step found on the Morgan's Island Wreck. Kaea Morris and Holly Holland led a team of international archaeologists on the site until 1989, when Gordon Watts took over the systematic excavation of the wreck. A full-scale metal detector survey was conducted in 1989, which enabled the researchers to map the extant materials in relation to two transecting baselines. Test pits were dug, and at the end of the season, the visible hull remains were reburied to preserve the site until research could continue (Bojakowski 2011: 19; Watts 2014: 72-73).

The initial investigation produced several artifacts, including lead-glazed coarse earthenware and stoneware fragments, as well as iron fastenings and organic samples which were sent for analysis. The 1990 field season on the Western Ledge Reef Wreck produced a photo mosaic of the exposed structure and a site map using a three-tiered, 1 m grid system erected over the hull and the stern assemblage (Figure 29). In order to facilitate more accurate and detailed timber recordings, the decision was made to extract the entirety of the wreck and bring it above

water. Completed in October 1991, the wreck remains were donated to the NMB for study and possible display (Bojakowski 2012: 86; Watts 2014: 75).

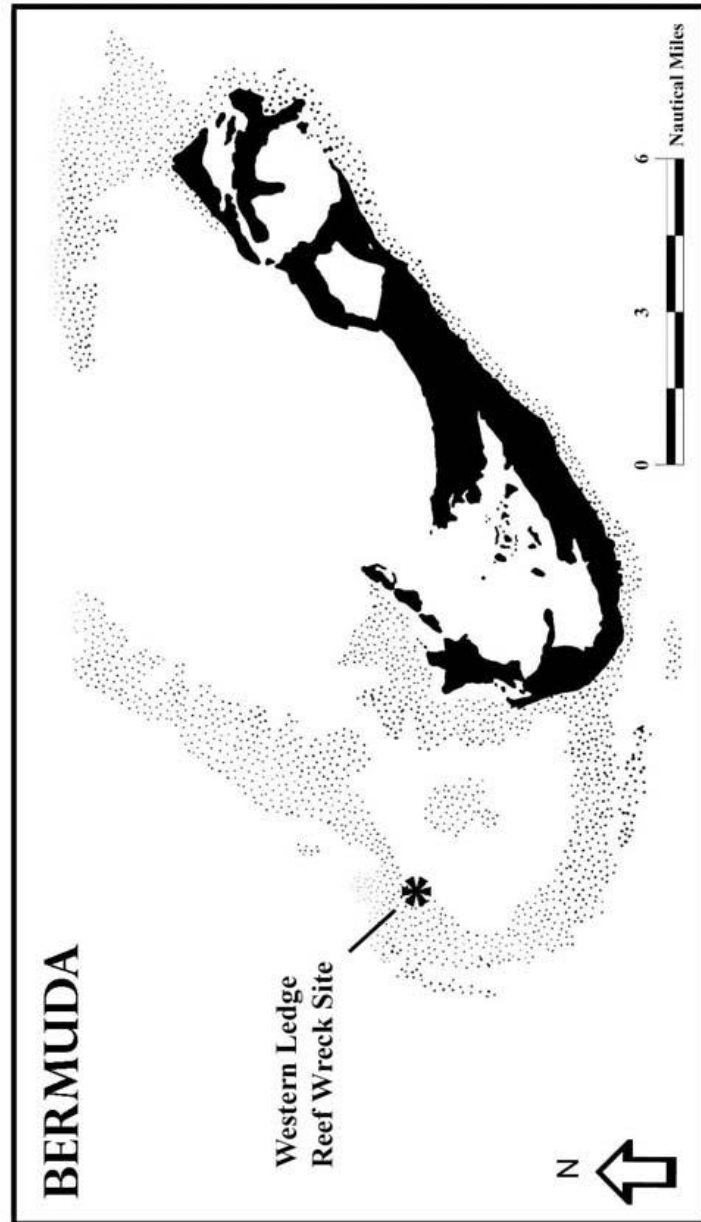


FIGURE 28. Site of the Western Ledge Reef Wreck. (Bojakowski, 2011).

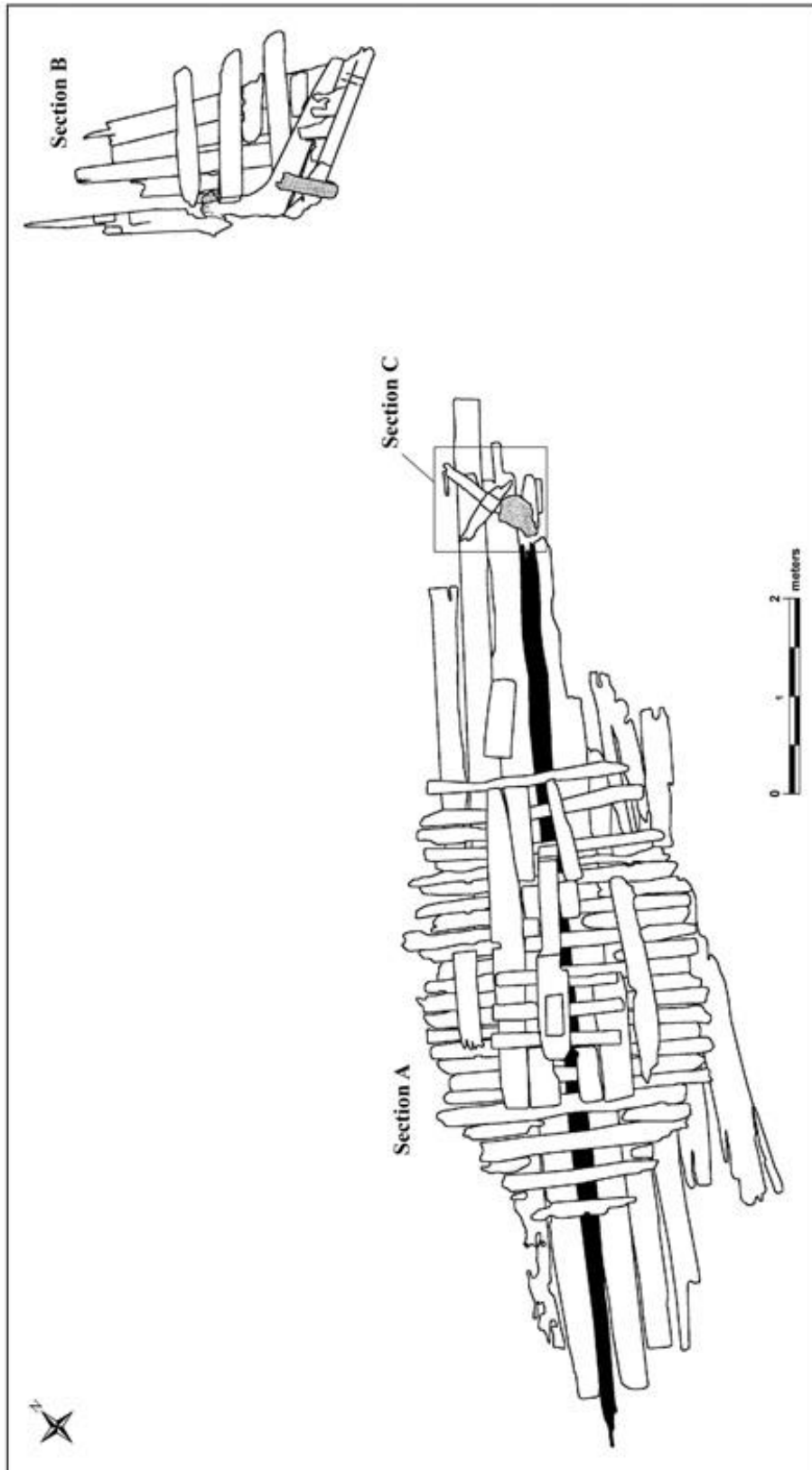


FIGURE 29. Western Ledge Reef Wreck site map. (Bojakowski, 2011).

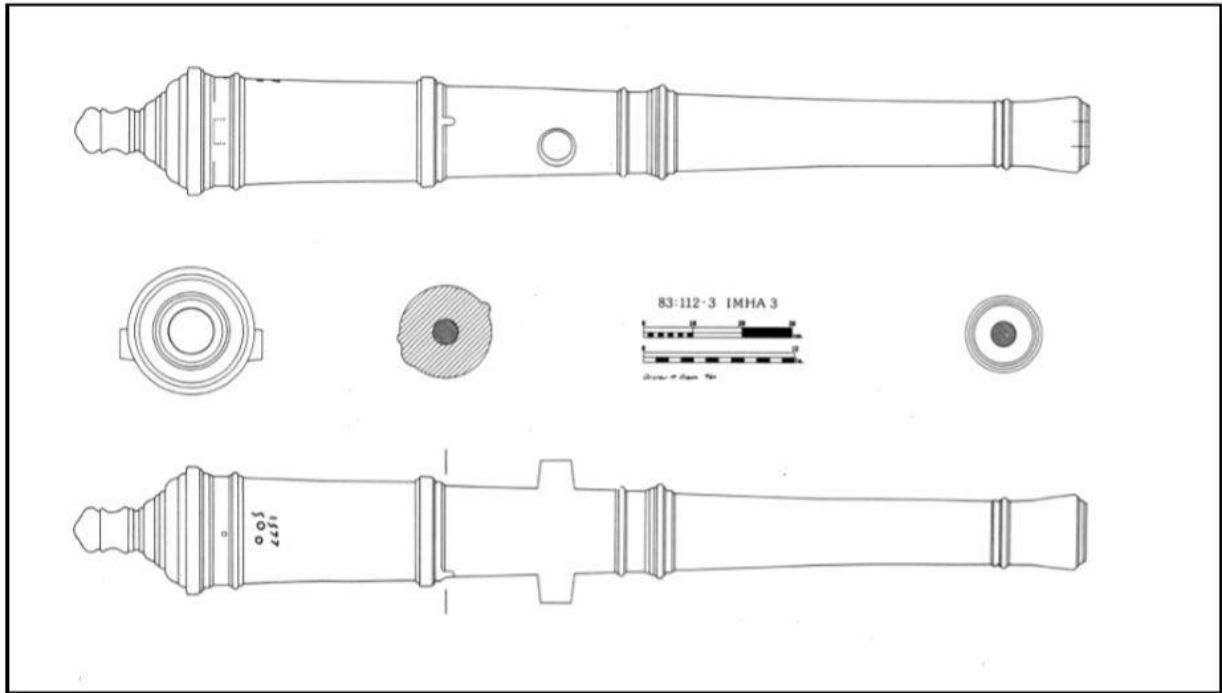


FIGURE 30. Cannon found on the Western Ledge Reef Wreck site. Illustration by Cristen M. Gober. (Watts, 1993).

Some of the diagnostic features found in the extricated timbers include characteristic dove-tail mortise-and-tenon joints found in 14 floor timbers, and the previously mentioned 6-buttressed mast step. Ceiling planks, an articulated stern, and 21 first futtocks were also found, including a remarkably well-preserved keelson (Institute of Nautical Archaeology 2017). Furthermore, the presence of a flat scarf at the aft end of the keelson, which itself was crafted from multiple timber pieces, is representative of other Iberian shipbuilding methods of the time. The raised timbers were then cleaned, photographed, documented, and drawn at 1:1 scale on Mylar. The oak remains of the Western Ledge Reef Wreck were then placed in large desalination tanks at the museum; unfortunately, due to delays and unforeseen complications, timber conservation efforts were halted and to this day remain unfinished (Bojakowski 2012: 26, 86).

In his dissertation, Bojakowski summarizes the probable ship characteristics of the original vessel:

According to the preliminary analysis produced by Brad Loewen, the Western Ledge Reef Wreck was a relatively small vessel of between 117.8 to 190.8 *toneladas*, and probably in the 140 to 180 *tonelada* range. Hypothetically, it had an elongated narrow stern and a short rounded bow... Estimates suggested that the total length of the flat keel was between 12.35 m to 13.50 m, with the higher value supported by the framing pattern and the plan of the starboard planking. Its greatest beam was between 5.06 m and 6.06 m it was estimated that such ship could reach 18.52 m to 23.45 m in length... Loewen also proposed that this vessel might have had a typical three-masted ship rig with a lateen-rigged mizzen mast and square-rigged main mast and fore mast. Nonetheless, a two-masted all lateen rigged configuration could not be entirely rejected (2012: 88).

Bojakowski was given permission in 2007 to continue analysis on the wreck site, which led to a more thorough investigation into the vessel's type and probable origins. While his work resulted in a dissertation and catalogue of information that aids in interpreting Iberian shipbuilding, the physical remnants of the wreck remain in a wet-storage facility at the NMB and have yet to be conserved. This thesis offers a solution for the preservation and use of the historically important wreck remains.

Interpretation and Implementation

Western Ledge Reef wreck, excavated and removed, has been in storage at the NMB for years and needs conservation treatments for stabilization. Bradley Rodgers has proposed treating the wreck materials to create an artificial wreck site within the waters of Snorkel Park for people to explore and interact with. Whether experienced by snorkel or by being viewed from above, the location proposed for the interactive exhibit is readily accessible and family-friendly.

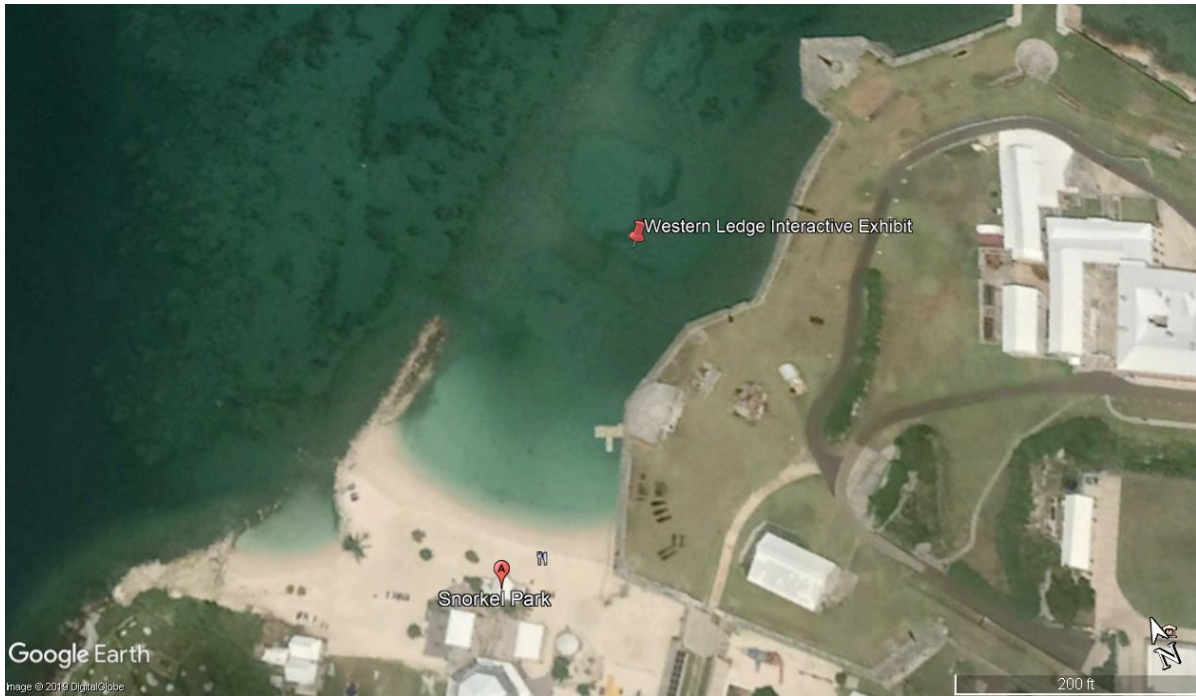


FIGURE 32. Proposed Location of Western Ledge Reef Interactive Exhibit. (Google Earth, 2019).



FIGURE 31. View from the NMB of the proposed site for the Western Ledge Exhibit. (Photo by Author, 2018).

The NMB overlooks the popular snorkel spot appropriately named Snorkel Park (Figure 32), and while the remains of the Western Ledge Reef wreck no longer retain their provenience, there is still an opportunity to conserve the timbers and to rebury them as an interactive museum exhibit. The remains will continue to deteriorate if they are not treated (Bradley Rodgers 2018, pers. comm.), but with the non-toxic conservation methods outlined by Bradley Rodgers in personal communications, the remains can be inexpensively conserved and placed in the shallow waters of Snorkel Park, creating a sustainable and educational experience. Signage at both Snorkel Park and at the lookout point at the Museum would be a plausible and effective interpretation method.

By making this shipwreck an interactive museum exhibit, it allows the public to handle and observe the materials with no concern to its structural or historical integrity, but instead encourages creative and curious interaction, and promotes further questions to be raised. This may lead to a trip to the museum up the hill to discover more about the wreck in the water below, and how its unique Iberian ship-type plays a role in Bermuda's history. Finally, this option of interpretation presents a low-risk and inexpensive undertaking for the NMB, and additional project stakeholders.

Chapter 7: Analysis

Maritime heritage trails are often heavily marketed towards those who can experience the sites in person. They are a fully immersive way of bringing the public closer to important cultural sites, but do not take advantage of the innovative museum methods employed by the world's most renowned museums. A questionnaire administered to a targeted audience sought to evaluate their perceptions and attitude towards the employ of new museum technologies (i.e. 3D models, AR and VR experiences) within a Bermudian maritime heritage trail. While studies have addressed the dive community and their direct involvement in heritage trail sustainability (Scott-Ireton 2005; Wright 2014; Mires 2014), this questionnaire aimed to examine a variety of ways in which to bridge the gap between divers and the non-diver demographic.

Identifying the public's response to the incorporation of new technologies into the traditional museum experience will help to qualify the use of these technologies for future heritage projects, while also demonstrating their ability to increase general public access. Additionally, a discussion involving stakeholder roles and responsibilities, using a series of personal communications, engages the use of *stakeholder theory* in assessing the viability of the trail's creation, interpretation strategies, and long-term management. This chapter concludes by examining three maritime heritage sites in operation today which have employed one or more of the interpretation methods discussed within this thesis.

Survey Results

The survey was created to provide statistical data for this project, and to offer useful data to the NMB. The survey was created using Google's Google Forms free online program which

made it easy to disseminate the survey through the appropriate channel. Included in the Google Drive office suite, Google Forms is a general-use survey application which is available to all Google users. Over the course of four weeks in early 2019, 26 participants responded to the Google Forms 19-question survey. The survey group was limited to those who had “liked” the NMB’s official Facebook page, targeting individuals who have an interest in both maritime history and museums.

The 19-question survey had the primary objective of gaging interest in interpretative technologies, both within museums and online. The first five questions were purely demographic; 19.2% of respondents were residents of Bermuda, while 80.8% were not, and it was an almost equal divide between female and male respondents (53.8% and 46.2% respectively). The majority of respondents were between the ages of 18-29 (57.7%) followed by the 30-44 age bracket (23.1%) and 45-64 age bracket (11.5%).

What is your age?

26 responses

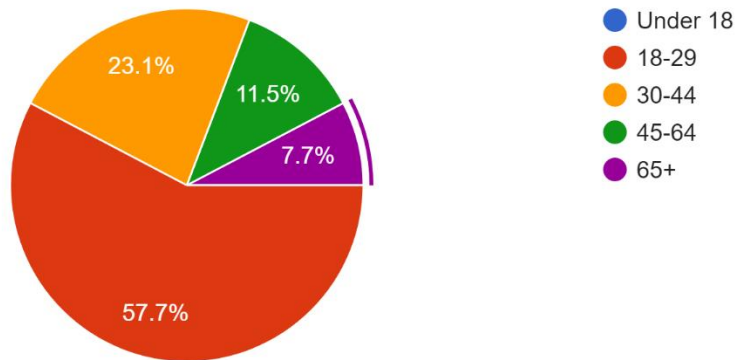


FIGURE 33. Survey Question 2 Results. (Google Forms, 2019).

The respondents were a majority of Caucasian (57.7%) and Hispanic or Latino (19.2%) backgrounds, while 11.5% of the respondents chose not to answer. Finally, the sample demonstrated high levels of education; 42.3% of participants reported having their Bachelor's degree and 34.6% said they had obtained their Master's degree.

How would you describe yourself?

26 responses

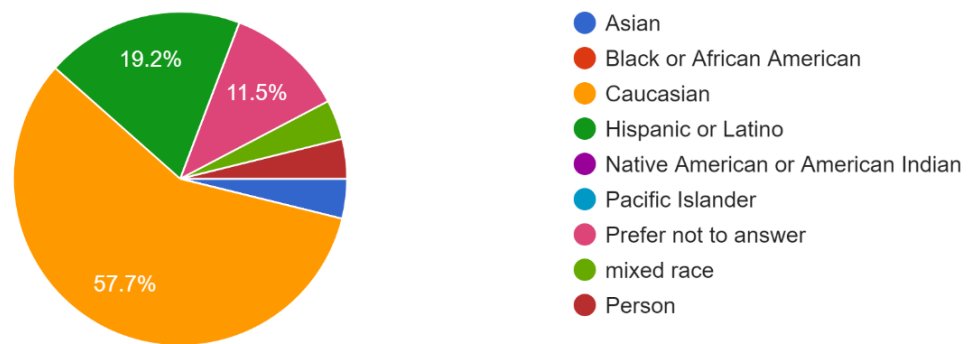


FIGURE 34. Survey Question 4 Results. (Google Forms, 2019).

What is your highest level of education?

26 responses

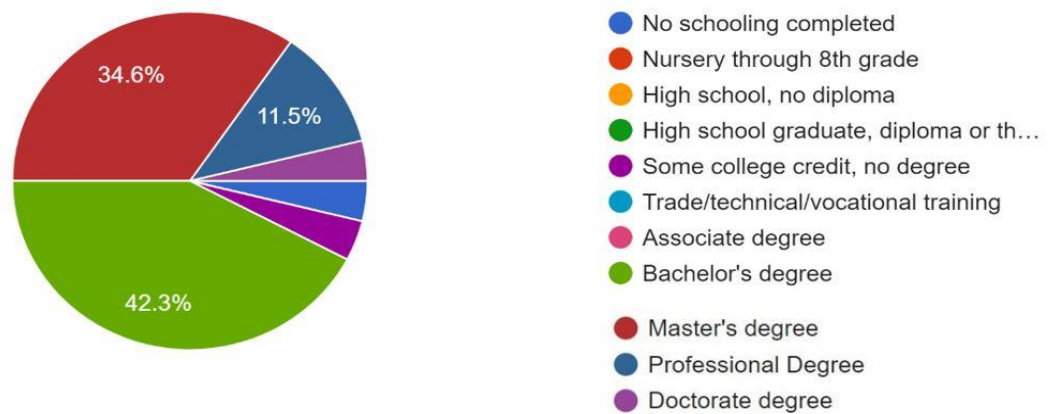


FIGURE 35. Survey Question 5 Results. (Google Forms, 2019).

Question 6 delves into the participant’s perception and understanding of maritime culture. The question, “What do you consider maritime cultural heritage,” allowed participants to select up to 6 options that could represent maritime culture. There was also an option of “other” for those who had additional ideas of what that constitutes. The most prevalent answers were shipwrecks, maritime folklore, and maritime buildings with 96.2% of the respondents agreeing these selections represented maritime culture. Closely following was maritime activities and trade (92.3%) and maritime museums (88.5%).

What do you consider maritime cultural heritage – click all that apply

26 responses

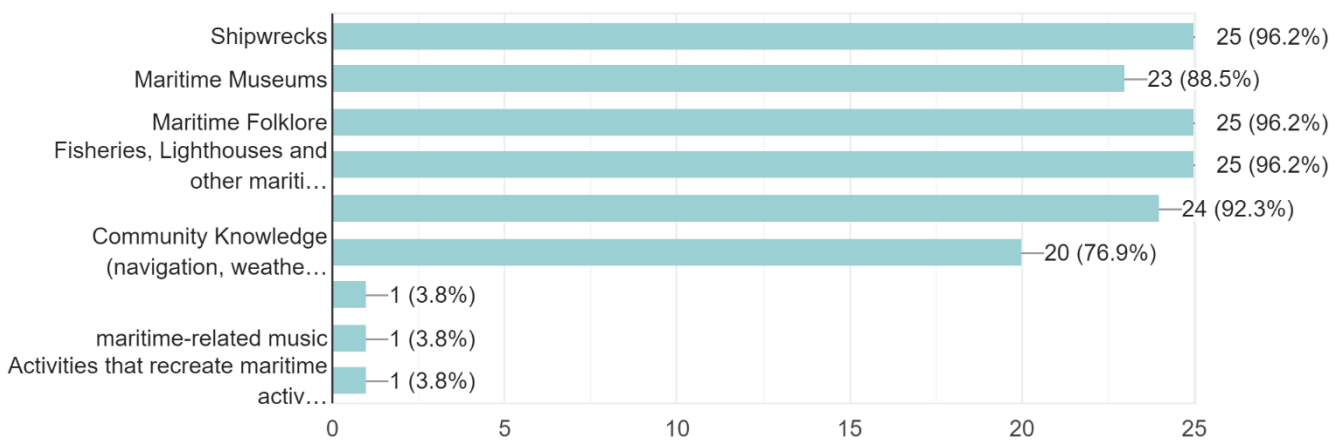


FIGURE 36. Survey Question 6 Results. (Google Forms, 2019).

Question 7 gaged general interest in maritime heritage, with 56% of the respondents indicating that maritime cultural heritage was “very important” to them. Questions 8, 9 and 10 were more museum specific, aiming to understand the sample’s museum attendance. 69.2% of respondents indicated that they visit museums more than twice a year, and a considerable 84.6% answered that they visit at least one museum while on vacation. Additionally, a large percentage

of participants (42.3%) responded that they visit museums in their local area more than twice a year.

How often do you visit Museums or outdoor exhibits?

26 responses

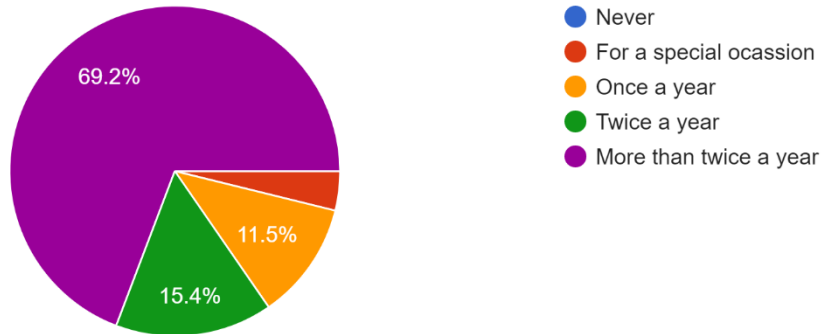


FIGURE 37. Survey Question 8 Results. (Google Forms, 2019).

The next three questions (11-13) were focused on diving capabilities and the respondent's specific interest in shipwrecks. Discerning which percent of the survey respondents were divers, and which were not was integral to the study; 56% of those who answered the survey responded that they were capable of SCUBA, leaving the remaining 44% to be the non-diver demographic. Also of note, the majority of respondents answered that they are "very interested" and "somewhat interested" in shipwrecks (61.5% and 23.1% respectively). And out of the 26 respondents, 38.5% reported that they had seen a shipwreck in Bermuda.

How interested are you in shipwrecks?

26 responses

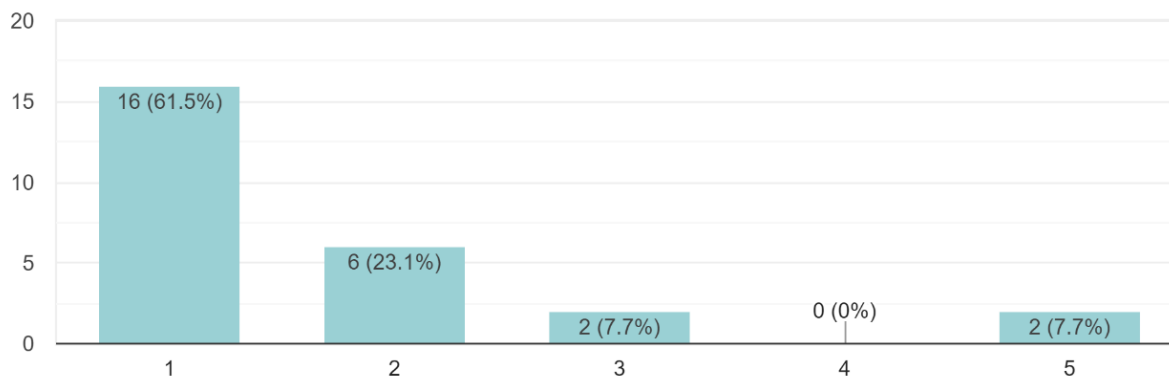


FIGURE 38. Survey Question 11 Results. (Google Forms, 2019).

The remaining 6 questions (14-19) of the survey were intended to measure whether the respondents had an interest in experiencing advanced interpretive strategies, which included 3D-printed artifacts, virtual reality exhibits, a museum mobile application, and an online maritime heritage trail with videos, pictures and historic models. 19 of the 26 survey participants (73.1%) indicated that they would be “very interested” in experiencing shipwrecks using three-dimensional technology. 3 respondents (11.5%) recorded that they would be “somewhat interested” in the 3D experience and 3 more respondents (11.5%) stated that they were “not very interested” in the 3D technology. Overwhelmingly, 92.3% of the survey respondents reported that they owned a smartphone, where only 2 respondents (7.7%) stated that they did not own one. This provided a segue to question 17 which asked if the survey participants would use a mobile app to explore historic sites on Bermuda. Encouragingly, 73.1% responded with “yes”.

Would you be interested in experiencing shipwrecks with 3D technology in a museum?

26 responses

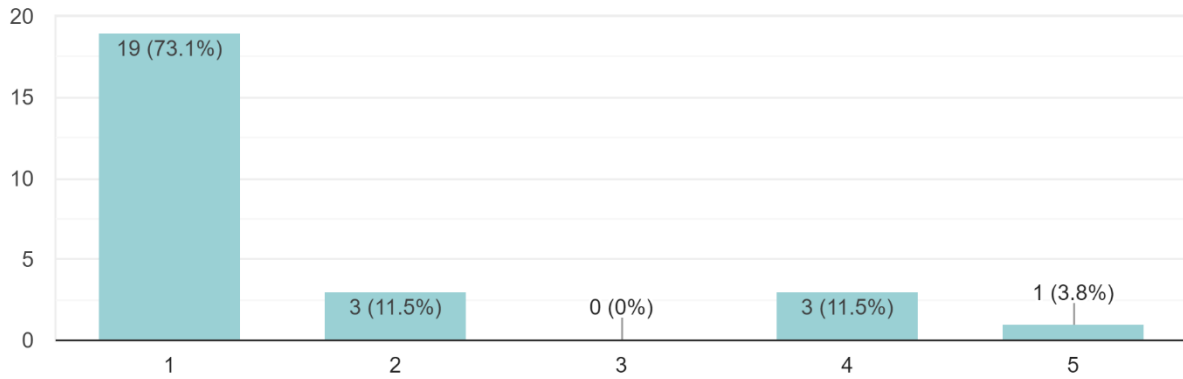


FIGURE 39. Survey Question 14 Results. (Google Forms, 2019).

Would you use a mobile app to explore important sites in Bermuda, including shipwrecks and forts?

26 responses

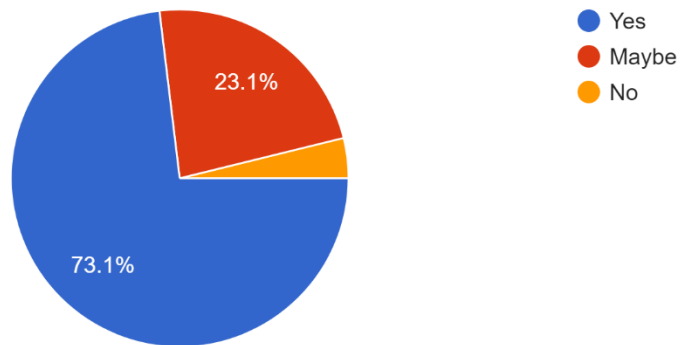


FIGURE 40. Survey Question 17 Results. (Google Forms, 2019).

There was a positive response to the creation of a heritage website: 64% of respondents responded to question 15 that they would be “very interested” in in a website, and 20% indicated that they were “somewhat interested.” Evaluating levels of interest in a heritage website was important in understanding if this kind of public history project could succeed. Considering the low overhead costs, a website which promotes the maritime heritage trail and, furthermore, becomes a whole new digital experience, would be a worthwhile addition to Bermuda’s current museological repertoire. Finally, when asked about a virtual reality (VR) experience and the prospect of 3D-printed artifacts, respondents also answered positively. 69.2% of respondents stated that they would be “very interested” in trying a VR experience within the museum, while 11.2% expressed that they would be “somewhat interested.” And a large majority 88.5% of respondents indicated that they would like to handle 3D-printed artifacts, while 11.5% of the participants said they would maybe like to handle them.

Would you be interested in a website with videos, 3D ship models, and historical information?

25 responses

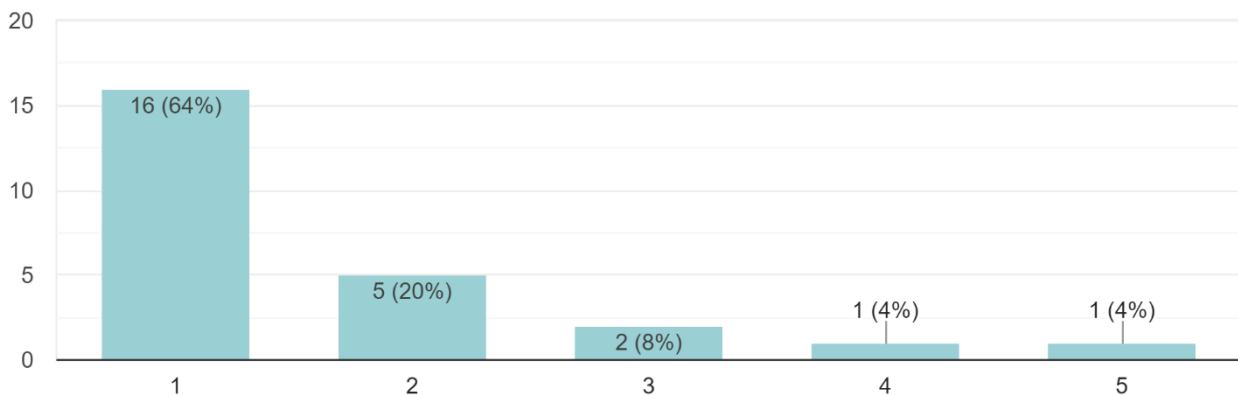


FIGURE 41. Survey Question 15 Results. (Google Forms, 2019).

How likely are you to try a virtual reality experience in a museum?

26 responses

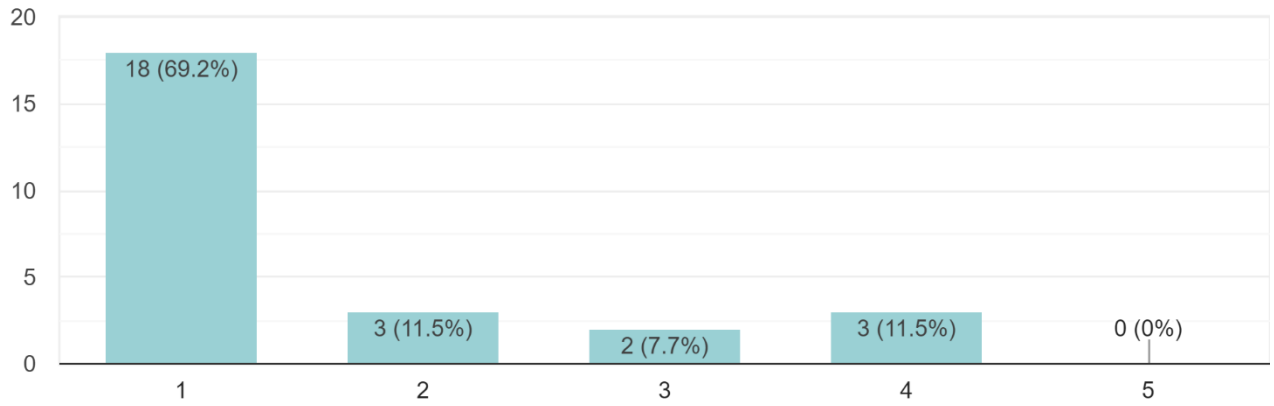


FIGURE 42. Survey question 19 results. (Google Forms, 2019).

Would you like to handle 3D printed replicas of artifacts?

26 responses

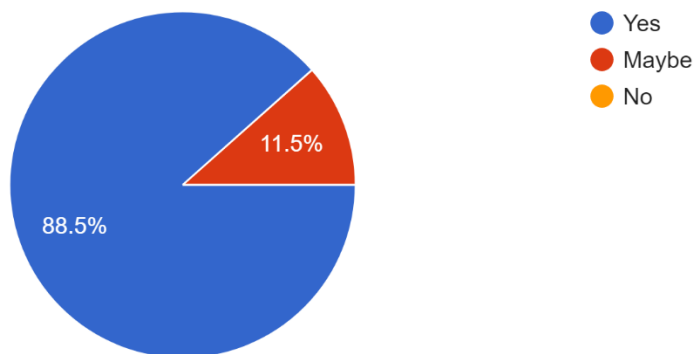


FIGURE 43. Survey question 18 results. (Google Forms, 2019).

Analysis

It is imperative to dissect and understand the sample pool when conducting a survey. From the demographic questions, the responses show that the respondents are younger (under 45 years old) and highly educated (88.4% of respondents had a university degree). Although just over the majority of participants indicated they were Caucasian, the sample pool made up 43% of a race other than Caucasian, creating a rather diverse group. Gender was also almost equally divided. And although the response number was low (26 respondents), the diversity of the participants is encouraging, and can still be seen as a significant contribution. Although it should be noted that through the distribution of this survey through Facebook, the sample pool was naturally skewed towards educated, heritage-aware people who have proven competent with social technologies.

Consistently, the survey results show that the participants were supportive of interpretative technologies. The respondents are interested and invested in maritime heritage, which is supported by the survey findings that indicate they heavily frequent museums both locally and while on vacation. The younger demographic of the sample pool may contribute to their acceptance of digital and experimental technologies in museum exhibits and experiences. Bermuda Tourism Authority (BTA) revealed in their meeting with the author that Bermuda has seen a significant increase in the younger demographic traveling to Bermuda. Supported by the survey findings, this demographic should not be ignored.

Finally, the author analyzed the number of people who were non-divers (11 respondents, or 44%), and their responses to interpretative technologies. Of the non-divers, 90% indicated that they would be “very interested” in experiencing shipwrecks with 3D technology (Figure 45). Furthermore, 64% of the non-divers stated that they would use a mobile application, while the

remaining 36% said they would “maybe” use an app, without a single negative response (Figure 47). And finally, 90% of the non-divers expressed that they would be “interested” or “somewhat interested” in an immersive website with videos, pictures, and 3D models (Figure 46). These statistics help to answer one of the author’s research questions: according to the survey responses it is evident that people who do not dive SCUBA are overwhelmingly supportive of the use of innovative technologies in interpreting or experiencing shipwrecks and other heritage sites.

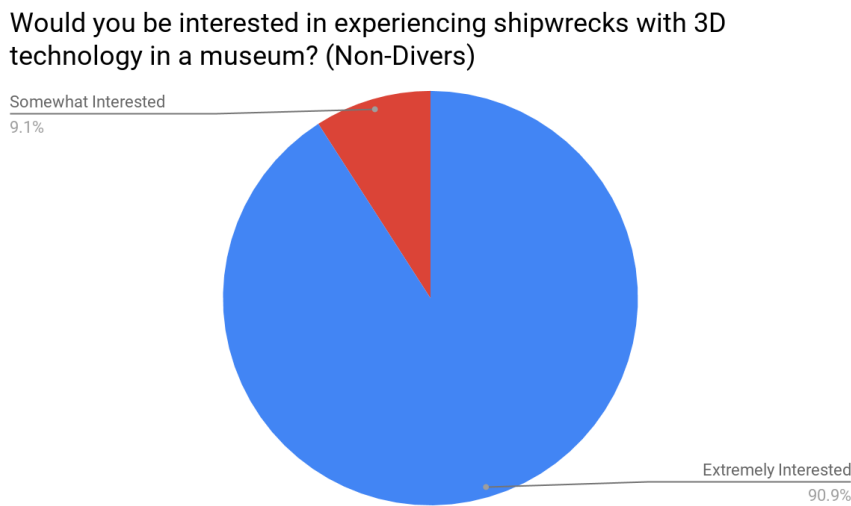


FIGURE 44. Non-diver response to 3D technology. (Image by Author, 2019).

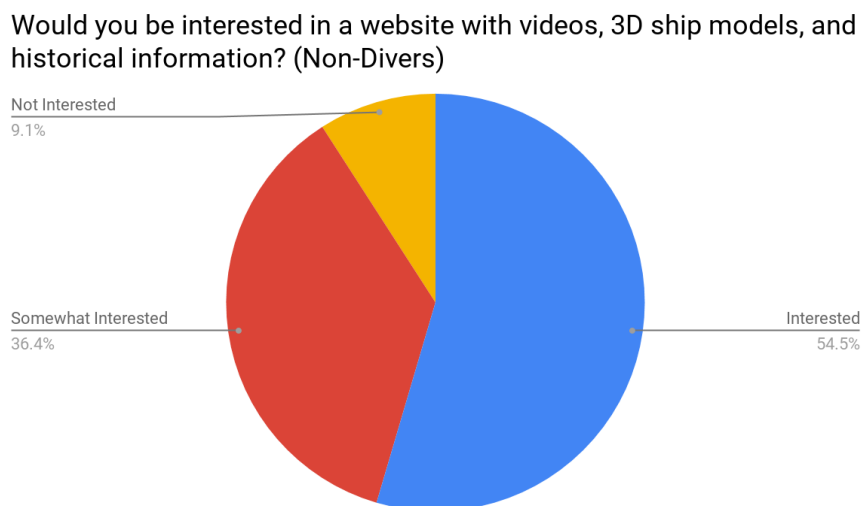


FIGURE 45. Non-diver response to an interactive website. (Image by author, 2019).

Would you use a mobile app to explore important sites in Bermuda, including shipwrecks and forts? (Non-Divers)

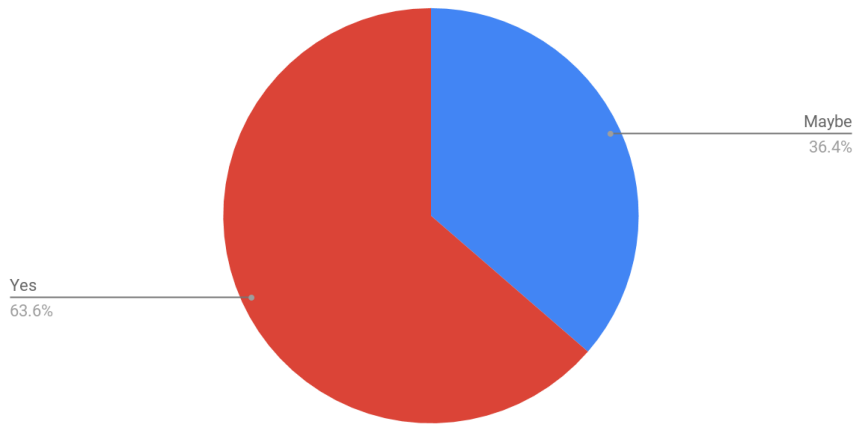


FIGURE 46. Non-diver response to a heritage mobile application. (Image by Author, 2019).

Stakeholder Involvement

During a research trip to Bermuda in 2018, the author conducted several interviews with select primary stakeholders. Stakeholder theory was instrumental in the formulation of interview questions, which sought to determine the stakeholder’s perspective on their role in a heritage trail, whether they identify as cultural stewards of Bermuda’s cultural heritage, and how they fit within a hypothetical stakeholder constituent group. Stakeholder theory centers around the idea of inter-disciplinary collaborations, where “the cross-pollination of ideas that comes from these collaborations is a key area of distinction” for this kind of multi-agency heritage project (Berman et al. 2017: 3). The questions were formulated with these considerations in mind.

The National Museum of Bermuda was incredibly enthusiastic about their involvement in a heritage trail. They explained in the meeting that they had explored different avenues in the past—including how to integrate interpretative technologies—but have yet to implement them.

The museum has a clear vision of its role in protecting and advocating for Bermuda's cultural heritage, and as a cultural pillar of their community, would be one of the most influential stakeholders in a maritime heritage trail. Their mandate asserts: "NMB actively promotes the preservation, understanding and enjoyment of Bermuda's cultural heritage through education, stewardship, historical, archaeological & scientific research, exhibition, acquisition, public outreach and advocacy" (NMB 2019).

During the interview, the museum expressed initial concern with developing a mobile application, as they were hesitant to create a resource that people would not use. But the evidence from the survey suggests the opposite; 73.1% of the participants responded positively to the creation of a heritage mobile application. However, the museum responded enthusiastically to the idea of placing the Western Ledge Reef Wreck into the shallow waters of Snorkel Park to create an interactive exhibit experience. The proximity of the attraction, along with the ability to put up signage in the vicinity, would allow the museum to monitor the site and provide further information on the historical context of the wreck. Finally, the museum wanted to employ simple, fool-proof methods in relaying trail information, like downloadable and printable itineraries, and waterproof dive-friendly information cards.

The Bermuda Tourism Authority (BTA) also conversed with the author to share their perspective on a heritage trail. Their chief concern is the growth and marketing of Bermuda's tourism economy, and the heritage trail could be a worthwhile addition to what Bermuda already has to offer. Surprisingly, they elucidated that from their research, divers and dive activities do not account for much of the tourist spending on the island, and so they do not promote dive-specific activities as widely as they do restaurants and entertainment activities. However, when discussing new interpretative technologies, BTA was intrigued and expressed their interest in

these kinds of endeavors, postulating that something of that nature would create positive press. When asked to define their role in Bermuda's heritage, BTA said that their primary role is to "promote" and "market" the island's cultural heritage. They also supplied that their role in a heritage trail would be to promote and market the attraction. The author and BTA discussed, and agreed, that Bermuda could benefit from the creation of a comprehensive trail which would highlight the locals, their community and their shared culture; becoming an authentic experience for both tourists and locals.

Island Tour Centre (ITC), a prominent tour operator in Bermuda, was also supportive of the heritage trail idea. One of the more illuminating facts they supplied was that many of their tour operators did not know much about the history of the wrecks and sites they frequent. By providing a well-researched informational booklet for tour guides and dive leaders, they could educate while leading tours. ITC insists this is something the tour guides themselves have expressed interest in. It was encouraging to hear of the organization's eagerness. Additionally, the island's existing infrastructure would make them a likely partner in a heritage trail, providing resources to trail goers who would like to hire boats and tour guides.

Lastly, the author met with Phillippe Rouja, Bermuda's Controller of Wrecks, to discuss the plausibility and sustainability of a maritime heritage trail. Rouja was, and continues to be, a stakeholder and contributor to the Bermuda 100 Challenge. He explained that the government had toyed with the idea of a "maritime park" which would protect a section of bay for biological and cultural purposes. This never materialized, but they remain hopeful. Rouja suggested a collaborative effort with the Bermuda 100 Challenge and the NMB, sharing data and 3D models. Rouja stressed the need for dimensionality in the endeavor. The heritage trail should be an attraction that would not only encourage tourism, but would be authentic, useful, and could

harness the power of consumerism—a multifaceted approach to cultural heritage preservation and presentation.

Maritime Heritage Trails

The final portion of this chapter is dedicated to a brief review of three maritime heritage trails in operation today. However, the author would direct further research and reading towards Della Scott-Ireton's dissertation titled *Preserves, Parks, and Trails: Strategy and Response in Maritime Cultural Resource Management* (2005) and Jeneva Wright's thesis titled *Balancing Acts: Public Access and Archaeology in the Cape Fear Civil War Shipwreck District* (2015) as they both do a thorough job presenting case studies and management strategies for some of the world's predominate maritime heritage trails, including the heritage trail at Biscayne National Park and NOAA's Thunder Bay National Marine Sanctuary. In an effort to not replicate their studies, this portion of the analysis will focus on trails that have employed more advanced interpretative technologies, and how they have failed or succeeded in this endeavor.

1. Blackwater Maritime Heritage Trail

The Blackwater Maritime Heritage Trail of Baghdad, Florida is a trail created to exist as an almost completely virtual entity with the help of Terrain360, a virtual tour company who use a Google Earth-type image technology. This allows the online user to visit each stop along the trail through a virtual reality/panoramic image experience. As the project coordinator, Kenyan Murrell expands in an interview:

We like to highlight the historical and archaeological features along the river such as shipwrecks or old mills... So when you're cruising down the river virtually and you're jumping from scene to scene, you might see a bubble that you can click and see, 'Oh, that's a shipwreck.' (Wallace 2018).

Upon inspection of the site, it is evident that a tremendous amount of effort and work was put into the making of this project, and the resultant website is interesting to peruse, albeit a bit clunky to navigate. Google Earth users will recognize the interface, and it follows in much the same way; a click forward or backward will take you along a predetermined path, while small markers appear along the side of the screen to indicate sites of interest (boat launchings, bridges, shipwrecks, etc.). A computer mouse lets the user freely move about the scene in a 360 degree turn, and the left menu gives detailed information like elevation, weather conditions, and distance traveled along the path.

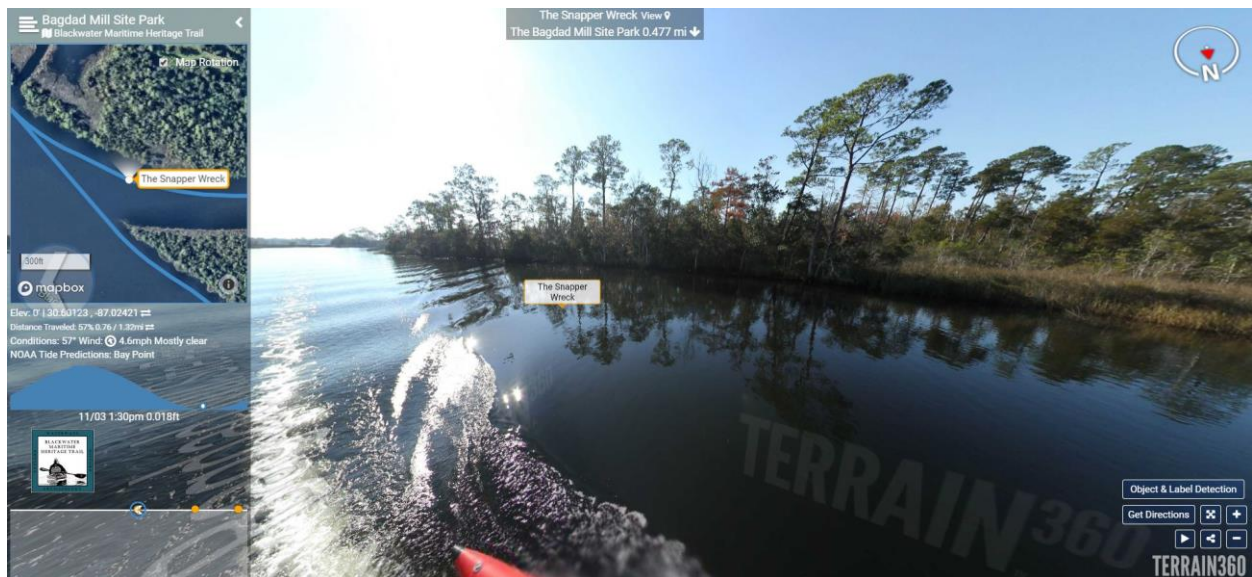


FIGURE 47. Screen grab from the Blackwater Maritime Heritage Trail showing the Snapper Wreck (Blackwater Maritime Heritage Trails, 2019).

Benjamin Wells' thesis titled *A Light in the Dark: Illuminating the Maritime Past of the Blackwater River* (2015), provided the initial research and idea for this trail. Using maritime landscape theory, Wells focused his research on how each site on the trail existed not as a singularity, but rather:

as components of the complete picture of the Blackwater River. A comprehension of how the parts make up the whole is the foundation of this interpretive pursuit, one which seeks to instill an appreciation of the resources present and to foster their protection and preservation for the future (2015: 88).

Wells' work certainly laid the theoretical groundwork for the project to be successfully carried out. And as a maritime heritage trail using interpretative technologies, this example succeeds at not only establishing an overarching cultural theme within a maritime context, but also organizes this data in a fun and interactive way, easily accessed through the internet. The project could improve by including 3D images of the wrecks and historic sites alongside the short descriptions listed for each interest point. This is especially important when the submerged sites on the trail are hardly, if at all, visible through the website's virtual tour lens as demonstrated in Figure 6. With these notes to consider, the Blackwater Maritime Heritage trail is a wonderful example of interpretative technologies being used in the curation and dissemination of cultural and archaeological information. The website can be found at the following web address: <https://www.blackwatermaritimeheritagetrails.org/>.

2. Outer Banks Maritime Heritage Trail

The National Oceanic and Atmospheric Administration (NOAA) Office of National Marine Sanctuaries released a new heritage trail website and virtual tour of North Carolina's Outer Banks in 2012, and has remained stagnant and unfinished since then, despite incredible advancement in technology. NOAA's website not only highlights maritime heritage, but includes natural environment as well, which makes this a unique resource with definite potential. The website interface appears dated and provides no fascinating imagery besides an "interactive" map (Figure 7) with buttons that launch an educational video about a specified cultural site or

environmental feature, although these sites are unlabeled, and instead coincide with a number and a video title, which could lead to confusion.

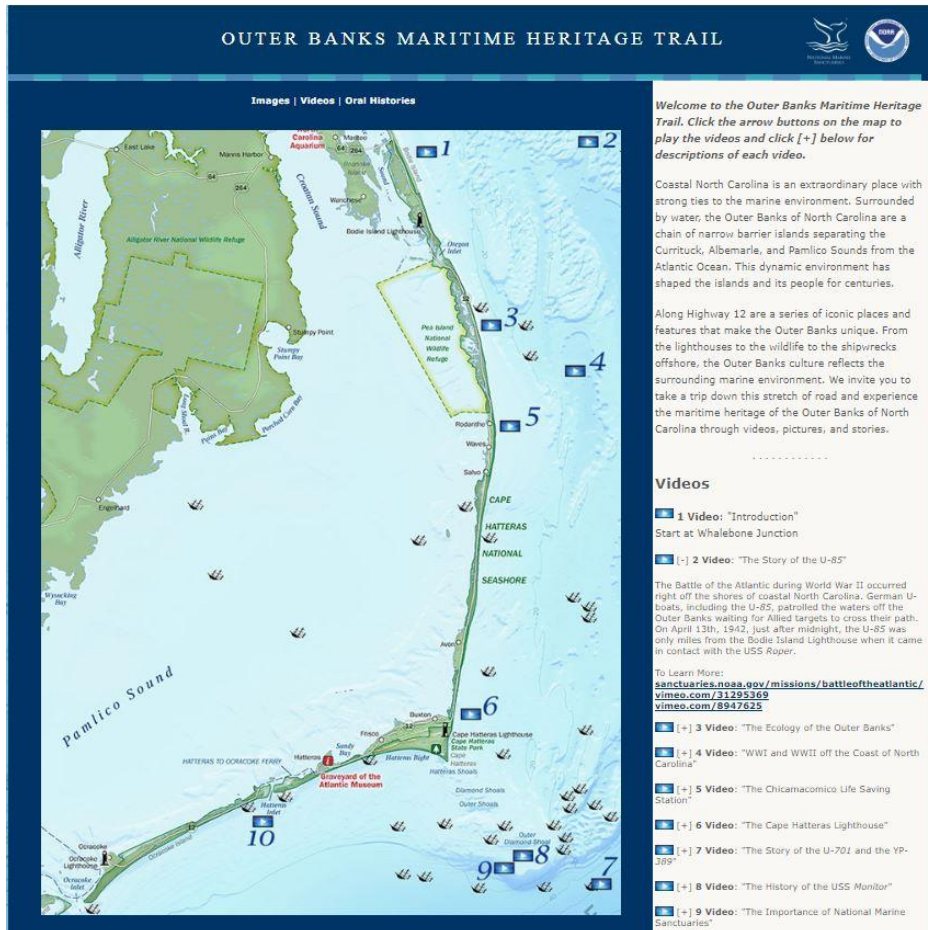


FIGURE 48. Screen grab of NOAA’s Outer Banks Maritime Heritage Trail website. (NOAA, 2019).

The site provides seven oral history accounts, a unique feature when compared to the other trails in this analysis. However, these oral histories look initially to be audio files, but are instead written transcripts. NOAA has missed out on a rare opportunity to let the visitor engage with the information in a more personal way. Finally, the webpage indicates there is an “images” section, but that is unfortunately left blank. The Outer Banks Maritime Heritage Trail has failed in effectively relaying historical and cultural information in an interesting and meaningful way.

The website is an example of a missed opportunity to display the vibrant and diverse heritage of the Outer Banks. The website can be found at the following address:

<https://monitor.noaa.gov/obxtrail/>.

3. Historic England Virtual Dive Trail

Historic England has done an exemplary job at displaying cultural information in an accessible and visually stimulating way. In a project that began in 2016 with only a few wrecks, Historic England now boasts a total of 15 interactive dive trails, all immediately available on their website. The imagery is stunning, and the material is illuminating. Their website prefaces their virtual dives with the following:

These trails use new technologies such as multi-image photogrammetric recording and virtual reality techniques. The new techniques allow viewers to see a clear 3D image of a site. Not only do they bring maritime archaeology to life for the non-diver, they're a lot easier to interpret than more traditional geophysical survey techniques or photographs taken in poor visibility. They can even aid archaeologists' work on land by allowing measurements to be taken and analysis to be carried out post-dive (Historic England 2019).

This statement acknowledges the need to make this data available to the non-diver, and to those who are sensory or physically impaired. It further expounds that these virtual tours can be used as tools by archaeologists who would otherwise have to make the dive to recover specific data.

Although labeled as a virtual dive trail, the sites do not seem to be temporally organized, nor are they organized to represent geographical location or proximity to one another. Instead, the website lists each of the 15 sites separately with its name and description, for the user to choose at will. Once a site is chosen, the wreck is produced in vivid three-dimensional detail, and prompts an automated tutorial which aids the user in navigating the experience. The site is

scattered with numbered bubbles which open up an informational window on the left-hand side of the screen, with video and the option to switch to VR or a panoramic view of the wreck.

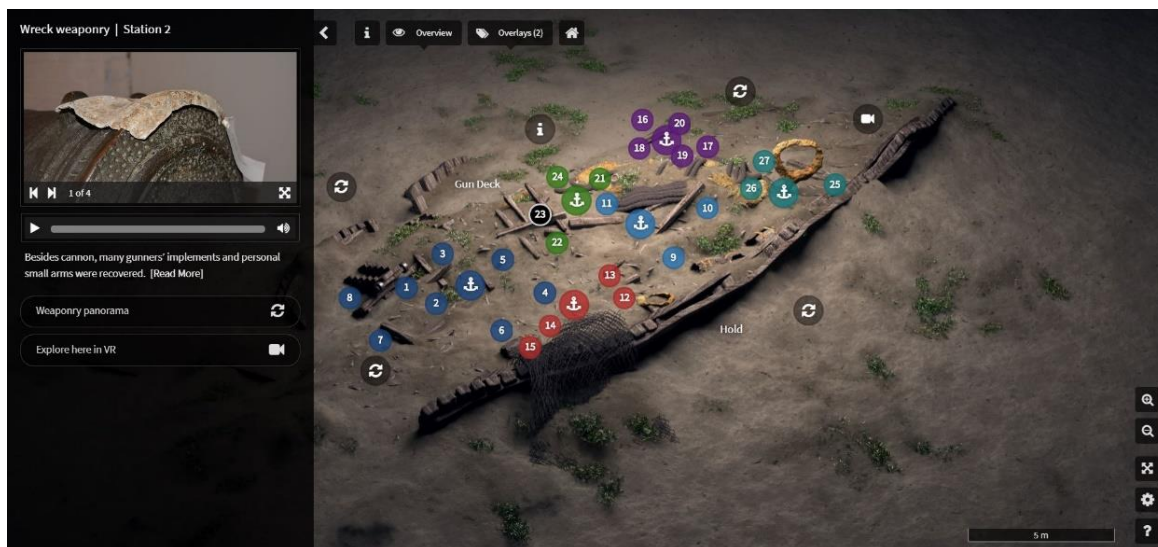


FIGURE 49. Screen grab from Historic England's Virtual Dive Trail, London wreck. (Historic England, 2019).

In 2018, two project reviews were commissioned by Historic England, and provided recommendations. Alison James, a maritime archaeologist, and Serena Cant, a marine information officer, wrote separate but complimentary reports which review the project's initial mission and highlight areas in need of improvement. These areas include; the creation of an eye-catching launch page, the inclusion of social media as a means of promotion to increase public awareness and making the virtual dive experiences more accessible to the impaired and disabled (fewer clicks, eliminating language obstacles, etc.) (Cant 2018: 4; James 2018: 1).

The author would agree with the recommendations made by both Cant and James and would like to emphasize that the suggestion to incorporate social media in the promotion of virtual and physical heritage trails is a logical and necessary future step and should be seriously considered as a supplementary public outreach tool to all heritage projects moving forward. The

author would further suggest that the project adapt a cultural framework in which to organize their wrecks and to create a separate website to house the experience, to make it a more immersive educational tool. However, Historic England's virtual dive trail is well executed, visually remarkable, and extremely responsive. Their efforts have produced one of the most impressive online maritime heritage projects to date. The virtual trail can be found at the following web address: <https://historicengland.org.uk/get-involved/visit/protected-wrecks/virtual-dive-trails/>.

Chapter 8: Conclusions

A maritime heritage trail in Bermuda would be an ambitious undertaking, but it is the author's hope that what has been discussed in this thesis will provide data to encourage essential influencers that a heritage trail is entirely plausible and has tremendous potential to educate and inspire. Stakeholders of a nation-wide trail can make informed decisions about resources and outreach methods. A heritage trail may also benefit Bermuda economically, but will become a significant part of Bermuda's cultural identity. And as the evidence suggests from the survey results in Chapter 7, the public will likely respond positively to the introduction of technology in interpretation methods, breathing new life into the museum and cultural experience.

Beyond any doubt, Bermuda will remain one of the world's top diving destinations. But the experience of seeing historic sites *in situ* are lost to those who are unable to travel to the ocean floor. With the help of innovative technologies—three-dimensional digital images, virtual and augmented realities—museums, heritage organizations, and government agencies can uphold their responsibility of making this information available to all people. Using a well-designed and visually appealing website and mobile application as digital platforms, Bermuda's heritage trail transforms into a global and immediately accessible resource. By re-thinking and revitalizing the antiquated methods in which this information is translated to the public, these incredible stories of evolution and rich maritime history might finally mean something to the public who would otherwise hold no connection or stake in the cultural identity of Bermuda.

Quite timely, the National Museum of Bermuda announced their new Education Strategy, released in May 2019, which opens with the following statement:

Today's museums are located at a significant and exciting multi-disciplinary intersection defined by an increased reliance on technology and the blurring of the restrictive boundaries that traditionally set informal learning apart from formal learning. In addition, there is growing appreciation of the ways in which the educational context of lifelong learning can ensure that mature, adult and young learners are continuously provided with opportunities to grow and develop (NMB 2019).

The technologically advanced and educationally progressive maritime heritage trail model presented in this thesis falls within the scope of NMB's new Education Strategy. Key words like "multi-disciplinary intersection" and "lifelong learning" hint at a new era of educational and public outreach development which would welcome and support the implementation of advanced and creative interpretation technologies. The NMB's vision to "be a first-class national museum and research facility, inspiring engagement with and protection of Bermuda's diverse cultural heritage" (2019: 3) should set a new standard for all cultural education institutions, especially museums.

Bolstering education efforts in originative ways also supplements the legislative efforts of heritage protection and preservation, as propagating knowledge is one of the surest ways of mitigating human destruction of culturally significant sites. Bermuda's 2001 Historic Wrecks Act, discussed in Chapter 4, is poised to protect and encourage the creation of a historically significant trail attraction. This undertaking would be further assisted by the policies outlined in UNESCO's 2001 Convention on the Protection of the Underwater Cultural Heritage, which prohibits any commercial exploitation of culturally significant sites, promotes *in situ* preservation techniques, and encourages a collaborative effort of information exchange (UESCO 2017). For these reasons, Bermuda should actively consider becoming a ratifying state of the UNESCO's 2001 convention.

Research Questions

The primary research question, how the gap between divers and the non-diver demographic could be bridged, can be answered quite simply. Using technology and media to make the material understandable, visually striking, and immediately accessible would enhance the public outreach efforts of a heritage trail to those who could not experience these sites first-hand. The public's opinion, and specifically the non-diver demographic, was generally supportive of interpretative technologies in cultural projects, as demonstrated in the author's distributed survey. Of the non-divers assessed in the survey, 90% indicated that they would be "very interested" in experiencing shipwrecks with 3D technology, while 64% of the non-divers stated that they would use a mobile application, and the remaining 36% said they would "maybe" use an app, without a single negative response. And finally, 90% of the non-divers expressed that they would be "interested" or "somewhat interested" in an immersive website with videos, pictures, and 3D models.

Ultimately, the lack of success for most heritage trails stems from their inability to connect to the wider audience. These "attractions" are predominantly curated and conceptualized by archaeologists, historians, and museum personnel, while largely eschewing the considerable contributions of film-makers, graphic design artists, public relations specialists, and web designers. For public archaeology to work, the subject matter needs to be digestible, visually appealing, interactive, and simple to access. Archaeology as a discipline has made tremendous strides in recent years to rectify these concerns, but maritime archaeology, however, still falls considerably behind in addressing these issues. The material is thought-provoking, culturally significant, and more thoroughly researched than ever before. But the process in which it is conveyed is fundamentally broken. For these reasons, this thesis was conceived.

The author's secondary question sought to address how cultural themes would be expressed through interpretive technologies, and how stakeholders would appropriately translate these themes through a heritage trail. Chapter 6's historiographic and archaeological analysis revealed cultural themes through the careful examination of the individual sites, themes which primary stakeholders could fit within Bermuda's cultural heritage trail as representative of Bermuda's ubiquitous maritime heritage. These themes include smuggling, piracy, Civil War blockade-running, "wreckers," and black and military history, which are integral to the story of Bermuda and its legacy.

Furthermore, the vessels discussed in Chapter 6 represent a span of Bermuda's early history that have tangible extant material that archaeologically supports the historical narrative of the island. 3D images and augmented reality experiences would enable the public to quickly and visually understand the significance of certain structural and archeological remains of the site, and how these materials help us interpret and support the historical narrative of the island. For example, Wreck Site 3 provides an educational opportunity for an interactive shallow water exhibit to display a "working" site; a shipwreck with no name and with little evidence to support its origins, but with a few obvious physical indicators—salvage marks and the general disarticulated nature of the site—that the shipwreck could have been a victim of Bermuda's "wreckers." This site simultaneously explores an ongoing archaeological investigation as well as inspires the notion that wreckers are an important and understudied part of Bermuda's history. When harnessed, the cultural information and innovative outreach strategies present a powerful tool of interpretation.

An additional research question asked how the current legislation helps protect Bermuda's heritage sites and how these laws would work to preserve a maritime heritage trail.

Chapter 4's literary review of heritage legislation explores this question and lays the legislative framework to understand how a cultural heritage trail would fit within Bermuda's current cultural repertoire. With the passing of the Historic Wrecks Act in 2001, Bermuda evolved its stance on salvage and maritime history to ensure shipwrecks and other submerged cultural heritage was the object of only serious scientific query and investigation. The author concludes Bermuda's legislation would support and protect a heritage trail project, as it falls within the boundaries of the Historic Wrecks Act's legislative language.

The final research question of this thesis asks how a maritime heritage trail could help foster a preservation ethic amongst tourists and locals, and if it would assist in their adherence to current shipwreck legislation. Through stakeholder conversations, the author was able to assess that a more ambitious multi-agency approach would ensure greater circulation of information, inspiring observance of current shipwreck preservation laws, and the idea that these culturally significant sites deserve to be preserved. As expressed in Chapter 7, an organization like the Bermuda Tourism Authority would play an instrumental role in the marketing and advertisement of the attraction—an attraction which would highlight the locals, their community and their shared culture—becoming an authentic experience for both tourists and locals. Knowledge empowers, and it is with this knowledge that the tourists and locals may view and consider Bermuda's shipwrecks with a more informed and educated perspective, leading to an evolution in thought as well as action.

Future Considerations

This thesis is largely exploratory in nature, and does not attempt to guarantee success, or provide a definitive recommendation for showcasing and interpreting Bermuda's rich maritime

history. However, the first few steps in a major undertaking are often exploratory and experimental, and it is the author's hope that what was provided here inspires further inquiry and exploration. All who contributed to this project were universally enthusiastic and supportive of the ideas presented within this thesis, which was immensely encouraging. But there were many avenues not explored in this thesis (due to time and length constraints) which are pivotal to understanding the role and manageability of a heritage trail.

Future research would entail a study into local stewardship of the sites, predicated by the support of local dive shops and dive community. This research would suggest feasibility for the long-term sustainability and management of the sites along the trail. Additionally, in an interview with the NMB, it was suggested that signage displaying government sanctioned regulations regarding the vulnerability of shipwrecks and the prohibition of artifact removal should be tested at various wayfaring points along the island. These types of public education efforts should be tested and implemented whether a heritage trail is conceived or not.

Methods of cross-agency cooperation involving museums, government and education programs, and commercial enterprises (like dive shops) is another avenue of future research to be considered. A heritage trail website which links to partnered organizations would provide a greater breadth of influence and information. The development of lesson plans, and scientific dive courses (e.g. Nautical Archaeology Society's scientific dive course or NAS or UNESCO stewardship courses) should also be considered in the future, as these avenues of action would contribute significantly to a trail as it would ensure its continual protection and would address site monitoring concerns. Additionally, the people of Bermuda should be consulted at length during the conceptualization of a heritage trail. This thesis touches upon the importance of

interpreting cultural heritage within a local context, but without the voice of Bermuda's diverse residents, its legacy can only ever be partially understood and appreciated.

Finally, while *inter-disciplinary cooperation* is a buzzword term often used in academic spheres, if not carried out with a truly inter-disciplinary vision, a heritage project of this magnitude will inevitably fall short. While trails may be lauded within academic circles or seen as successful public outreach initiatives to those who understand their significance, the public tend to disagree. On a research trip to Biscayne National Park in 2017, the author was surprised to hear the park had an extensive and fascinating heritage trail. Further discussion revealed that few people knew of its existence, and that non-divers would almost certainly never have heard of it. Education only succeeds when it can be reached by many and is available to all. By incorporating and considering perspectives that reach beyond the academic realm, this project aimed to break down barriers and to encourage the field to turn a skeptical eye on the delivery of the material.

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APPENDIX A. ECU UMCIRB Approval Letter



EAST CAROLINA UNIVERSITY

Office of Research Integrity & Compliance

Brody Medical Sciences Building, 4N-64 • 600 Moyer Boulevard • Greenville, NC 27834
Office 252-744-2914 • Fax 252-744-2284 • www.ecu.edu/oric

Notification of Exempt Certification

From: Social/Behavioral IRB
To: Andrianna Dowell
CC: Lynn Harris
Date: 2/5/2019
Re: UMCIRB 18-002963
Maritime Heritage Trail- Interpretative Technologies

I am pleased to inform you that your research submission has been certified as exempt on 2/5/2019. This study is eligible for Exempt Certification under category #2a.


It is your responsibility to ensure that this research is conducted in the manner reported in your application and/or protocol, as well as being consistent with the ethical principles of the Belmont Report and your profession.

This research study does not require any additional interaction with the UMCIRB unless there are proposed changes to this study. Any change, prior to implementing that change, must be submitted to the UMCIRB for review and approval. The UMCIRB will determine if the change impacts the eligibility of the research for exempt status. If more substantive review is required, you will be notified within five business days.

The Chairperson (or designee) does not have a potential for conflict of interest on this study.

IRB00000705 East Carolina U IRB #1 (Biomedical) IORG0000418
IRB000003781 East Carolina U IRB #2 (Behavioral/SS) IORG0000418

APPENDIX B. Bermuda Government List of Open and Restricted Wrecks



GN: #

BERMUDA GOVERNMENT


*Ministry of the Environment,
Telecommunications and E-Commerce*

DEPARTMENT OF CONSERVATION SERVICES

THE CUSTODIAN OF HISTORIC WRECKS HEREBY GIVES NOTICE
THAT THE FOLLOWING HISTORIC SHIPWRECKS HAVE BEEN
CLASSIFIED AS OPEN AND RESTRICTED, AS PER SECTION 6(1)
OF THE HISTORIC WRECKS ACT 2001.

OPEN WRECKS					
19th Century Ballast Pile	32.2517748	64.9464522	Rita Zovetta	32.3584167	64.6415333
America	32.4116670	64.6505560	Stonewall	32.3951500	64.9034830
Aristo	32.4790000	64.6572833	Superior	32.4140840	64.8517100
Ballast Billy 1	32.3126000	64.9748500	Verdad Deck	32.3126500	64.9734500
Ballast Billy 2	32.5186000	64.9174700	Verdad Keel	32.3126000	64.9739670
Blanche King	32.2713000	64.9756500	Caesar	32.2592670	64.9816500
Carquet	32.4630833	64.8350667	Case Gin Wreck	32.2761880	64.8029940
Constellation	32.3611833	64.9139833	Crystal Catfish	32.4757990	64.7694680
Cristobal Colon	32.4851167	64.7190833	HMS Cerebus	32.3371470	64.6697570
Curlew	32.4829550	64.7526520	Taunton	32.4830333	64.7049000
Darlington	32.2875500	64.9841833	WB Smith Tug	32.4747980	64.7688930
Florida water wreck	32.4378000	64.8380330			
Fratemite drop	32.3695140	64.9155400			
Gleana	32.2444950	64.8274170			
Inresistible	32.2831280	64.8104820			
Kate	32.3273333	64.6965333			
L'Herminie	32.3189667	64.9760667			
Larlington	32.3634833	64.9131667			
Mediana	32.4674167	64.8200333			
Marie Celeste	32.2421167	64.8321000			
Minnie Breslau	32.2446333	64.8086833			
MonJuan	32.3742830	64.8573300			
Montana	32.3636167	64.9135333			
North Carolina	32.2616333	64.9590833			
North Rock	32.4753080	64.7690150			
Pelinaon	32.3557833	64.6434333			
Pollockshields	32.2713889	64.7700000			

	RESTRICTED WRECKS
	Floating Dry Dock
	Fratemite actual
	HMS Ready
	Medway
	Norkoplin
	Sea Venture
	Tylon
	Vixen
	Warwick
	Wood 044
	Wood 3
	Wood 1
	Emma Davis



Philippe Max Rouja, PhD
Custodian of Historic Wrecks
July 13th, 2007

AN OPEN WRECK IS OPEN TO RECREATIONAL USE BY DIVERS.
A RESTRICTED WRECK IS NOT OPEN TO RECREATIONAL USE BY DIVERS.

Please enjoy visiting these Open wrecks responsibly

NO PERSON WITHIN THE WATERS OF BERMUDA SHOULD DAMAGE OR REMOVE
ANY PART OF, OR ARTEFACT FROM, A MARINE HERITAGE SITE OR SHIPWRECK
WITHOUT BEING EXPLICITLY AUTHORIZED TO DO SO.

Under section 7. The protection of Wrecks and Marine Heritage. (1) No person shall mark, remove or otherwise interfere with, deal in or possess any wreck or historic artefact unless he is licensed under section 8 and authorised by the licence to do so.
(2) a person who contravenes subsection (1) is guilty of an offense on summary conviction to a fine of \$25,000.00 or imprisonment for one year or both.

Dr. Philippe Max Rouja
Custodian Of Historic Wrecks • Ministry of the Environment, Telecommunications and E-Commerce
Conservation Services, Flatts Inlet, Bermuda
Tel: 441.293.4464 Ext. 150 • Email: pmrouja@gov.bm

APPENDIX C. Survey

Museum Exhibit Technologies and Maritime Heritage

Consent:

You are being invited to participate in a research study titled Maritime Heritage Trail- Interpretative Technologies being conducted by Andrianna Dowell, a graduate student in the History Department at East Carolina University.

The survey will take approximately 10 minutes to complete. It is hoped that this information will assist in creating more diverse and innovative museum experiences. Your responses will be kept confidential and no data will be released or used with your identification attached. Your participation in the research is voluntary. You may choose not to answer any or all questions, and you may stop at any time. There is no penalty for not taking part in this research study.

Please call Andrianna Dowell at +1 619-565-0627 for any research related questions or the Office of Research Integrity & Compliance (ORIC) at +1 252-744-2914 for questions about your rights as a research participant.

Are you a Bermuda resident?

- Yes
- No

What is your gender?

- Female
- Male
- Prefer not to say
- Other: _____

What is your age?

- Under 18
- 18-29
- 30-44
- 45-64
- 65+

What is your age?

- Under 18
- 18-29
- 30-44
- 45-64
- 65+

How would you describe yourself?

- Asian
- Black or African American
- Caucasian
- Hispanic or Latino
- Native American or American Indian
- Pacific Islander
- Prefer not to answer
- Other: _____

What is your highest level of education?

- No schooling completed
- Nursery through 8th grade
- High school, no diploma
- High school graduate, diploma or the equivalent (for example: GED)
- Some college credit, no degree
- Trade/technical/vocational training
- Associate degree
- Bachelor's degree
- Master's degree
- Professional Degree
- Doctorate degree

What do you consider maritime cultural heritage – click all that apply



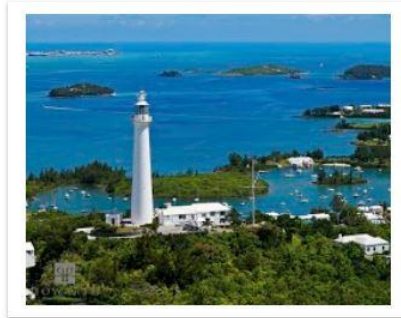
Shipwrecks



Maritime Museums



Maritime Folklore



Fisheries, Lighthouses and other maritime buildings



Maritime Activities and Trade (piloting, shipping, whaling, fishing, etc)



Community Knowledge (navigation, weather, etc)

Other:

How important is maritime cultural heritage to you?

	1	2	3	4	5	
Very important	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Not at all important

How often do you visit Museums or outdoor exhibits?

- Never
- For a special occasion
- Once a year
- Twice a year
- More than twice a year

Do you visit museums when you go on vacation?

- Yes
- No
- Sometimes

How often do you visit museums in your local area?

- Never
- For a special occasion
- Once a year
- Twice a year
- More than twice a year

How interested are you in shipwrecks?



Very Interested 1 2 3 4 5 Not at all interested

Have you been to a shipwreck site in Bermuda?

Yes

No

Other: _____

Do you dive (SCUBA)?



Yes

No

Would you be interested in experiencing shipwrecks with 3D technology in a museum?

Very interested 1 2 3 4 5 Not at all interested

Would you be interested in a website with videos, 3D ship models, and historical information?



1 2 3 4 5

Very interested Not at all interested

Do you have a smartphone?

- Yes
- No

Would you use a mobile app to explore important sites in Bermuda, including shipwrecks and forts?

- Yes
- Maybe
- No

Would you like to handle 3D printed replicas of artifacts?

- Yes
- Maybe
- No

How likely are you to try a virtual reality experience in a museum?



	1	2	3	4	5	
Very likely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Never

SUBMIT

Page 1 of 1