

Barges, Battlefields, and Ferry Slips

A Study of Archaeological Findings and Site Formation Processes in Rockley Bay, Tobago

by

Thomas Lacey

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Director of Thesis: Dr. Lynn Harris

Major Department: History

The Rockley Bay Research Project (RBRP), under the auspices of the University of Connecticut and the Institute of Nautical Archaeology, conducted surveys and excavations between 2012 and 2016 in search of the vessels lost in the Action of March 1677 in Rockley Bay, Tobago. The project surveyed for the squadron of defending Dutch vessels under the command of Jacob Binckes, on *Beschermer*, and the French squadron under the command of Comte d'Estrees, on the flagship *Glorieux*, and any material from those vessels that remained in context. RBRP positively identified only one vessel, *Huis de Kreuningen*, as a wreck from that event and time period. This thesis evaluates the historical and archaeological contribution of the project through the assessment of site formation processes, threats to the sites from harbor development and shipping, and the implementation of legal policy to ensure best management practices. Increased cultural transforms, particularly from an expanding tourism sector, will likely be the most detrimental force to the underwater cultural heritage of Tobago. This thesis also suggests future avenues of research and policy in Trinidad and Tobago.

Barges, Battlefields, and Ferry Slips

A Study of Archaeological Findings and Site Formation Processes in Rockley Bay, Tobago

A Thesis

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by

Thomas Lacey

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by

Thomas Lacey

APPROVED BY:

DIRECTOR OF
THESIS: _____

Lynn Harris, PhD

COMMITTEE MEMBER: _____

Jennifer McKinnon, PhD

COMMITTEE MEMBER: _____

Wade Dudley, PhD

CHAIR OF THE DEPARTMENT
OF HISTORY: _____

Christopher Oakley, PhD

DEAN OF THE
GRADUATE SCHOOL: _____

Paul J. Gemperline, PhD

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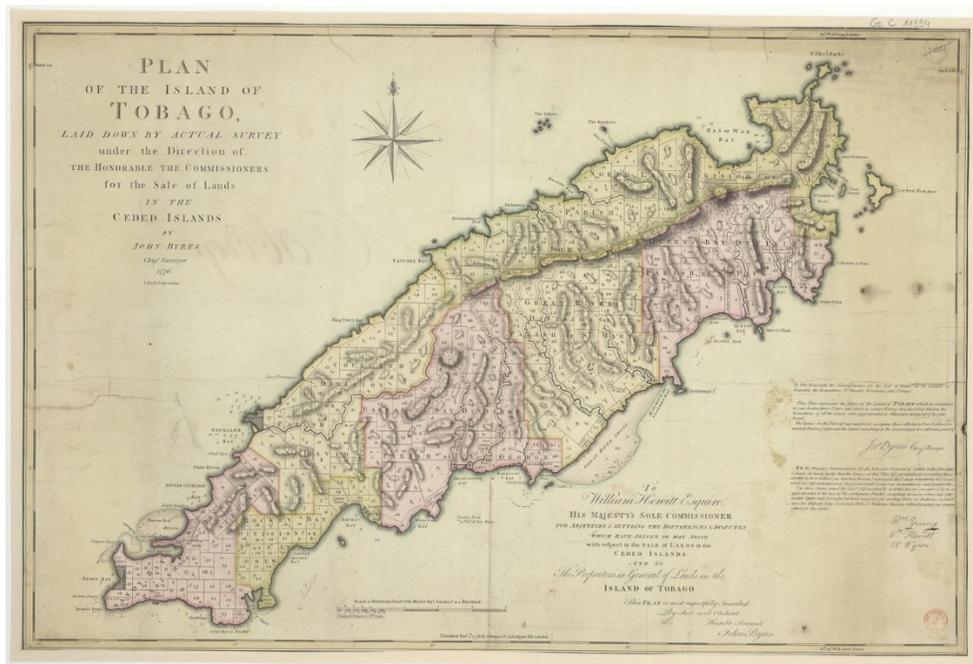
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LIST OF ABBREVIATIONS

| | | |
|--------|--|----|
| GRAN | Groupe de Recherche en Archeologie Navale | 42 |
| HMC | Heritage Management Consultancy | 46 |
| NAS | Nautical Archaeology Society | 4 |
| RBRP | Rockley Bay Research Project | 2 |
| SFM | Structure From Motion | 70 |
| THA | Tobago House of Assembly | 43 |
| TRB | Tobago Rockley Bay | 4 |
| UCH | Underwater Cultural Heritage | 91 |
| UNCLOS | United Nations Convention on the Law of the Sea | 90 |
| UNESCO | United Nations Educational, Scientific, and Cultural Organization..... | 90 |
| UWI | University of the West Indies | 84 |

CHAPTER 1: Introduction

The purpose of this thesis is to identify and assess the impact of site formation processes on six vulnerable submerged historic sites located in a harbor with commercial shipping and a high rate of development. The case study assessed here is the archaeological work performed in Rockley Bay, Tobago. The project established baseline environmental and preservation data because this is the first comprehensive study of its kind at this location. Rockley Bay is on the southern, windward, Atlantic coast of Tobago (Figure 1), in the country of Trinidad and Tobago. It is a partially sheltered harbor, as well as the site of Scarborough, Tobago's biggest city and island capital. Scarborough and Rockley Bay are the historic sites of a major naval battle and terrestrial skirmish between the Dutch and the French in March 1677. Until recently, the naval battle, usually labeled the Action of March 1677, was only an event in a long timeline of colonial wars, for both Tobago and the Caribbean in general.



Source gallica.bnf.fr / Bibliothèque nationale de France

Figure 1. Plan of the island of Tobago, 1776, with land divisions. (Bibliothèque nationale de France, département Cartes et plans, GE C-11394)

In 1990, divers discovered shipwreck remains in the newly dredged inner harbor of Rockley Bay, Tobago. An archaeology team from Martinique started the first investigation in 1990 and archaeological investigation of the harbor has continued with frequent interruption and multiple teams from different organizations carrying the responsibility. The Rockley Bay Research Project (RBRP) team is the most recent group to study the area, conducting diving operations in the harbor over five years. RBRP is also the longest-lasting project under the authority of the Tobago House of Assembly and, for now, remains the sole investigative team searching the harbor for archaeological material, despite discontinued efforts resulting from funding problems. This thesis uses the data and observations accumulated from five field seasons to propose research questions related to site formation processes and how those affect legislation and management decisions.

1. How has harbor development, commercial traffic, and the heritage management choice to contract a non-local underwater archaeological team compromised the historical integrity of the sites?
2. How effectively have cultural resource managers implemented heritage legislation to protect the sites against development threats and to monitor archaeological compliance to best practices in field work?
3. Despite management challenges, what are the major contributions and significance of the extant material culture toward a greater understanding of the 1677 naval battlefield and Tobago's connection to its maritime history?

The most significant single wrecking event in the bay was the Action of March 1677, a battle between French attackers and the Dutch occupants of Rockley Bay, part of the Franco-Dutch War (1672-1678). While there have been several hurricanes throughout the island's colonial history, sources do not list maritime losses. Additionally, other wrecks exist outside this

scope, but at present there is no research on any other potential events. RBRP has concluded that two wrecks in the harbor are not associated with the Action of 1677 and it is possible both are associated with major storms. Currently, there is not enough evidence to determine the date or cause of sinking. So far, the team has positively identified one Dutch vessel, *Huis de Kreuningen*, to the Action of 1677, by analysis of its artifact assemblage of pottery and pipes. While other shipwrecks may remain undiscovered, there are likely other deposits from the battle somewhere in the harbor. Chapter 2 will cover the historical context of the Action of 1677 to lay the groundwork for a discussion of potential extant material culture in the harbor.

Theoretical Framework

In 1976, Keith Muckelroy proposed a framework for classifying and examining wrecks as processes, from the action or events that led to a vessel's sinking, to the current state of relative equilibrium observable by archaeologists. The idea was not new to archaeology, but it was new in its application to underwater sites and shipwrecks. Muckelroy later placed this framework in a flowchart, with factors removing or contributing to the state of cultural material. Muckelroy also defined classifications for shipwrecks' states of preservation and wholeness, ranging from Class 1 to 5, in order of decreasing integrity (Muckelroy 1978:282).

The study of site formation processes has continued to develop as archaeologists expanded and elaborated on types of transforms that affect sites. Two types of factors are C and N transforms: cultural factors: the result of human action or inaction; and non-cultural factors: due to geological, meteorological, biological, or chemical processes. As archaeologists contributed to the understanding of these factors and their effects, they authored expanded flowcharts displaying how these added processes removed or scrambled cultural material throughout the process of wrecking and reaching equilibrium. This thesis will add further to the

discussion of site formation processes by expanding the range of factors to include those present in Rockley Bay, Tobago.

Past Work

Several other projects preceded RBRP's work in Rockley Bay. A pair of French archaeologists based in Martinique conducted the first survey of the harbor works in 1990. They briefly investigated the harbor upon discovery in 1990 of cultural material, including a French cannon. They concluded that, despite the significant cultural finds in the harbor uncovered by dredging and modifications to the harbor, the harbor construction posed little risk to the archaeological integrity of the bay's resources.

Several investigations by Wes Hall, Mid-Atlantic Technology and Environmental Research, followed in the 1990s. These consisted of magnetometer surveys and limited diver surveys. Wes Hall became the first to document individual sites and wrecks and discovered the wrecks later designated by RBRP as Tobago Rockley Bay 1, 2, 3, and 4 (TRB-1, 2, 3, 4). Wes Hall later joined RBRP to assist in relocating the wrecks for its first season in 2012.

The third team to investigate the bay consisted of English archaeologists trained by the Nautical Archaeological Society (NAS). Their team excavated a trench along the length of the shipwreck, TRB-1, which uncovered ship's timbers, keelson, and keel, as well as artifacts. This led the team to believe the site was 17th century and from the Action of March 1677. Unfortunately, their submitted reports and the artifacts associated were lost following the conclusion of their work. These projects, while not comprehensive surveys of the bay, all provide valuable observations of not only the materials uncovered, but also the environmental assessments of divers studying and observing the harbor.

Legal Framework

The laws and regulations governing the protection of cultural material are as much a significant factor of a ship's preservation or destruction as any natural or cultural process acting directly upon a site. Heritage legislation, policies, and procedures have the potential to protect sites or make them vulnerable.

Tobago's protections, under the national government of Trinidad and Tobago and as a former colony of the United Kingdom, are based upon the parliamentary acts of the UK. In many ways, they offer thorough protections on paper, much in line with other progressive countries. Much of their legal code remains untested and lacks enforcement procedures or guidelines, which are up to the discretion of the government ministers. This thesis discusses the role these protections will play in the future for underwater archaeology in Tobago, as well as their specific role in affecting the site formation processes at work currently.

Methodology

RBRP provided the archaeological work, recordings, and opportunity to make first-hand observations on the physical conditions of the site for this thesis. Field work, in the form of diving, excavation, and processing of artifacts, took place over five summers in Tobago. Historical research consisted primarily of archival research in digital archives and collections from England and France, as well as contact with the University of Leiden, Netherlands, for the missive written by Jacob Binckes (1677). Archaeological background information came from documents published in journals or online, as well as several unpublished reports (Hall 1999; McKewan 2006). Prior to 2016, the only published information from RBRP came in the form of Flag Reports written for the Explorers Club (Paterniti 2012; Paterniti and Inglis 2012, 2013, 2014, 2016).

Archaeological work consisted of daily dives for survey and excavation. Magnetometer surveys covered large areas of the bay, followed by diver ground truthing through probing or metal detectors. Despite such large coverage, much of the bay is unexplored and unseen by divers, due to time and budget constraints in locating and unearthing material for examination and analysis. There are also no fully excavated sites, but limited dredging, excavation, and artifact recovery occurred on three sites: TRB-1, TRB-2, and TRB-5. RBRP also uncovered part of TRB-6, the site of an anchor concreted to a coral wall, using a dredge, but no artifacts came from this trench or sand pit and there were only organic materials mixed in the sand. The most extensive excavation occurred during the 2014 season at TRB-5, the cannon site believed to be a Dutch warship. Most other sites received brief probing dives or hand-fanning, but the team discovered no new sites of cultural or historical significance since the most recent season in 2016.

Island Description and Working Conditions

Rockley Bay is the main port of entry for Tobago, the smaller of two main islands in Trinidad and Tobago. Tobago is a hilly and densely vegetated island in the southern Caribbean Sea. Rockley Bay is located on the southern, windward side of the island facing the Atlantic Ocean to the southeast and Venezuela to the south. Scarborough, the largest city on the island and the capital to the local government, surrounds the bay, extending into the hills to the north and the hill leading to Fort King George on the east. The harbor hosts boats and vessels regularly. It is a small port, usually hosting no more than one or two high speed ferries daily and an occasional cargo vessel. During the winter, the port also hosts cruise ships of varying sizes along the longest pier. The condition of the water and the sites has not been observed by RBRP during the cruise ship season, nor did the team observe the ships during the summer, but it is possible

these vessels have an even greater impact than the ferries. In addition to the large ships, there are several personal vessels and fishing boats moored to the east of the channel, a small fishing marina on the inside of the breakwater in the eastern corner of the harbor. A Trinidad and Tobago Coast Guard station is at the end of the 150-meter pier extending southwest from the marina, parallel to the breakwater (Figure 2). The breakwater itself extends 250 meters from the base of the steep hill leading to Fort King George, an 18th-century French and English fort. In the middle of the harbor, the port complex sits on a large concrete and asphalt slab extending over a shoreline otherwise composed of sand. The complex is over 250 meters at its longest and over 300 meters at its widest. The ferry slip is 120 meters wide, with a length of 140 meters along the east side. Along the slip's west side, a pier extends 250 meters towards a final platform. The western pier is where the port authority directs ferries or vessels that are not immediately offloading or loading out of the way of the eastern half, where the high-speed ferries regularly deliver passengers and the cargo vessels transfer goods to the open storage areas.

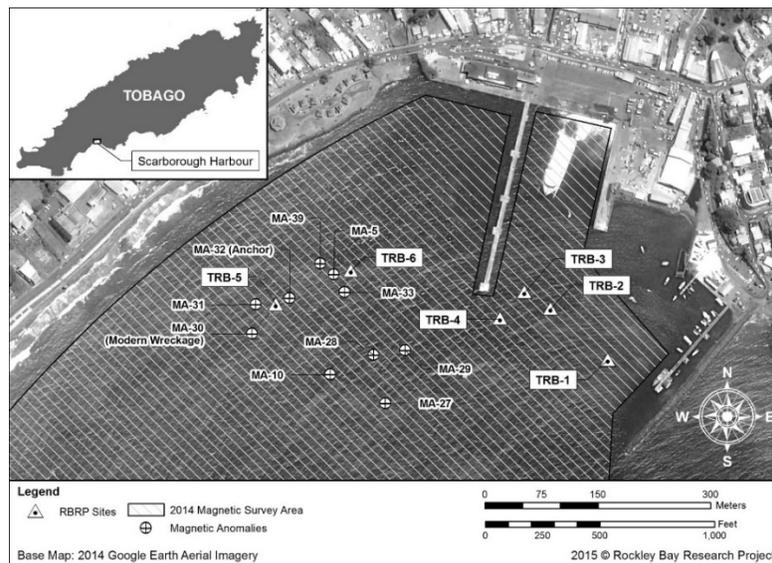


Figure 2. Chart of Rockley Bay and magnetometer targets from the spring 2014 survey (Doug Inglis 2016).

Conclusions

This thesis combines the observations and recordings of the five seasons of RBRP, the three prior project teams, and the legal framework in Trinidad and Tobago to draw conclusions about the current condition and prospects for archaeological work on sites related to the Action of March 1677. It asserts that, in the case of Rockley Bay, an expansion from the traditional framework of site formation process is necessary in discerning among cultural factors present and unique to small commercial harbors. Additionally, legal frameworks play a role in the success or failure of protection for cultural heritage and can effectively encourage or eliminate cultural transforms from the site formation processes.

CHAPTER 2: Historical Overview

Historiography

Historical research for this thesis included both primary and secondary sources, from authors and historians writing decades or centuries later. Europeans in the Colonial Era were aware of Tobago's existence and settled its neighbor, Trinidad, shortly after Columbus' discovery. Europeans attempted to colonize Tobago for just as long, but with little success or longevity. As a result, Tobago has a sparse historical record with a few exceptions. One is the Action of March 1677. Until the latter half of the 18th century, Tobago had no record-keeping or official history of its own, as there were no permanent residents. Fortunately, the event at the core of this thesis was significant in the eyes of the European powers and received attention from the French, the Dutch, and the English.

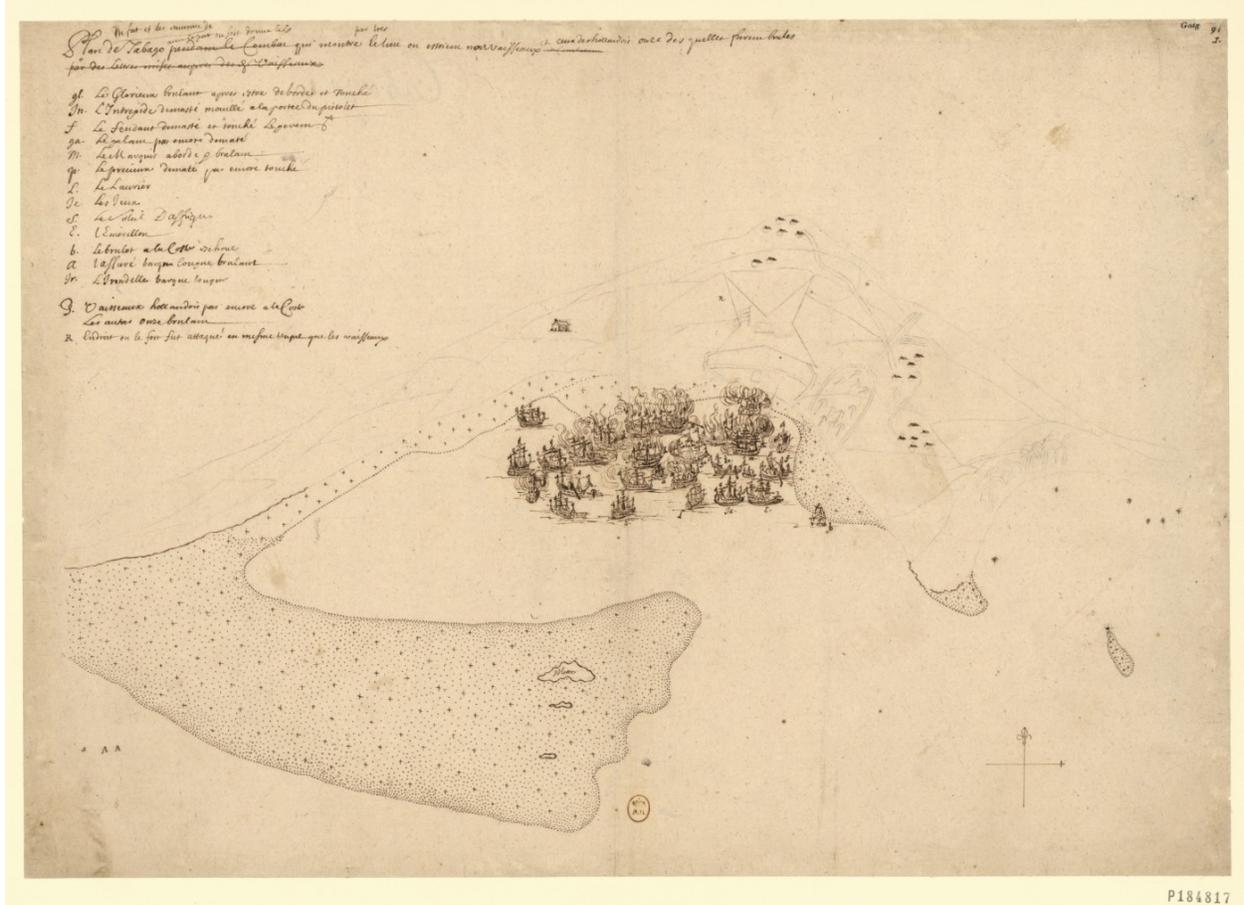
French material exists in abundance and the Bibliotheque Nationale de France collects and digitizes historic documents. Their online archives (gallica.bnf.fr) grant access to full-sized scans of charts, letters, and books. Maps of Tobago (Figure 1), charts of the bay (Figure 3), artistic depictions of the battle (Figure 4, 5), as well as French newspaper articles (*Gazette de France* 1677), containing Admiral d'Estrees accounts of the battle, contributed to this thesis. Dutch material, specifically a printed letter written by Jacob Binckes to the Prince of Orange, was located at the University of Leiden in the Netherlands and a copy was acquired on request through interlibrary loan (Binckes 1677). English materials, such as the *London Gazette*, were also digitized and stored online. The *Gazette's* website allows the search of issues going back to 1665. Two issues, 129 and 1198, contained excerpts relating to the battle, both published in May 1677. Another common account of the battle comes from an unnamed "Diligent Hand," written in English as a third-party observer to the events that took place. This account is available in

several academic archives on the internet. An English description of the island, by John Poyntz (1683), added some insight into the physical features of the island and was similarly available through digital collections online. Another digitized description of the island has no author listed but was printed for a W. Reeves in 1749.



Source gallica.bnf.fr / Bibliothèque nationale de France

Figure 3. Plan of the port at Tobago, depicting Rockley Bay and a star-shaped fort in ruins (Bibliothèque nationale de France, département Cartes et plans, GE SH 18 PF 159 DIV 5 P 5 D)



Source gallica.bnf.fr / Bibliothèque nationale de France

Figure 4. Plan of the fort at Rockley Bay and depiction of the Action of March 1677 (Bibliothèque nationale de France, P184817 [Vd-22 (1)-Fol.]



Source gallica.bnf.fr / Bibliothèque nationale de France

Figure 5. Depiction of the Action of March 1677, including plans of the Dutch fort (Bibliothèque nationale de France, département Cartes et plans, GE DD-2987 (9145))

Secondary sources include histories from the 19th century, such as Henry Iles Woodcock's *A History of Tobago* (1867) and Alphonse D'Augerot's *Recits de Batailles Navales* (1872), the latter of which included excerpts from Comte d'Estrees' own writing. There were four 20th century histories used for research in this thesis: Rupert Douglas Archibald's *Tobago: Melancholy Isle Vol. 2* (1987); Cornelius Goslinga's *The Dutch in the Caribbean, and on the Wild Coast, 1580-1680* (1971); David Phillips' *La Magdalena: The Story of Tobago 1498 to 1898* (2004); and Eric Eustace Williams' *History of the People of Trinidad and Tobago* (1962).

All four books represent the broad history of the island and borrow from many of the same primary sources regarding the Action of March 1677.

Early History

In modern times, Tobago is a small, peripheral island in the Caribbean's far south, outside the path of both hurricanes and mainstream tourism. There is only a small tourism industry on the island. While the most obvious features of the island are its rainforests and beaches, its natural beauty shrouds a rich history. As the late Eric Williams wrote: "If there was one West Indian Colony with a sadder history than that of Trinidad in the first 300 years after its discovery by the Spaniards, that colony was Tobago" (Williams 1962:51).

Columbus most likely discovered the island on his third voyage (Woodcock 1867:19), but it is not known who first set foot on the island. As is the case in modern times, what drew Europeans to Tobago was its promise as a fertile island ready for colonization and planting, rich in wildlife and exotic plants (Poyntz 1683, Reeves 1749, Blome 1687). The island also held immense strategic value for its proximity to the southern entrance into the Caribbean, for naval purposes, trading, and shipment of West African slaves. The result is a long list of occupants (Table 1).

| Tobago's Occupants and Settlements | Start | End |
|---|--------------|------------|
| Zeelander (Dutch) colony | 1628 | 1634-1637 |
| Barbadian settlers | 1639 | 1642 |
| Courland Bay colony | 1642 or 1654 | 1659 |
| Lampsins (Dutch) | 1654 | 1677 |
| Courland grant | 1664 | - |
| First and second battles of Tobago | | 1677 |
| Unknown occupancy | 1677 | 1763 |
| English colony | 1763 | 1781 |
| French colony | 1781 | 1814 |
| English colony | 1814 | 1962 |

Table 1. List of known European occupants and settlements on Tobago from its discovery to its independence in 1962.

During the years 1628 to 1678, Tobago was claimed as the property of the Dutch West India Company, under the name New Walcheren, but the island was contested many times during that period, as many European naval powers believed their own claims to be stronger than those of the Dutch (Goslinga 1971:433). The English believed the island was theirs, seeing the attractiveness of Tobago, and they held one of the earliest claims with a settlement attempt in 1625 (Woodcock 1867:23). England gave rights to the island to a Thomas Warner in 1628, but the significance or context of this claim is unknown at this time. The French also sought control of the island under Cardinal Richelieu, 20 years later for the French West India Company, but did not act in any meaningful way on their claim until the 18th century (Williams 1962:51). As the first colonial power to discover the island, Spain also asserted a claim but was unsuccessful in gaining de facto control (Goslinga 1971:433).

The first Dutch settlers arrived in 1628, but the status of the island at that point, and whether it was occupied by any other group, is unknown. James I of England also possibly claimed the island and granted to James Hay, Earl of Carlisle, then to the Earl of Pembroke. It is also possible that the island was a gift to Jacob, son of William, Duke of Courland in 1610. The

English had an interest in the island but there was no concrete claim in place in the form of a settlement or occupation. The Dutch made the first known attempt to colonize Tobago when Zeelander Jan de Moor sent one ship of in 1628. More colonists, as well as slaves, bolstered their numbers in the following years to a population of 200 (Goslinga 1971:434).

This original Dutch colony disappeared at some point between 1634 and 1637 (1971:436). At the time, the Spanish controlled the neighboring island of Trinidad. The Dutch began planning to attack the Spanish on Trinidad but delayed the operation. As a preemptive action, the Spanish attacked the Zeelanders on Tobago first, capturing and shipping the prisoners to Margarita, an island to the west, where the Spanish hanged most of them. Franciscans saved the lives of the youths, and the two leaders of the Dutch expedition returned to Europe, but this left the island with very few remaining settlers and no leadership.

The English also renewed their interest in the island in 1639 with a settlement attempt by Captain Robert Marsham and his fellow dissatisfied neighboring Barbados colonists, but they soon left the island due to indigenous Carib Indian attacks. Tobago, in addition to being an asset to the Europeans, was a frequent stop for indigenous Caribs traveling between the Antilles and South America. The tumultuous relationship between the West Indians and Europeans became a major obstacle for settlement on Tobago and other islands. Another similar attempt by settlers from Barbados occurred under Captain Marsham in 1642 but was unsuccessful in the long term (Archibald 1987:26–27).

According to Goslinga's (1971) research, Duke Jacob of Courland, previously given a grant for the island, undertook another effort to colonize the island in 1654. Woodcock (1867) also discusses a Courlandian settlement in 1642, which met with success, at least to the extent that it did not disappear as others had. It is unclear whether these two Courlandian efforts are the

same, or eventually unified. The Courlanders set up a colony in what is now Great Courland Bay on the northern shore of Tobago, according to both accounts. The group of Zeelanders from the Netherlands set up a colony on the south side of the island in 1654, led by Adrian Lampsins, and the two settlements remained unaware of each other for some time. Eventually, the two settlements agreed to split the island until Courland and Zeeland could come to an official agreement (Goslinga 1971:441). The Courlanders did not fare well against the Caribs in the North and the interior of the island and received little replenishment. The Dutch also expanded to surround and threaten the small Courland settlement (Goslinga 1867:24). The Courlanders soon surrendered to the Dutch in 1659, committing mutiny against their own leader to ensure their survival (Archibald 1987:30).

The Lampsins, descendants of Adrian Lampsins and leaders of the Dutch colony, lived on the island for decades under the Dutch. They eventually applied for and became a French Barony to find greater patronage and protection, further legitimizing a competing French claim to the island (Woodcock 1867:25). Eventually, a second settlement under the Lampsins formed, near Rockley Bay, and the remains of the Lampsins and other French-controlled colonies persevered until the naval battle in 1677 (Boomert 1987:253).

In addition to its earlier claims and restitution for the loss of its colony, Courland received the island by grant from England in 1664. The Courland grants also gave additional English colonists the right to settle on the island and the English showed renewed interest. The Governor of Barbados wanted Tobago in 1666 on lease for 31 years, but not for the purpose of settlement or full use of its resources (Woodcock 1867:26).

Barbados wanted to keep the island under the control of England and devoid of European rivals (Williams 1962:53), including English, even if they failed to do so against foreign settlers.

If there were no English troops on the island to lose a battle, then the island could not officially capitulate. Instead, the English plan was to use the island for supplies and timber. Spain would agree to this arrangement, as the island's proximity to Trinidad meant a garrison or base of operations was a direct threat. Similarly, other major European powers wanted Tobago for precisely this reason: for its proximity to the entrance of the Caribbean and its ideal position for watching the Spanish. Buccaneers also targeted the island, stripping settlements bare of anything valuable during raids in 1666 (Williams 1962:54–55). Local place names and folklore also hint at the presence of buccaneers in Tobago's past, but for the purposes of this thesis, this avenue of research never produced anything. This would only become a pattern in Tobago's history, with colonies coming and going and no significant or lasting settlement ever gaining a proper foothold on the island.

One of the most significant, though isolated, events to occur on the island and the focus of Rockley Bay Research Project (RBRP) and this thesis was the naval action between the Dutch and French in Rockley Bay in March 1677. This battle is one of the primary contributors of archaeological material in the harbor.

Action of March 1677

During the height of the Franco-Dutch War, in March 1676, Dutch Vice Admiral Jacob Binckes led a fleet of 13 warships with 1,600 men to the Caribbean to attack the French and lay claim to the island of Tobago. At the time, a mixture of Europeans under a French Barony loosely occupied the island. The fleet made quick work in accomplishing its goals and captured the French colonies of Cayenne, in French Guiana, and Marie Galante, in the Lesser Antilles, taking loot and slaves, along its journey towards Tobago. Binckes then split his forces, sending a portion of the force directly to Tobago, while the larger portion took a detour toward the Spanish

colonies of Puerto Rico and Hispaniola. Before Binckes could make it to Tobago with the larger squadron, the Dutch faced a desertion at the hands of Jan Bont, who fled back to Europe with the smaller squadron, where he eventually received the death penalty. Binckes possessed a weakened fighting force once he arrived. The Dutch were well aware of the rumors that the French sought to eventually destroy all Dutch presence in the area, so Binckes needed to find a defensible position should the time come that the French retaliate against his recent exploits (Goslinga 1971:448).

Binckes selected Rockley Bay as his base of operations in defending against any potential French attack. The bay's entrance was narrow, between a large reef and the rocky shore, so it seemed likely that the French would only be able to attack by land from elsewhere on the island. By 23 June 1676, slaves worked on extending existing infrastructure and defenses remaining from the Lampsins, the previous French colonists. The Dutch constructed a star fort overlooking the shore, as well as an embankment of cannon. In addition to constructing defenses, the Dutch also demolished or repurposed structures around the fort in preparation for an attack, creating batteries and storage (Archibald 1987:46).

In November 1676, French Vice Admiral Comte D'Estrees sailed from Brest with ten ships of the line, two frigates, and three small vessels to recapture Cayenne and Marie Galante and eventually remove the Dutch from their settlement on Tobago. His fleet reached Cayenne on 17 December 1676 and relieved Marie Galante soon after, before traveling to Martinique where they exchanged 400 Dutch prisoners for 400 French militia. D'Estrees then sailed toward Tobago with a slightly altered fleet of ten ships, six small vessels, and one fire ship; choosing *Le Glorieux* as his flagship. The French force totaled 446 guns and over 4,000 men (Goslinga 1971:449). The Dutch had completed, with great haste, a four-pointed star fort. The fort had two

guns on each point, nine guns placed on the crescent redoubt below the fort, and six more on a redoubt closer to the shore. The guns were 18 to 24-pounders. Staffing these defenses were 460 Dutch, but the vessels, anchored in the harbor, were relatively shorthanded (Archibald 1987).

On 18 February 1677, the buccaneer Jan Erasmus, in *De Fortuyn*, brought word of the approaching French vessels, confirming D'Estrees' intention to attack Tobago (*Gazette de France* 1677:414). In response, Binckes made final preparations and arranged the eight warships in a crescent along the shore with the three supply ships, holding the women, children, and slaves, and the fire ship between the battle line and the shore (Goslinga 1971:450).

On the 19 February, the French quickly attempted to enter Rockley Bay, but the lead ship, *L'Intrepede*, struck a rock and caused the French to lose their momentum. The French retreated to Palmit Bay, one and a half miles east of Rockley Bay along the south shore. The French then captured an African slave who informed them of the details of the Dutch defenses, filling in the gaps in their knowledge (Archibald 1987:47).

D'Estrees then landed nine companies of marines and the militia, totaling 850 men, under the command of Chevalier de Grandfontaine and Herouard de la Piogerie. The Dutch, aware of their location, soon met them, but then retreated while the French advanced inland. The French soon reached the peak of a hill overlooking the Dutch fort, a mile away. Louis Gabaret was sent to take soundings around the entrance to the bay, but *De Fortuyn*, stationed as a sentry, fired upon the French vessels and forced them to retreat, leaving the French without the soundings with which they could navigate the harbor safely (Archibald 1987:47).

The Dutch continued to bolster their defenses as they reconnoitered the French positions and demolished the buildings between the French and their fort. French settlers, conscripted by the Dutch, reinforced the defending numbers by 200 (Archibald 1987:48). Unfortunately for the

Dutch, despite the strength of their defenses, their numbers were dispersed between their ships and terrestrial positions. The French fleet possessed both larger ships with more cannons and full crews. Compared to *Le Glorieux*'s 445 men and 72 guns, the Dutch possessed a 56-gun warship, *Huis de Kreuningen*, with only 153 men (Figure 6, Figure 7).

Finally, on 23 February, a French drummer, who was disguised as an officer, arrived at the Dutch fortifications, calling for surrender and warning against Dutch impressment of the French settlers living in the area. In response, Binckes refused to surrender and assured the messenger that the French settlers had come to the defense of the fort of their own free will and none would be forced to fight against their own nation (Goslinga 1971:450).

D'Estrees, despite having little knowledge of the bay, wanted to attack with the full strength of the fleet, but his captains disagreed, favoring an attack by land, and so work on siege works continued (Goslinga 1971:450–451). The French attempted to build entrenchments but the Dutch regularly repelled them so they could not make proper preparations to attack the fort. Luck was on the side of the French and they captured a small barque, gaining a knowledgeable pilot who agreed to help the French enter the harbor. D'Estrees then called another council of war and argued once again in favor of launching a full naval assault. The French made their decision and on 3 March the fleet sailed into Rockley Bay.

At around seven in the morning, Gabaret, the commanding officer aboard *L'Intrepede*, led the French ships in a single file through the channel into the bay. The Dutch were surprised because they had not expected a naval attack given the natural defenses of the bay. *L'Intrepede* opened fire and set *Wafen de Leyden* aflame, an easy task considering the heat and sunlight of the tropics that dried out the vessels' wood structures. Chaos soon erupted between both fleets. *Wafen de Leyden* subsequently drifted to the shore with French attackers still onboard, setting

Huis de Kreuningen on fire on its way through the Dutch line. Meanwhile, *Huis de Kreuningen* broadsided *Le Glorieux*, setting the French ship on fire and sending it drifting into the vessels inshore from the line before it exploded. The explosion destroyed the transports behind the line of battle, killing the women, children, and slaves taking shelter in the holds (Diligent Hand, 1677).

D'Estrees, wounded on the deck of *Le Glorieux*, found his way to a small boat with the help of a French marine called Sieur Bartier and escaped to the shore, at which point "the boat was sunk deep enough near the ground, in a place where there were only four feet of water" (*Gazette de France* 1677:422–423). Having reached the safety of shore, "seven or eight men of the Enemies who might have taken it, threw the weapons, and went to him. *La Caiche* passed by chance: he gave her a signal, she approached the reception" (*Gazette de France* 1677:423).

While fires and explosions consumed the harbor below, the French land forces mounted a simultaneous attack against the fort but failed. The Dutch had entrenched themselves and were well prepared for a land attack, while the French had withdrawn their focus and instead invested in a primarily naval push. D'Estrees, returning to the battle, saw the devastation in the bay and heard of the routing of the land forces. He ordered them to embark and for the remaining ships to leave the bay while the Dutch on shore let him retreat (*Gazette de France* 1677:423). The French retreated from Tobago as the Dutch had succeeded in defending the island.

The French lost this battle in that they had not succeeded in eliminating the Dutch from Tobago, but both sides had numerically suffered a loss. D'Estrees' fleet lost four ships: two were burned and two were captured. Binckes lost eight vessels to fires and the remaining vessels ran aground (*London Gazette* 1677 [no. 129]). Out of 3,210 total, 1,200 people died on the French side, while around 500 Dutch people died, out of their significantly smaller force (*London*

Gazette 1677 [no. 1198]). While the French fled home to repair and refit, the Dutch remained with a weakened force in a difficult position.

The true State of the Dutch Squadron, under the Command of the Admiral Jacob Binck, Captain of the Dutch Fleet, on the 29th day of February 1677.

| Ship | Commander | Tons | Men |
|-----------------------------------|----------------------|------|-----------------|
| Cap. M. Jacob Binck | The Swallow | 50 | 153: all aboard |
| Cap. J. van Santen | Princess of Scotland | 44 | 118: all aboard |
| Cap. Roemer Slack | Stout Dragon | 36 | 128: Burnt |
| Cap. John Warts | Middleburg | 36 | 83: Burnt |
| Cap. G. de Goffin | The Lion of Saint | 34 | 73: Burnt |
| Cap. Peter Schelwich | Europa | 24 | 52: Burnt |
| Cap. Peter van der Meer | The Golden Star | 28 | 74: Burnt |
| Cap. Cornelius Schelwich | Agnes | 24 | 25: all aboard |
| Administration and Crews of Ships | | 276 | 706 |
| Cap. Frederick Swears | Duke de York | 26 | 34: Burnt |
| Cap. David Pison | De Godsmick | 31 | 25: Burnt |
| Cap. Weyls of Angrea | Diparamid | 32 | 20: Burnt |
| Cap. Hecker Jandry | De Sager | 13 | Burnt |
| Cap. John Gamm | De Gouland | 25 | Burnt |

It is said, all this hazard was in the fleet and with the battery
 all aboard of the Dutch Squadron and all together were
 about four hundred and eighty men with goods and the Battle

Figure 6. Dutch vessels and their crews in the Action of March 1677 (van Griepkoven 1677).

This is the true Account of the French Squadron under Command of M^r de La Bourdonnais
 Admiral of France, who had sailed on the 21st day of July 1677
 of the taking of look and the Islands of Tobago the 21st day of July 1677

| Ship | Commander | Sum | Men |
|----------------------------|-------------|----------------------|---------------------------|
| Monsieur de la Bourdonnais | L'Esperance | 72 all with the boat | 445 |
| Monsieur de la Bourdonnais | L'Esperance | 62 one third | 380 by main mast and side |
| Monsieur de la Bourdonnais | L'Esperance | 58 one half | 350 taken by the Dutch |
| Monsieur de la Bourdonnais | L'Esperance | 50 one half | 320 taken by the Dutch |
| Monsieur de la Bourdonnais | L'Esperance | 48 one half | 300 by main mast and top |
| Monsieur de la Bourdonnais | L'Esperance | 46 one third | 260 |
| Monsieur de la Bourdonnais | L'Esperance | 38 one quarter | 250 |
| Monsieur de la Bourdonnais | L'Esperance | 38 one third | 240 |
| Monsieur de la Bourdonnais | L'Esperance | 36 one quarter | 220 |

Small Shipp
 One of our shipp on a side on the side 25
 Two little frigates one burnt with 250
 One taken to a gallipot in Cronitien

And all the shipp have been mounted in the night
 of four hundred and fifty men
 And all the shipp have been burnt and taken
 from there was an hundred and fifty young gentlemen

This List is given up to the French
 by the French Captains and taken to the best
 of their knowledge and approved by the French

W^m van Griepkoven

Figure 7. French vessels and their crew numbers: the French outgunned and outmanned the Dutch in number (van Griepkoven 1677).

Second Battle of 1677

Binckes refloated the beached vessels and transformed them into defensible hulks close to the shore and the Dutch attempted to salvage the supplies and strength to defeat any further retaliation. Meanwhile, d’Estrees returned to France and, despite an overall failure, received a commanding position in charge of another expedition to remove the Dutch from the island. On his second expedition, he returned to Tobago with 11 ships and 6 flutes. This time, he chose *Terrible* as his flagship. Marquis de Grancey was present on *Tournant* and Charles de Courbon,

Comte de Blenac, was on *Belligeaux*. The latter received the position of Governor General of the French West Indies after the battles in 1677 (Archibald 1987:51–52).

The newly formed fleet left Brest on 3 October 1677 and arrived off Tobago, four miles west of Rockley Bay, on 6 December 1677. The French would not make the same mistake this time. Three hundred fifty men under Comte de Blenac landed on shore with three mortars, which they positioned on a hill within range of the fort. On 9 December, the French began their assault on the fort, firing the mortars. At one point, a gunner offered odds that the third mortar would destroy the fort, and sure enough, the third shell ignited the powder magazine and created a massive explosion. Binckes and his officers were at lunch at the time and all died in the blast while they ate. Of all the Dutch officers, only one, Van Dougen survived the battle (Woodcock 1867:30). The French did not establish a presence, instead razing the town and fort and abandoning Tobago once again, leaving it deserted and officially uninhabited.

Colonial period

Following the end of the war, Tobago was abandoned, at least diplomatically, from 1678 until 1763. After 1763, the English officially occupied and settled the island. Unlike previous attempts, the English settlers remained on the island following settlement, and divided Tobago into properties for sale. When the French took Tobago from England in 1781, they allowed the English to stay and even enjoy some leniency under French rule. According to Williams (1962), the French gave the island's economy significant stimulation. In return for increased taxes, the French attempted to offer incentives. Establishing cultivation on uncultivated land granted a tax-free period of six years. The French also recommended that the Minister of Colonies bribe artisans and free people of color to leave Trinidad for Tobago. Fathers also received a tax allowance of five percent for each living child under the age of 14, incentivizing population

growth. Additionally, the duty on imported slaves decreased from 100 to 6 livres (Williams 1962:57). The French enacted these measures to encourage settlement and planting.

Great Britain regained control of Tobago in 1814. Unfortunate for those hopeful planters on Tobago, slavery's end was on the horizon. Compared to other islands, settlement had not occurred in any significant or long-lasting form until the end of the 18th century. Tobago moved from slavery to a system of servitude and apprenticeship before adopting unconditional freedom in 1838 (Woodcock 1867:88–89). Tobago united with Trinidad at the end of the 19th century when it gradually transformed into a ward of the larger island, cutting costs for the Crown, but laying the groundwork for the political struggles occurring through modern times. The two islands remained a colony of the United Kingdom until 1962, when Trinidad and Tobago became an independent country, with laws and government based loosely off the United Kingdom.

CHAPTER 3: Theoretical Framework

Introduction

The primary theoretical framework used in this thesis is the study of site formation processes. Site formation process studies in maritime and nautical archaeology developed as an effort to legitimize the field by processual standards, examine shipwrecks in anthropological and theoretical ways, and bring the field more in line with other scientific disciplines. The study of formation processes developed in terrestrial archaeology prior to its adoption in the maritime realm. Archaeologists such as Louis Binford (1976), David Clarke (1973), and Michael Schiffer (1983, 1987) examined formation processes in practice and their work helped lay the groundwork for its use across all disciplines. Underwater archaeologist Keith Muckelroy used statistical analysis of site formation to analyze the Kennemerland site and its formation (1976). Muckelroy further developed the idea of underwater site formation in his book, *Maritime Archaeology* (1978).

Since those first forays into the subject, maritime archaeologists have expanded on and reinterpreted the framework to use in other locations and types of sites. Site formation processes are factors that determine the state and location of a shipwreck. They include everything from the construction of the ship, which determines its reaction and durability; the event which catalyzed the sinking or deposition; and factors that contribute to settling, either slowly or quickly; breaking down; and eventually bringing a state of equilibrium to the shipwreck.

Careful examination of the processes, which affect a site's formation, is crucial in the case of submerged cultural materials and shipwrecks, even more vital than on terrestrial sites. Ships are mobile; covering long distances between different ports and diverse cultures. In addition, their final resting places are often unintended, caused by events and processes, which

vary from natural disasters to human error. In some cases, materials or entire shipwrecks are abandoned, leaving them to natural transformations. While location is determined by the time and wrecking event, its conditions are just as important as the wreck itself in understanding the past. Study of the environment where the shipwreck resides helps to reconstruct the past and can help formulate what may occur to the shipwreck in the future.

Validity of any conclusions reached in maritime archaeology depends fundamentally on the understanding of these processes. Muckelroy sought to bring maritime archaeology to the forefront and legitimize it as a scientific discipline. Understanding of the individual elements and processes in the framework of site formation provides partial knowledge, but most important is placing each part in context with the others. When archaeologists observe and describe factors that transformed the organized, dynamic ship into a disorganized, static site, the researcher can begin to disentangle the evidence presented in the site's final form.

Site Formation

Archaeologists simplify the relationships between processes because they are so complex, making them easier to conceptualize. Keith Muckelroy created a scheme for defining the extent of archaeological remains after a wrecking event and the effects of the site formation processes on the extant cultural material. This scheme places wrecks on a scale of five classes ordered from the most extensive remains down to the absence of coherence and patterns (Muckelroy 1978).

Class 1: Extensive structural remains, many organic remains, many other objects, and coherent distributions.

Class 2: Elements of structural remains, some organic remains, many other objects, and scattered ordered distributions.

Class 3: Fragments of structural remains, some organic remains and other objects, and scattered ordered distributions.

Class 4: No structural remains, little organic material, some other objects, and scattered or disordered distributions.

Class 5: No structural remains and no organic material, few other objects, and scattered or disordered distributions (Muckelroy 1978:164).

Using Muckelroy's scheme for classifying wrecks, archaeologists can organize and prioritize sites, but this system is not self-sufficient and may even be too simplistic when so many factors are at work. In addition to what shape wrecks are in now, archaeologists also must examine the process sites undergo to reach this point.

To this effect, Colin Martin (2013:47–50) breaks down the process into three phases to simplify the overall process. The first phase includes the environmental and human factors that led to the wrecking event. The second phase is the dynamic phase, which includes environmental and cultural input. Martin's dynamic phase begins with the shipwreck. For whatever combination of reasons, the ship leaves human possession and use and, as Martin puts it, "reverts to nature." This phase may be quick and dramatic or very slow. Martin defines the phase as the ship becoming an environmental anomaly. The final phase is the stable phase, in which the wreck no longer moves, breaks apart, or disintegrates. It has settled onto, or into, the seafloor.

Returning to Muckelroy, his work in examining site formation processes used statistical analysis to determine the leading factors in site preservation, scrambling, and destruction. Muckelroy listed several presumed factors and examined their effects. The factors were as follows:

1. Maximum offshore fetch within 30° degrees of the perpendicular to the coast.

2. Sea horizon to the site; sector within which there is more than 10 km of open water.
3. Percentage of hours during which the winds are greater than Force 7 from directions within the sea horizon.
4. Maximum speed of tidal streams across the site.
5. Minimum depth of site.
6. Maximum depth of site.
7. Depth of principal deposit on site.
8. Average slope of sea bed over the whole site.
9. Underwater topography: proportion of the site made up of geologically recent sediments.
10. Nature of the coarsest material within these deposits.
11. Nature of the finest material within these deposits (Muckelroy 1978:162).

Upon examination of these factors, Muckelroy found that once the site had initially settled on the bottom, factors 1–8 had little effect on the site, while the final three factors, the sediments 9–11, were what most determined whether a site would survive and become static within the environment (Muckelroy 1978:162–163). While this thesis does not include the amount of raw data needed to do statistical analysis, it is still possible to apply these factors from a qualitative perspective.

The early work of Michael Schiffer and William Rathje (Schiffer and Rathje 1973, Schiffer 1983, 1987) developed a scheme that separated processes into two categories: N-transforms and C-transforms. What archaeologists seek for anthropological study are C-transforms, which represent the cultural and spatial relationships between materials, seen as a reflection of the past and of the origin culture. The processes that act as part of the environment

in changing or altering the original context and conditions of artifacts and assemblages are the N-transforms.

Muckelroy devised another scheme for simplifying the myriad factors and processes. In addition to being C- or N-transforms, processes could be either scrambling or extracting filters. Scrambling filters rearrange and disturb a site's context, while extracting filters contribute to the removal or destruction of material (Muckelroy 1978).

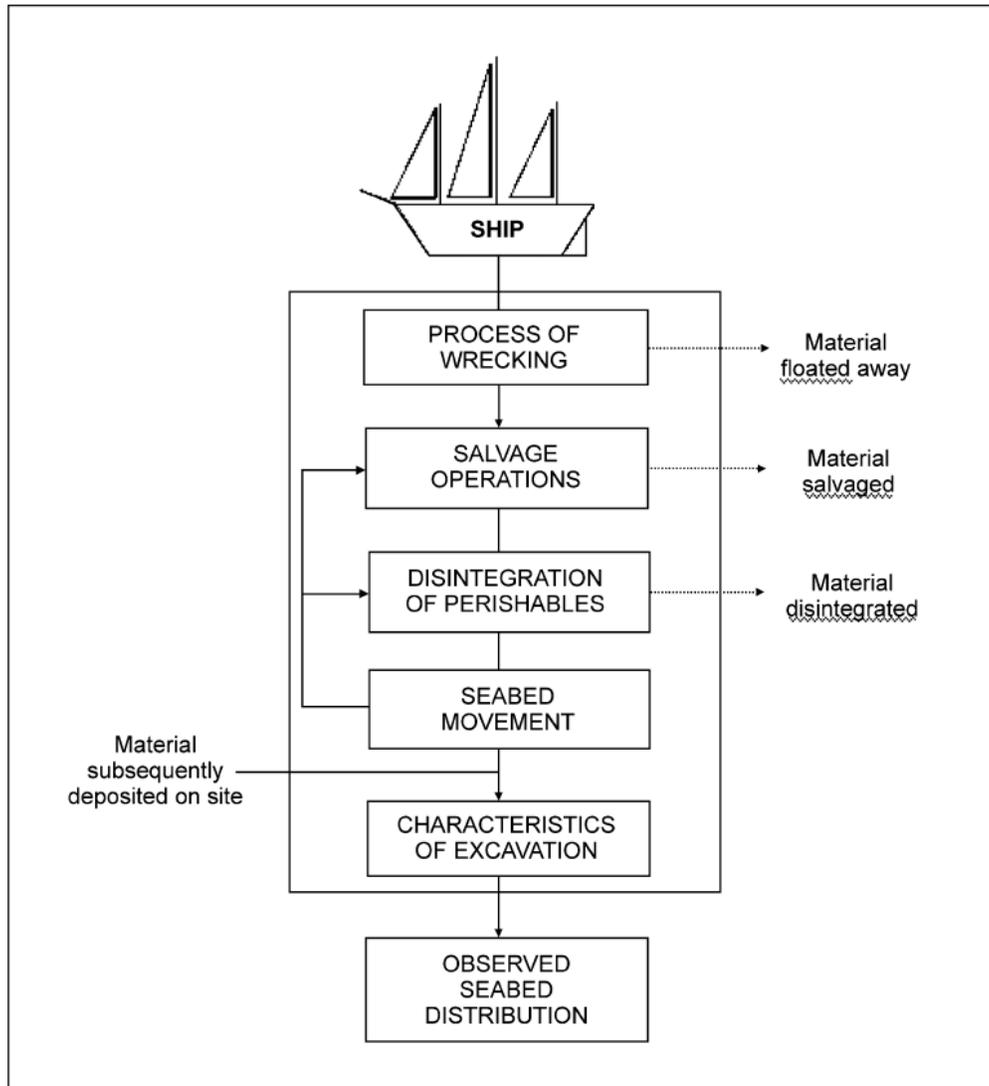


Figure 8. Site formation flowchart devised by Keith Muckelroy (1978)

Muckelroy used these schemas to draw a flowchart as an overall depiction of the interactions of site formation process (Figure 8 from Muckelroy 1978:158). Archaeologists have since expanded on the original chart to serve purposes in displaying how processes act to remove from, add to, or otherwise change the final resting site, with each iteration becoming increasingly

complex as more factors enter consideration. They all share common features, such as the initial ship and the disaster event that catalyzes the events of site formation. The central box represents the cultural material and the wreck site, with factors that remove material from the box, or site, or alter the context. What remains in the box is the shipwreck site at the center of the archaeologists' investigations. Martin Gibbs' model (Figure 9 from Gibbs 2006:16) focuses on the efforts of salvors, historic and modern, in altering the site. Gibbs examined shipwrecks in this way by proposing a series of stages, from pre-impact, to impact and the rescue and post-disaster stage, finally ending with the observed seabed distribution. Examination of the known sites in Rockley Bay by using these flowcharts assists in the study of factors that have affected the wrecks.

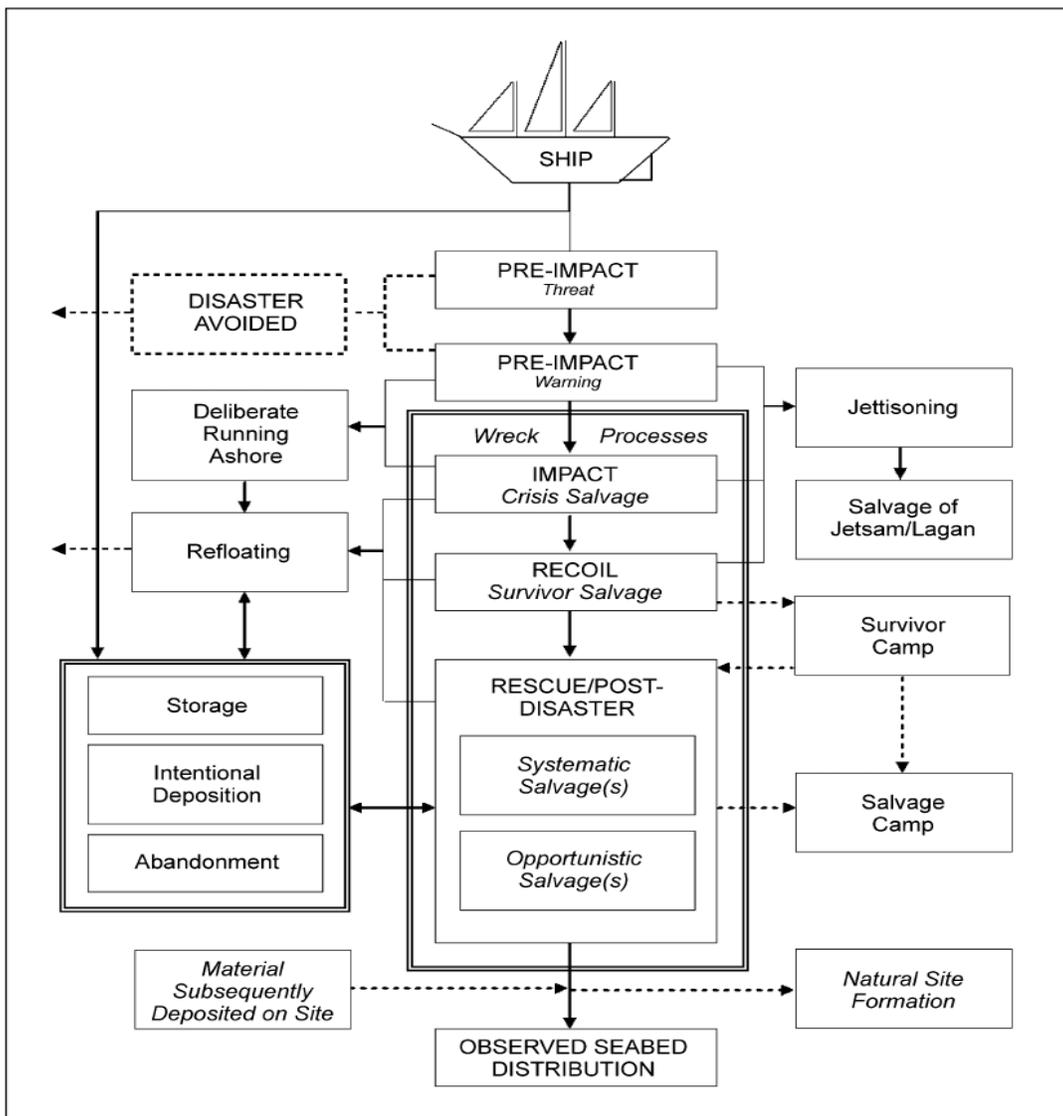


Figure 9. Site formation flowchart devised by Martin Gibbs (2006).

Contributors to Site Formation

David Stewart (1999) attempts to simplify our understanding of site formation by listing three types of formational deposition as the sources of cultural material on the seafloor. The first type of deposition and the primary concern of this study is the shipwreck (Stewart 1999:568).

Shipwrecks are the most obvious and referenced type of underwater site. Ships served as a means of accessing, traversing, and living upon the sea. Shipwrecks occur when disaster strikes these vessels. Because of the unexpected nature of a shipwreck, they contain items which may be removed in any intentional or premeditated sinking.

Intentional deposition is another source of submerged ships (Stewart 1999:570). Usually, abandoned or intentionally deposited ships had valuables and rigging elements removed and they sank because of human action. This may be a form of disposal for an unneeded vessel, or the creation of artificial reefs and obstacles for the defense of harbors and shores. There are no known intentional depositions in Rockley Bay. There is an abandoned barge on the shore between the harbor complex and the small fishing marina as of 2019.

The other type of deposition according to Stewart is inundation. Inundation involves the rise of the sea level or the fall of land into the sea. It refers to terrestrial or shoreline sites that have since submerged. As Stewart notes, preservation is not ideal in gradual inundation because water level rise occurs slowly. Whether it is exposure and repeated drying and wetting of the material, or wave action as the site sits in the shallow surf zone, context and preservation will be minimal. Greater preservation comes from faster inundation (Stewart 1999:572).

As Stewart (1999) suggests, there is still much work required to produce comprehensive studies on site formation processes. Most studies are concerned with wrecks or regions and this study is no different. The question remains as to whether the study of site formation processes is simple enough to fit into all situations and environments, while comprehensive enough to examine the various aspects of a site and its formation.

Stewart (1999) attempts to simplify and list major processes and factors, most of which are outside Muckelroy's quantified list of factors and are instead site-specific to whether these

factors' effects are perceptible. One such process is reclamation. Reclamation is the removal of artifacts from the site for reuse, recycling, or repurposing. This is the work of salvage operations, commercial development, looters, and archaeologists and reclamation can both scramble and extract cultural material and its context (Stewart 1999:574–575). Reclamation includes more than modern salvage and recovery; salvage of valuables, cargo, and guns existed for as long as those items have travelled on water. There is also a risk that recreational divers will take or disturb sites, but the real threat is professional and systematic work with heavier equipment and concerted efforts. Even the items left “untouched” on the ocean floor are in danger of exposure and removing or disturbing the sediment on and around the wreck can upset the equilibrium of the site. Other human factors explained by Stewart include construction, dredging, and fishing, all of which can similarly cause damage to sites, even when they do not specifically target the sites (Stewart 1999:576–578).

Bioturbation is a major natural environmental process acting on sites. Shipwrecks and other submerged sites form reefs, either intentionally by human intervention or unintentionally. They attract a wide variety of plant and animal life, from algae to sponges, coral, mollusks, and fish. As Stewart points out, one of the most destructive animals acting on ship hulls is the *Teredo Navalis* worm, a mollusk with a worm-like outer appearance that bores into exposed wood. It is known around the world, but especially prevalent in warm tropical waters. If the ship is left exposed, *Teredo Navalis* gradually eats away at the wood, leaving mucus-lined holes (Stewart 1999:578). Other animals living in the seafloor also risk exposing once covered wrecks to oxygen and disturbing stratigraphy, much like burrowing animals on land. Octopuses are well-known for their penchant for collecting and hoarding small artifacts. The behavior of marine

animals such as these can mislead researchers in their pursuit of the archaeological context by serving as a scrambling factor (Stewart 1999:580).

Muckelroy (1978) identified another element of site formation as the topography of the bottom and Stewart discusses this factor as the effect of gravity (1999:584). A steep slope means that items, and in some cases the entire wreck, will shift over time. A ship may be more inclined to fall onto one side when it initially reaches the bottom, but the slope may shift cargo downwards at another angle. Slopes or gullies can also accumulate debris and cultural material at their bases, much like terrestrial sites, and features on the bottom can provide shelter and protection for cultural material. Topography also affects the sediment around the site, as the substrate material also falls and shifts with gravity and currents.

As Muckelroy (1978) observed, one of the most important aspects of site formation processes is the nature of the sediment around and over the site. Many of the above factors contribute to the wreck site configuration, but these also contribute to the sedimentary and fluvial processes. Just as artifacts are subject to scrambling and movement, gravel, sand, and clay similarly flow down with gravity to the bottom of slopes and travel with the currents, tides, and out-flowing rivers; biological factors create and disturb the sediments and anthropogenic forces can influence all the above and move a large amount of sediment in a small amount of time. In warm waters, where biological processes otherwise erode timbers and other organic materials, wrecks often accumulate fine sediments that do not allow the flow of oxygenated water or the intrusion of mollusks and other animals. Ballast aids the accumulation of finer gravels and sediments and these protect the wreck from currents and water movement. Sediment also protects wrecks from human interference, keeping sites outside the reach of anyone without the equipment needed to locate and excavate. Conversely, sediment might cause some sites more

risk in heavily populated or frequently traversed waterways. Dredging large swathes of harbors and channels can lead to damaging sites that were previously unknown, highlighting the importance of surveying for archaeological material before such projects.

Concerns

Several limitations are associated with interpreting sites and formation processes. Sailors could throw refuse overboard throughout the journey, so there are no trash middens, nor are there graves or burials for those who die at sea. Some aspects of sea-board life are simply not as visible as they are on land. Nevertheless, artifact assemblages on shipwreck sites yield chronological data from sites. Shipwrecks can and do still fill the role of a time capsule, but they also represent a complicated and incomplete picture. This highlights the importance of understanding the processes that have affected the ship's current state: between the submerged site's creation and its current state, even when focusing on just those processes during and after the wrecking. This is an especially important consideration in Rockley Bay, where multiple time periods manifest through artifacts and refuse continues to fall into the waters even today.

Another problematic assumption is that human interference, while a major factor on terrestrial sites, is less significant underwater. This is true where great depth or remoteness are concerned, but shallow sites are highly exposed to human interaction and destruction. With the rise in the popularity of recreational SCUBA, increasing ship traffic, pollution, and overfishing, not to mention treasure hunting and salvage, sites are as vulnerable to humans underwater as they are on land.

Another observation, made by Muckelroy (1978), as well as members of the Rockley Bay Research Project (RBRP), is that within loose sediment, items with higher specific gravity will often sink into the sediment. This disrupts the stratigraphy and leads to deceptive appearances of

modern or more recent items at or below the level of historical material. RBRP observed this effect in Rockley Bay in many locations.

Conclusion

In examining how conditions of the shipwreck or other site interacted in the past through observations in the present, we can piece together a picture of how the same conditions will act on the site in the future. Through the observations by members of the RBRP team, it is evident the sites are in danger from exposure, from dredging, and from looting. Any perceived equilibrium, such as the balance seen under the mud on TRB-1, remains delicate at best and that modern refuse can penetrate this protection only indicates how delicate that balance is. In environments increasingly under more development, it is crucial that formation processes and environmental conditions undergo observation in relation to cultural material. These factors collectively highlight the importance in understanding site formation processes and for observing and recording details to come to conclusions regarding a site's past, present, and future. The sites within its waters can be inserted into the framework of site formation through research and observations into the history and present state of the harbor and by using a modified flowchart. Examining the sites in this context can open more lines of inquiry and provide a basis for future research.

CHAPTER 4: Previous Archaeological Work

Rockley Bay encompasses a moderately large area of diverse underwater terrain and there have been several expeditions attempting to document and record the cultural material present. These include a brief expedition by French archaeologists in 1990; three investigations by Wes Hall in the 1990s; another by a British team in 2000; and four years of expeditions by Rockley Bay Research Project (RBRP) under Kroum Batchvarov of the University of Connecticut, the latter of which is the primary source of information for this thesis (Table 2). Due to funding and time constraints, as well as the large area of the harbor, there is no comprehensive knowledge base of all the shipwrecks. Each of the expeditions had to contend with traffic and conditions such as poor visibility and rough weather, yielding less than ideal results, in addition to reducing the amount of bottom time spent recording and excavating. The result was that each successive project created more questions about the identity of more shipwrecks, in addition to the original project goal of identifying shipwrecks from 1677.

| |
|---|
| Timeline of projects in Rockley Bay |
| Groupe de Recherche en Archeologie Navale |
| Investigation in 1990 |
| Wes Hall, Tidewater Atlantic Research |
| Investigations in 1991, 1992 Magnetometer survey in 1999 |
| NAS trained dive team |
| Investigation in 2000 |
| Rockley Bay Research Project |
| Investigations in 2012, 2013, 2014, 2016 Photogrammetry and SFM in 2015 Magnetometer survey in 2014 |

Table 2. Timeline of Archaeological projects in Rockley Bay and their expedition years.



Figure 10. A barge moored to the end of the ferry pier, with the high speed ferry moored beyond (Photo by Doug Inglis).

Site Conditions and Description

RBRP conducted most field work during June and July due to decreased water traffic in Tobago during the rainy season. Unlike other Caribbean islands, Tobago does not depend on tourism for income. Trinidad and Tobago's income is from natural gas, and the country is one of the largest exporters in the Western Hemisphere (www.energy.gov.tt). Most of Tobago's visitors are people on holiday from Trinidad. This lack of dependency on tourism means that the main commercial harbor in Rockley Bay is not often occupied by visitors or cruise ships, and the island's cultural resources are at less risk of over-exploitation. Except for the daily high-speed jet ferries to and from Trinidad, TT *Spirit* and TT *Express*, and the large propeller ferry *Warrior Spirit*, there are few other arrivals in Rockley Bay, especially during the summer. Small vessels

are infrequent and often slow their speed while in the harbor. On several occasions, the team's boat operations encountered limitations due to cargo vessels or barges moored in harbor, though they did not pose a threat to diving safety, simply obstructing the path to sites like TRB-2 (Figure 10).

The seafloor's sediment across the harbor also affects the water quality. The bottom in the western portion is primarily a coral reef. The top of the reef is mostly level, with shallow pockets of sand and caves formed from concreted rocks and coral; it slopes gradually upward to the beach. The one confirmed Dutch wreck is located on the reef, designated as cannon pile TRB-5. Following the reef eastward, the seabed drops an average of three meters to a flat sandy plain. Along the side of the reef wall is the concreted anchor, TRB-6; close to the anchor are four modern oil barrels. The sand is featureless directly below the reef, with sparse debris consisting of modern refuse and the remains of construction and dredging. It is currently unknown when the construction took place, whether it was related to 1990 harbor improvements or to the blocked sewage outflow to the north of this area. Around this outflow there is a pile of rocks, originally thought to be ballast but later believed to be construction debris. The pile came from elsewhere in the harbor during its numerous improvements, deposited as refuse. At this pipe, the visibility is noticeably less than around the coral reef; the trend continues northward and eastward into the harbor.

Gradually, the sand gives way to a mix of finer substrates and a greater frequency of loose debris and stones. The channel is flat and featureless with scattered modern and historic material, but with little to no known context. The two high-speed ferries turn in place, using jet engines and thrusters, continually altering the distribution of cultural material, but the topography itself remains level and unchanged. At times, the area has remarkable visibility, but

the substrate easily clouds the water column because of boat disturbance, producing inconsistent visibility. Aside from the loose silt, the substrate contains river rocks and other stones, pottery fragments, shells and organic matter, and ceramic roofing tiles.

The area around the marina and Coast Guard pier to the east, just off the breakwater, consists of a large amount of gelatinous silt-mud often a meter or more in depth. The mud contains plant matter and other organic material, but denser materials sank beneath in a layer more consistent with the substrate in the center of the harbor. The mud proved difficult to excavate during the field seasons due to the sheer volume, as well as the subsequent decrease in visibility following several minutes of digging. Before disturbance by excavation or hand-fanning, this area's visibility could be as good as that of the central harbor, but divers at work worsened conditions.

GRAN Investigation (1990)

The first survey of the harbor took place shortly after the discovery of a French cannon during construction and dredge work in 1990. The purposes of the harbor improvements were to 1) construct a breakwater, piers, and harbor facilities; and 2) dredge to nine meters in depth within the commercial harbor. Trinidad and Tobago contacted the French government upon discovery of the cannon; however, most of the dredging and construction had already concluded. The only remaining work was the removal of a large coral head. French archaeologists Max Guerout and Marc Guillaume based out of Martinique and working under Groupe de Recherche en Archeologie Navale (GRAN) at the time, surveyed the harbor and interviewed supervisors and workers to determine the extent of any damage or discovery. Aside from the cannon, they reported nothing out of the ordinary for an historic port, attributing the artifact scatter to usage over centuries of occupation. The archaeologists concluded that, as far as they could see,

dredging has not impacted any 17th-century material and the depth of any material from that period was beneath nine meters of sediment in the harbor. Additionally, because the construction of the concrete harbor works had concluded, there was no way to determine whether anything had been buried beneath the piers (GRAN 2000).

The search for the French reports led to an archive in Martinique; however, the archive did not respond to inquiries in English or French. WORLDCAT provided a copy of the published report (Guerout 1992), which reflected the content on the website. In other reports, there is little or no mention of the French investigation in the harbor, possibly because of a contradictory opinion that there was little reason to halt the project, or the lack of any artifacts remaining from that excavation. In researching the material found in the harbor, the French efforts have not produced precise archaeological data and the expedition served the singular purpose of examining material to determine risk and whether work should continue. Both the report and the website note that the authors saw little or no risk to cultural material, going against the majority opinion from other projects that the harbor works likely displaced at least one ship and possibly more. As other teams observed in the subsequent surveys and expeditions, 17th-century material was at risk in the dredged area and the dredging crews potentially destroyed and redistributed the remains of the French flagship. Workers reportedly kept some of the artifacts found during their work (Hall 1999).

Wes Hall (1991-1999)

In the 1990s, archaeologists conducted three surveys for the Tobago House of Assembly (THA) at the request of the director of the National Museum and Art Gallery in Port of Spain, Trinidad. Tidewater Atlantic Research, Inc. conducted the first two surveys in 1991 and 1992, as a direct result of the discovery of shipwreck material by the dredge and construction crews in

1990–1991, material not mentioned by the French archaeologists. Wes Hall, who worked for Tidewater Atlantic at the time, reported that during improvements to the harbor, the dredging crews uncovered and raised large amounts of cultural material (Hall 1999), a fact corroborated by the NAS report and RBRP’s findings. Dredge company workers and divers took some of those items and Hall’s report notes that the team recovered at least one cannon. The cannon was likely the one examined by GRAN.

Tidewater Atlantic discovered two previously unidentified shipwrecks during the first of these two surveys, designating them as Vessel A and Vessel B, which became TRB-1 and TRB-3. Vessel A is located west of the Coast Guard pier and Vessel B is 125 meters south of the old ferry dock. At the time, Hall noted, the vessels were slightly exposed to the elements from passing ship and ferry traffic (Hall 1999:2).

The second expedition in 1992 examined the extent of Vessel A, to prepare for the construction of the new Coast Guard pier. While the project also intended to evaluate the site, they were unable to complete all the objectives. The shipwreck site, which consisted of a large ballast pile covering some ship’s timbers, was 16 by 45 meters long. They found several artifacts, ranging from an iron cannon to fasteners and a fork. The cannon and fork were purportedly 17th-century French (Hall 1999:2).

THA contracted Heritage Development Consultants to oversee the process of further investigations of the harbor. In turn, Hall and Mid-Atlantic Technologies Inc. received the task of investigating Rockley Bay with a controlled marine magnetometer in 1999. This survey covered the entirety of Rockley Bay north of Red Rocks, a formation of rock visible above the surface of the water (Figure 11) (Hall 1999:3).

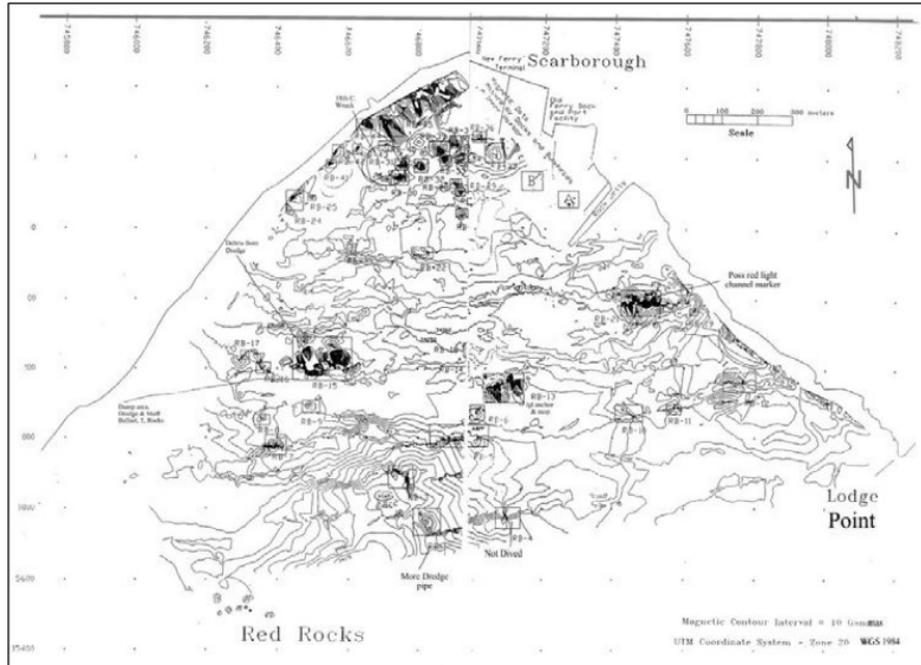


Figure 11. Map of magnetometer anomalies from Wes Hall's survey (Hall 1999).

Hall's investigations used two vessels: *Superstition*, a 30-foot pirogue, for remote sensing; and *Event Horizon* for diving operations. The survey scanned lines east- and west-oriented, using a Geometrics 881 cesium marine magnetometer. The magnetometer recorded data at one second intervals two meters apart (Hall 1999:8–9). Hall's report lists 45 targets found during the survey. This number excluded Vessels A and B, found in previous expeditions. Divers confirmed that several sites contained historic material, including RB-15, which appeared to be where dredged material was deposited, mixed with modern debris. Unfortunately, time restricted the expedition crew's ability to investigate many of the findings (Hall 1999:22). Beginning in 2012, RBRP revisited the most promising of these hits over the course of five summer expeditions, starting where Hall left off.

British Excavation 2000

In 2000, Claire Broadbridge of Heritage Management Consultants (HMC) contacted the Mary Rose Trust to invite archaeologists to investigate the sites in Rockley Bay. Alexandra Hildred brought together a team of archaeologists to investigate Vessel A, now called TRB-1. The team, consisting of six commercially trained divers, excavated the site on surface supply air, diving from a barge. In addition to conducting the excavation, they conducted a Part I training course for NAS (McKewan 2006:8–9). Part of their work was recorded in a Part II NAS report, written years later in 2006.

During the initial stages of their investigation, the team of archaeologists removed ballast from the site. Consistent with Wes Hall's report in 1999, the NAS report notes the presence of sediment three feet thick above the ship structure. It also notes that artifacts found two feet down intermingled from different time periods (McKewan 2006:9). The team laid out a baseline along the length of the wreck and determined the extent of the trench (Trench A), at two to three feet in width along the length of the baseline, running east to west. The dive team placed datum points at the far ends of the trench and recorded with total stations (McKewan 2006:10).

The team took measurements of the timbers to determine inclination and width and to locate the keel. They also expanded the trench and eventually opened a second trench (Trench B) in search of diagnostic timbers. Throughout the excavation, the divers took more than 150 artifacts from Trench A and additional artifacts from Trench B including glass and pottery (McKewan 2006:11–12). The NAS Part II report also notes the presence of exposed artifacts elsewhere in the harbor due to prop wash, reportedly collected by local divers. In addition, the team removed a piece of timber for dendrochronological analysis, the results of which are not indicated (McKewan 2006:13–14).

The report does not include any of these measurements or findings, but it notes that upon further expansion of both trenches, the dive team completed a final drawing and made recommendations to HMC. As of 2019, those results submitted by the NAS dive team to HMC are unavailable. The available Phase II report indicates that the team believed what is now TRB-1 was a 17th-century ship, based on the associated artifacts. The author notes the stratigraphic mixing present in the silt confused attempts to accurately date the vessel. In turn, the report recommends further research and more precise dating of the wreck, as well as a more comprehensive survey of the harbor's endangered resources. As of 2006, there were no further investigations by the British team and the location of the artifacts was, and still is, unknown (McKewan 2006:14).

Conclusion

Rockley Bay has been the subject of brief studies conducted by diverse teams, which has led to missing information and a loss of data between each generation of expeditions. These problems highlight the need for comprehensive examination of the harbor and, in the future, extensive excavation of endangered resources. Other than the 1990 French field season, each project has found a highly dynamic and vulnerable environment with areas of exposed cultural material and evidence of past destruction and disturbance.

CHAPTER 5: Methodology

Kroum Batchvarov, with support from the University of Connecticut and the Institute of Nautical Archaeology, became involved in Tobago beginning in 2012. Dr. Batchvarov formed Rockley Bay Research Project (RBRP), which continued to work in the harbor until 2016. Support and authorization came from the Port Authority of Trinidad and Tobago along with both the Tobago House of Assembly and the national government of Trinidad and Tobago. The first exploratory expedition attempted to relocate the few confirmed shipwrecks from previous projects, with the assistance of Wes Hall (Paterniti 2012).

RBRP provided the archaeological work and excavation data used in this thesis. The author also examined site formation processes—both N and C transforms—and assisted in excavations during the 2013, 2014, and 2016 seasons. Dive assessments on the sites granted firsthand knowledge of each location and respective conditions. The earlier investigations, prior to the author's involvement in 2013, supplied baseline data and context, along with longer-term observations invaluable to understanding processes over time as well as consistencies and changes in the harbor's conditions. Information regarding these expeditions, the interim visits by other members of the team, and remote sensing surveys were available through reports. The team revisited many of the discoveries of those expeditions for testing or re-examination.

The primary goal of RBRP, across all seasons, was the search for the remains of the Action of March 1677. Prior to its first season in 2012, Wes Hall of Mid-Atlantic Technology and Environmental Research assisted in re-locating the remains of vessels on the seafloor of Scarborough's harbor. Unfortunately, due to his passing, a reputable source of knowledge regarding the harbor has been lost. Subsequently, Kroum Batchvarov, from the University of Connecticut, served as project director for a team of researchers and students from Texas A&M,

University of Connecticut, and University of Wales, Trinity St. David, with the purpose of investigating any remains of the battle, with the specific hope of finding Dutch hull remains and timbers. Between 2012 and 2016, RBRP performed focused dredging excavations at five sites in Scarborough Harbor (Rockley Bay) and surface surveys on several more.

The process of authorizing archaeological work, discussed further in chapter 7, differed from the methods of granting permission to RBRP. The project acquired excavation rights through verbal agreements with the government and written permission authorizing the excavation of the harbor. The governing bodies responsible for granting written permission for the project's diving operations included the Port Authority, Port Police, and the Tobago House of Assembly. The Tobago House of Assembly, the island government acting independently from the national government of Trinidad and Tobago, was responsible for a portion of the funding as well as acting as official oversight. Port Police provided additional written authorization each season to enter and exit the harbor complex, otherwise a restricted area. The Ministry of Tourism also approved the operations, supporting the push to bring Tobago's cultural heritage to light. The Ministry of Tourism wanted further commercial dredging in the future, in hopes of increasing cruise ship capacity in Scarborough. Archaeologists therefore agreed to verify whether there is endangered cultural material in the proposed project's path, but this effort is ongoing due to RBRP's focus on the Action of March 1677 and the absence of a dedicated team to perform the study. The Tobago House of Assembly acted as the official signatory in granting permissions, as it had with previous projects in Rockley Bay. Tobago's Historic Trust provided unofficial oversight while outreach programs and events helped involve other sectors of Tobago's community with the goal of passing archaeological responsibility and protection of cultural heritage on to the people of Trinidad and Tobago.

Diving Operations

RBRP operated out of the conservation lab overlooking the harbor directly to the east of the port's concrete jetty and, before the completion of the lab, in a wood shack next to the concrete lab. Early in the first full season, in 2013, the rocky shoreline, accessed through a locked chain-link gate, served as the point of entry for diving operations. The team constructed a temporary wooden ramp leading down to the water. Shore entry was the primary method of conducting diving operations for the first two weeks. Eventually the team began using *Blu Spartan*, a 49-ft. catamaran, captained by Iain "Wabba" Milne, as a dive boat and the vessel moored to the east side of the ferry jetty opposite the active ferry slip.

Diving activities during the 2013 season of RBRP's investigations depended on the nearby ferries' schedules and the team regularly communicated with both the harbor authorities and high-speed ferry crew to maintain a safe environment for divers. Each of the high-speed ferries departed and returned, on an alternating schedule (Figure 12). During the other project seasons, work directly in the ferry channel became infrequent, but the lines of communications remained open in case diving operations returned to TRB-1 through TRB-4. Otherwise, the ferries remained docked at the pier (Figure 13), at sea, or in Trinidad. In one instance, a barge moored to the end of the concrete jetty, with a chain stretched across the area between the port jetty and the edge of the marina, resulted in a portion of the bay being inaccessible to boat traffic, including the dive boats.



Figure 12. T&T Spirit turning in place over TRB-2 to reverse into the slip (Thomas Lacey 2014).



Figure 13. T&T Spirit tied to the jetty for loading and unloading, with the cruise ship terminal in the background (Thomas Lacey 2014).

RBRP conducted diving operations every project season. In the three full seasons, 2013, 2014, and 2016, the team operated with a diving safety officer. All divers had at least an advanced certificate in open water diving, while divers under the auspices of the University of Connecticut held scientific diver certification. Outside of official training, divers' experience levels varied, and all inexperienced divers underwent a brief checkout dive at the beginning of the season to gauge skill level and comfort. Experienced divers paired with the less experienced divers for the first few weeks and eventually those less experienced divers would be able to work with another diver of their experience level.

Tank rentals came from Markus of Black Rock Divers for the 2013 and 2014 season, close to the route between Scarborough and Mount Irvine Bay, where the team lived in 2013. In 2014, when the team operated out of Scarborough Harbor, the location of the dive shop moved to Black Rock, north of Mount Irvine and farther from Scarborough. In 2016, Derek Chung, owner of Undersea Tobago and a member of the Tobago Historic Trust, became a regular team member and began providing the tank rentals.

The average diving schedule rotated through all team members able to dive and usually gave each diver two dives, sometimes three, for as long as tanks would last. During hand fanning or searches, partners would usually ascend together, but once stationary excavation was underway, individuals could swap out at whatever rate tanks emptied, depending on the task. The more experienced or smaller divers with better air conservation might stay down longer, while someone less experienced or doing heavier labor could be relieved one or more times during that same span. This ensured partners did not limit each other's dives, but there were always at least two divers on site. Whether such active alternating was occurring or not, divers taking an interval would monitor the bubbles of those underwater and ensure the next diver or divers in line were

ready to immediately enter the water once a diver surfaced. When the team was large enough, another pair of divers could perform additional tasks such as photography or removal of large debris. An available person on the boat would log the times and air contents of divers in and out. The designated dive safety officer would later enter them into a database. The upper limits of dive times could reach over two hours in 5 meters of water, while at 13 meters or more it would be much less.

Aside from the challenges associated with working around ferry schedules and commercial vessels, divers met difficulties in the physical harbor conditions. The breakwater protects most of the inner harbor from waves and currents, but visibility in the harbor depends on tide, ferry traffic, and location within the bay. As with many coastal dive sites, the best visibility occurs as the tide came in and at slack tide. It was not always possible to coordinate the tides, the ferries, and a full day of diving work. Clearer blue-green waters flowed in over the western half of the bay, off the beach. Visibility over the reef stretched above six or seven meters and the surf and light current, the latter of which was usually no more than a knot, kept water clear compared to the inner harbor. Within the channel, the water could be clear, depending on the boat traffic and tides, but was brown and murky, with visibility anywhere between two to four meters. To the east of the ferry channel, water quality diminished with increasing proximity to the breakwater, where tide had negligible effect and terrestrial runoff settled. Surface visibility was on par with that in the channel but dropped near the silt-covered bottom. Diver's movements would agitate the bottom into a dense cloud, which remained for hours.

Weather was not a severe or frequent challenge to the project's diving operations, but extremely poor visibility occurred on days of heavy downpours. Heavy rains cause normally dry or shallow outflows to flood and carry debris and sediment into the harbor. There are at least two

such outflows: one running under the road, where the eastern edge of Scarborough's long beach meets the rocks before the harbor complex, and one in the deepest corner of the harbor, adjacent to the port facility's east side. Fortunately, these storms were rare, as the rainy season more often consisted of light rain and brief scattered storms. Tropical storms and hurricanes are rarely a concern for the island, and the team did not experience any major storm systems during their seasons in Tobago (Office of Disaster Preparedness and Management).

Moderate surf and wave action occurred in the western portion of the bay, beyond the reach of the breakwater and beyond the structures of the piers and jetties. On most days, waves were not an issue and using larger boats with catamaran hulls meant entering and exiting the water easily. Issues arose when diving later in the day, after the wind typically picked up, or on days of abnormally high wind and surf. Wave action was greater during dives toward the southern and western extremities of the bay where there was little to no protection from the open ocean. Waves could make the task of exiting the water challenging, especially in smaller boats. In addition to making the diving more difficult, monitoring divers from the boat also proved troublesome in the presence of whitecaps. Over TRB-5, where the flat topography exposed divers to the swaying of each surge, the surf frequently required divers to wedge themselves into a coral trench or find arm or footholds for steady and careful excavation. Divers had to be creative in securing tools, mesh bags, and artifacts.

These natural elements also challenged the boats and their captains. Dredging at 30–40 ft. created little room for the vessel carrying the pump to swing along its mooring in the wind and waves. Using both anchors and improvised cement moorings, RBRP secured the boats to three points, or at least two, accounting for wind and water movement. During the 2015 season, the

team did not use the moorings over TRB-5, instead opting for a wider placement of two anchors when it came time to dredge briefly around the concreted anchor.

Dive Logging

RBRP kept a spreadsheet listing dive times, depths, and intervals, but each team member also filled out a dive log detailing their dive partner, activity performed and site observations. In this manner, the project combined diving and archaeological logs. Divers filled out the forms with information they deemed important, or interesting, regarding their observations from an archaeological or diving viewpoint. Individuals who did not dive would also complete a log, as they provided insight from all perspectives, even those on the boat or on land logging artifacts. Dive logs were crucial to obtaining personal observations and descriptions of aspects of sites not measured or photographed and were a benefit to the archaeological research as well as the day-to-day management of the project.

Artifact Survey

During initial surface surveys, divers collected artifacts on the seafloor and marked their provenience based on one of several systems. During the rudimentary surface searches, RBRP labeled found items based solely on the site in which they were found. Because of the highly dynamic context of the surface finds, this was as precise as could be considered reasonable, as their exact positions changed daily, and looser items sometimes disappeared from sites entirely. The more precise circle searches labeled found artifacts by their site, their direction from the center of the circle by compass, and their distance on the tape. The team eventually laid out a grid system and quadrants for TRB-2 and TRB-5. RBRP initially experimented with trilateration, mapping based on three-dimensional measurements from datum points; however, the excavation on the test site TRB-2 ended to focus on TRB-1. RBRP eventually used trilateration while

mapping the cannons on TRB-5, and an extensive network of datum points stretched over the site. The team never used the technique for smaller details, as they transitioned to less time intensive methods during short seasons and frequent changes in site focus.

Artifact Recovery and Processing

RBRP retrieved hundreds of artifacts from the sites in Rockley Bay to record and examine. Following the discovery of artifacts, the team placed them in bags or plastic containers and kept them submerged in a large water bucket on the boat. Small squares of plastic sign board attached to the artifacts indicated their location and the initials of the diver who found them, as well as notation on which dive, to give a rough estimate of when an artifact was found. Upon reaching land, artifacts received a cleaner tag, later used when photographing artifacts, and a member of the team would fill out a form describing the provenience, appearance, and measurements of the artifact. These forms were scanned, and physical copies kept in a binder. All artifacts received a lot number, while important or diagnostic artifacts received a catalog number. All artifacts had a corresponding entry in the catalog (Figure 14), which also tracked whether forms and pictures existed for each artifact. Photographs of artifacts included standard images with scales and various angles, along with photos taken for popular publication (Figure 15). In 2014, 2015 and 2016, the team also used photogrammetry to model artifacts, in addition to modeling sites.

| Artifact Catalogue | | | | Rockley Bay Research Project 2016 | | | | | | |
|--|-------|--------------------|--------------|-----------------------------------|------|----------|------|-------|------|--|
| CAT# | LOT# | Provenience | Material | Qty. | Date | Initials | Dive | Photo | Scan | |
| 228 | 145.1 | TRB-4 Surface Find | Ceramic Pipe | 1 | 6/14 | DI, DC | | ✓ | | |
| white Pipe with pig & donkey/horse design. large vert cal bowl | | | | | | | | | | |

Figure 14. Sample of artifact catalog entry (RBRP 2016).

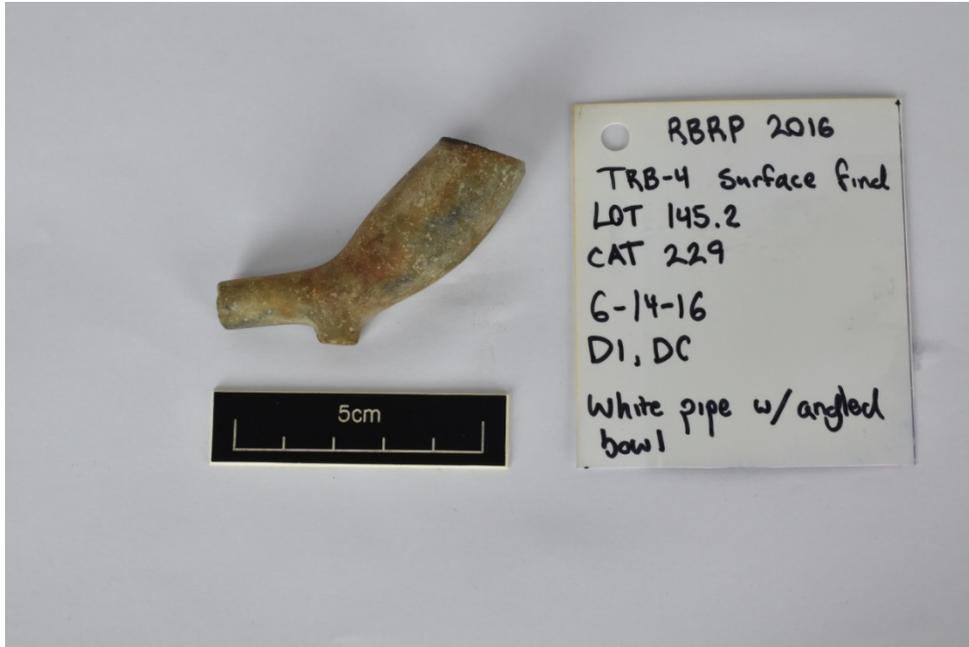


Figure 15. Artifact photography and artifact label (RBRP 2016).

During the field seasons, there was no full-time conservator, nor the equipment and materials for long-term treatment and conservation, so the team returned all artifacts to the water until such resources would become available. A few artifacts, such as ceramic pipes or intricate pottery, received light cleaning and brushing. Several team members had training and experience in conservation. Upon completing forms, logging artifacts in the catalog, and taking all relevant photographs, RBRP attached the newer labels, bagged and boxed artifacts in plastic containers or buckets, and returned the artifacts to the seafloor under rocks and sediment in locations easily accessible to the project in the future, while also discreet enough to go unnoticed.

Remote Sensing

In 2014, using HYPACK hydrographic survey software, a Marine Sonic Side-Scan Sonar, and a G-882 c-v Magnetometer, the RBRP team ran survey lines spaced 20 meters apart. The Magnetometer recorded data every 0.1 second, about every 60 cm (Figure 16) (Paterniti and Inglis 2014). For this survey, RBRP divided the harbor into three blocks, from east to west: the

harbor block, pier block, and western block (Figure 17). The harbor and pier blocks laid within areas previously explored by earlier expeditions, though to a limited extent. The pier block proved more difficult to survey due to commercial traffic and obstacles, as well as anomalies caused by the structure and debris of the harbor's construction. The largest area was the western block, which yielded several targets outside the scope of the first magnetometer surveys by Wes Hall. This block covered the area west of the harbor complex out along the shore.



Figure 16. Survey lines tracking the area covered by the magnetometer survey (RBRP 2014).



Figure 17. The division of the harbor into three blocks, for survey (RBRP 2014).

The team used a shot line and buoy to mark the location for divers when targets were found using survey equipment. Sites explored in this manner were mostly from the western block and those not examined during the survey were later tested during the field season from June to mid-July. Divers visually inspected sites used hand fanning and limited probing, and attempted to use a hydro-probe to reach greater depths in sandy areas. Many of the sites proved inconclusive and would require later investigation, while other small targets turned out to be modern debris. Divers investigated 13 sites total and added three to RBRP's designated list of sites of interest; TRB-5, TRB-6, and TRB-7 (Batchvarov 2016:6). The site RB-30, as designated among the larger number of magnetometer targets, appeared to be significant in terms of size and area, but is more modern wreckage. TRB-5 and TRB-6 are discussed below. The team believed

TRB-7 to be a ballast pile and initially thought it could be a shipwreck from the Action of March 1677 or one of the supply ships that carried women, children, or slaves. The site runs along an inactive sewer pipe and at the time the team also found modern construction debris and 19th century bricks. RBRP did not fully investigate TRB-7 during the 2014 season but revisited the site in 2016.

Surface Surveys

RBRP conducted surveys of the surface scatter over a wide area of the inner harbor, from the western pier toward the breakwater. This was the area most known to prior projects and the supposed location of several wrecks from the Action of March 1677. Due to the size of the team and time limitations, more focused search areas were limited to known features in the harbor, such as the cannon and anchors associated with TRB-2, the extensively explored TRB-1, as well as TRB-3 and TRB-4. During the 2014 season, the search area expanded after the discovery of the cannons at TRB-5 to the areas over the reef and near Red Rocks, all flagged by the remote sensing survey two months prior.

The 2013 season of RBRP's field work focused on TRB-1 and TRB-2. Surface searches around the cannon and brick pile revealed many pottery fragments, some whole, as well as several large artifacts including two anchors and a small cannon. Unfortunately, during the 2013 season, divers were unable to find the cannon. The status of the artifact is unknown and further visits to the site in later seasons have not rediscovered it. It is probably the victim of looters, as its mass and weight would have prevented movement due to the regular currents and ferry prop wash that dispersed so many smaller artifacts. The 2013 season proved the most prolific in surface finds and the team raised a considerable number of artifacts from TRB-2 and its surrounding area for examination. The goal of the project was primarily to determine whether

there were any remains of the 1677 conflict, so study focused on dating and excluding artifacts and sites for possible 1677 remains. TRB-2's cannon appeared old enough, but the bricks beneath it were more than likely British from the 19th century. Similarly, the artifacts on the surface around the cannon were a mix of modern bottles and refuse and 19th-century pottery, such as the many blue-on-white ceramic pieces. TRB-1 provided little in the way of surface finds, as the silt consumed most objects. It was not until after dredging that anything significant came from what is probably an 18th-century vessel.

The 2014 season followed a remote sensing survey in which a diver found the cannons on TRB-5. After that success, the team embarked on many dives in the harbor to truth other potential targets found by the survey. Using metal detectors, divers searched for the sources of magnetometer hits. Many of these hits turned out to be garbage and refuse as small as metal cans and as large as sewage pipes. Since this was a dumping site for material dredged in 1990, RBRP was interested in the possibility of shipwreck remains and cultural material, despite the loss of coherence and context. A large magnetometer target showed up near the rocks, but radial searches from a piece of metal scaffolding near the debris pile revealed no meaningful finds. The contents seen at that time primarily consisted of modern refuse and equipment over an area of boulders.

Unsuccessful in discovering targets beyond the coral reef in the western end of Rockley Bay, RBRP focused on the ballast pile around a disconnected sewage outflow and the cannon pile at TRB-5. Surface survey of the ballast pile revealed bottles and materials no older than the 19th century, but the team extensively hand-fanned and eventually dredged. Unfortunately, little cultural material remained and if at one point the site was a ballast pile, it was moved or displaced. Organic material, such as nuts and leaves, mixed with and penetrated the site which,

unless extreme preservation existed beneath the substrate, indicates a lack of context in the stratigraphy. Findings below the surface would later validate RBRP's interest in TRB-5 beyond the cannons, but surface finds included materials consistent with the variety found in the rest of the harbor, including lead plating, a modern car tire, bottles, and other refuse and scatter from the bay's past and present. The cannons concreted to the coral appeared old enough and significant enough to warrant breaking through the concretions to dredge. In the following two years TRB-5 underwent many more surface searches to uncover its extent and relationship to other sites, such as the anchor at the edge of the reef.

Dredging

Archaeological dredging operations occurred on five sites in Rockley Bay. For the 2013 season, RBRP acquired a very old marine pump of unknown make. The pump was reliable enough, but the hoses and heads were not powerful and often clogged. The pump was also heavy and difficult to move. In 2014, RBRP acquired two brand new Honda pumps, new hoses, and new dredge heads (Figure 18). The team only used one at a time, as dredging never expanded beyond the limits of one dredge, but their arrival increased productivity. *Blu Spartan* and other project vessels acted as barges for the dredge, with two or three lines tying the dredge down to keep it from moving while it vibrated. Team members on the deck watched the fuel level of the pump and monitored a handmade buoy, usually a bottle or jug tied with polypropylene rope to the dredge head, for the signals to start and stop the engine. Following the conclusion of dredging for the day the crew on deck unhooked the hoses and dropped them into the water, where they remained, weighed down and secured to the site with concrete blocks until the next day.



Figure 18. Doug Inglis and Jason Paterniti test the newer Honda dredge pump (RBRP 2014).

TRB-1 proved difficult to dredge due to visibility. When dredging, a large cloud of silt covered the site. All the water and silt that the dredge pulled could not keep up with the amount of silt and debris kicked up into the water column. Near the dredge head, divers experienced complete lack of visibility and light, only able to feel with their hands what they were excavating. Frequent trips to the clearer water only a couple meters away was necessary to check time and gauges. Divers checking the cage at the end of the dredge encountered similar difficulties with visibility, but in total only a few artifacts came from the trench at TRB-1 and those indicated the wreck was neither Dutch nor from the 17th century. After pulling several timber samples for dating and concluding that further dredging would not yield better results, the team focused on refilling the trench.

TRB-5 underwent the most intensive dredging and required breaking through concreted ballast and brick piles. Because the substrate was rock, coral, shells, and sand, visibility

remained good, but the work required to break through these layers was intensive. Divers hand fed the dredge as there were many small artifacts such as pipe heads, lead shot, and eating utensils. The team members moved large pieces of concretion outside the deepening trench into piles and separated and measured bricks (Table 3).

| Leiden brick measurements (in centimeters) from TRB-5 trench | | | | | | | |
|--|--------|-------|-----------|---------|--------|-------|-----------|
| Brick # | Length | Width | Thickness | Brick # | Length | Width | Thickness |
| 1 | 18.4 | 8.8 | 3.8 | 24 | 18.8 | 9.0 | 3.7 |
| 2 | 18.5 | 9.1 | 3.9 | 25 | 18.5 | 9.2 | 3.8 |
| 3 | n/a | n/a | n/a | 26 | 18.5 | 9.0 | 4.0 |
| 4 | 18.4 | 9.0 | 4.0 | 27 | 18.3 | 9.0 | 3.7 |
| 5 | 19.0 | 9.0 | 3.5 | 28 | 18.2 | 9.5 | 4.0 |
| 6 | n/a | n/a | n/a | 29 | 18.2 | 8.9 | 3.8 |
| 7 | 18.8 | 9.3 | 3.4 | 30 | 18.3 | 9.0 | 3.9 |
| 8 | 18.7 | 9.0 | 3.5 | 31 | 18.5 | 8.8 | 3.8 |
| 9 | 19.1 | 9.0 | 3.6 | 32 | 18.1 | 9.6 | 3.4 |
| 10 | 18.3 | 8.5 | 3.5 | 33 | 18.5 | 8.3 | 3.5 |
| 11 | 18.3 | 8.5 | 3.9 | 34 | 19.0 | 8.6 | 3.5 |
| 12 | 18.5 | 9.0 | 4.0 | 35 | 18.7 | 8.5 | 3.7 |
| 13 | 18.0 | 8.0 | 5.0 | 36 | 18.4 | 9.0 | 4.0 |
| 14 | 19.0 | 8.3 | 3.8 | 37 | 22.0 | 9.0 | 4.5 |
| 15 | 18.3 | 8.5 | 4.0 | 38 | 18.3 | 8.0 | 3.5 |
| 16 | 18.5 | 8.5 | 5.5 | 39 | 18.5 | 9.5 | 4.0 |
| 17 | 18.5 | 8.5 | 4.0 | 40 | 18.5 | 9.0 | 4.0 |
| 18 | 18.5 | 8.5 | 4.0 | 41 | 18.5 | 8.0 | 3.5 |
| 19 | 18.5 | 9.1 | 3.8 | 42 | 18.5 | 8.0 | 4.0 |
| 20 | 19.1 | 9.5 | 4.0 | 43 | 18.5 | 8.5 | 4.0 |
| 21 | 18.2 | 8.8 | 3.7 | 44 | 18.5 | 8.9 | 3.7 |
| 22 | 18.5 | 9.4 | 3.7 | 45 | 18.3 | 8.7 | 3.8 |
| 23 | 18.3 | 8.8 | 3.8 | 46 | 18.5 | 9.3 | n/a |
| Average Length: | | | 18.6 | | | | |
| Average Width: | | | 8.8 | | | | |
| Average Thickness: | | | 3.9 | | | | |

Table 3. List of measurements taken from 46 bricks on TRB-5; absent measurements are due to significant concretion (Thomas Lacey 2014).

The possible ballast pile near the sewage pipe was the third dredging target, but operations there lasted only one day. There was scant artifactual evidence in the form of surface scatter and only organic material beneath the rocks. The anchor, TRB-6, also underwent limited

dredging to expose its entirety, which involved careful work as only the upper edge of the shank remained supported by concretion, while the rest supported itself by structural integrity once the dredge pulled the sand away.

After completing each dredging operation, the team covered the trenches with sediment and, in the case of TRB-5, stones and bricks. While some further erosion on structures like the keel of TRB-1 is expected, the team believed that covering the sites would help to stabilize the environment quickly to reduce the impact of worms and rot. In an expedition to expose and take samples from a wreck on the Caribbean side, not associated with the Action of March 1677, the team likewise covered the exposed wood in stones and sand as thoroughly as possible.

Dendrochronology

Nigel Nayling, a dendrochronology expert from the University of Wales, Trinity St. David, joined RBRP for every official season of excavation in Rockley Bay. He set up a field lab, the first in Tobago, and tested samples at sites with intact timbers. At the time of writing, only TRB-1 produced samples large enough to date and those were infested with the tunnels of the marine worm, *Teredo Navalis*, either from early exposure or vulnerability following earlier excavations. On other wrecks, potential and proven, RBRP has only excavated small test trenches and most sites either did not have any wood present within the area tested, or it was too fragmented, as was the case with TRB-5.

Photogrammetry

The team used photogrammetry to map and model both artifacts and sites. Using computer programs such as Agisoft Photoscan, the RBRP team constructed three-dimensional models from long series of photographs. The team initially tried to use photomosaics to map TRB-2, but the eastern part of the harbor lacks visibility and contrast along its floor, so the

software was unable to locate shared points in the repetitive textures. Similarly, trilateration proved too lengthy a process for such a limited time with a small team. While the team mapped artifacts using offsets and quadrants on a grid, in the case of TRB-2, the surface was dynamic and cultural material moved frequently or even disappeared.

In 2014, the team tried to use photogrammetry to create faster and more visually appealing representations of sites and artifacts and got mixed results. Like with photomosaics, repetitive or featureless surfaces confused the software in some areas, while certain artifacts or features made for excellent models. Lighting proved crucial to capturing the details and textures of the subjects. As of the season in 2016, this technique produced vastly improved results and precision.



Figure 19. Example completed photogrammetry model as prepared for a project website (Doug Inglis 2016).

In 2015, a smaller part of the team made the trip to Tobago to further develop the practice and application of the technology. In 2015 and 2016, the team placed tiles, with symbols or codes recognizable by the software, across the site, to help Agisoft recognize overlaps and spatial relations between photographs. Models gradually became better over time and reached a high level of fidelity, including notable models of an anchor trench through the center of the harbor, the excavated trench at TRB-5, the cannon and bricks at TRB-2, and the supposed ballast pile. Artifacts modeled include several pipes, a ceramic cup, the Westerwald jug, and the cannon found on the port property (Figure 19). Though the technology is far from perfect and requires ideal conditions for photography, photogrammetry was useful for recording the topography and layout of a site and displaying archaeological finds to a public that cannot dive on the site.

CHAPTER 6: Rockley Bay Research Project Fieldwork

Rockley Bay Research Project (RBRP) first entered negotiations for archaeological access in 2011 and soon received permission from both the governments of Trinidad and Tobago and the local government on Tobago. Between the years 2012 and 2016, the project conducted a variety of surveys and excavations to search for the remains of the 1677 battle between the Dutch and the French, as well as establish and further the study of underwater cultural heritage in Tobago. The following are the expeditions the project undertook to achieve these goals, each with individual goals on a seasonal basis.

2012 Season

The goals of the first season, in June 2012, were to locate and survey the extent of any 17th-century wrecks in the harbor to find the ships associated with the 1677 battle. Additionally, the team intended to establish conservation facilities on the island in preparation for the future excavation of artifacts and ship structure. Finally, the team attempted to follow leads on other 17th-century wrecks, specifically a shipwreck featuring bricks discovered among the islands between Trinidad and Venezuela (Paterniti 2012:6–7).

Using the catamaran *Blu Spartan*, the team dove and found Vessel A, originally found by Wes Hall. Labeled TRB-1 for the new project, the wreck is 16 meters wide by 45 meters long and is covered by between 20 and 150 centimeters of very fine compacted sediment, depending on the area. Divers set up a baseline and delineated the extent of the site. RBRP initially believed the site was one of the Dutch ships from 1677 because of the size and location, as well as the conclusions of McKewan's report. It was also a promising location for conducting a full excavation (Paterniti 2012:21). The ship became a primary target for future investigation to determine its identity and would become the focus of excavation for a part of the 2013 season.

TRB-2 lies to the north-northwest of TRB-1 and consists of a partially buried cannon surrounded by loose surface scatter exposed by the ferry prop wash (Paterniti 2012:20–21).

2013 Season

The 2013 season of the RBRP was the first season of excavation. The goals for this season included the investigation of TRB-1, 2, 3, and 4. Within each site the team wanted to determine whether the wrecks contain 17th-century components, in the continuation of the search for ships from 1677, and to expand the knowledge base on 17th-century ship construction. They also recorded routine archaeological data and evaluated the level of risk posed to the sites based on marine traffic, looting, and dredging. A second major goal was to expose structural elements of TRB-1 for dendrochronological sampling. RBRP's investigation of TRB-1 also required measurements and recordings to determine construction techniques and origin, to verify whether past projects were correct in their identification of the vessel as 17th-century. The team hoped that in surveying the wrecks in Rockley Bay, excavation would uncover a Dutch warship from the Action of March 1677. The 2013 season also served two other purposes. It trained a small group of university students in underwater archaeological techniques and it tested the viability of conducting major underwater archaeological projects in Tobago (Paterniti and Inglis 2013:9).

2014 Season

In the spring of 2014, several members of the RBRP team returned to Tobago to conduct a remote sensing survey with the aid of Jean B. Pelletier, of URS Corporation. Shortly after, a larger team returned to Tobago for a full field season in June and July (Batchvarov 2016:106). The objectives for the 2014 season included locating magnetic anomalies and potential sites found using side-scan and magnetometer survey, in addition to investigating these sites and determining whether the ships are historical wrecks or modern debris or infrastructure. Finally,

the team tried non-invasive modeling technologies to record artifacts and sites that showed promise.

2015 Survey

The RBRP conducted a brief survey in 2015 to evaluate the sites and attempted more Structure From Motion (SFM) photogrammetry. Using a smaller team, the project built higher-quality three-dimensional models of artifacts from the 2014 season. Doug Inglis, Texas A&M University, discovered during the 2015 survey that a ship's large anchor chain dug a trench through the center of the harbor, highlighting the vulnerability of the seafloor in this heavily trafficked location.

2016 Season

The team's expedition in 2016 was a short excavation season. With only two weeks, limited by funding, a team of divers attempted to further investigate several targets that the project was unable to explore in previous seasons, including TRB-4, TRB-6, and TRB-7. TRB-4 was previously a noticeable ballast pile located off the cruise ship dock. It was at once apparent that the site was almost unrecognizable from prior years. Cultural material was loose and the ballast pile was no longer coherent. Team members who had been on the site in past years had difficulty recognizing the area. The team concluded that the material related to TRB-4 was from a later period, perhaps the 19th century. They moved from the site, taking note of the significance of the vulnerability of its exposed artifacts. Following this investigation, the team focused on uncovering the anchor at TRB-6 and further surface surveys on TRB-5.

Rockley Bay Site Designations

In the process of carrying out research in Rockley Bay over the five years the project has been active, RBRP determined seven sites to be significant and worth further excavation at this

time. While some have already undergone testing and survey, all still require examination and excavation in full to determine their full extents.

TRB-1

RBRP began excavation on TRB-1 in 2013, having first examined it via surface survey in 2012. Previous expeditions by other teams believed this vessel to be from the 17th century. In visibility of less than 10 feet, often lowered to zero visibility by the fine clay-like muck, the team found and reopened a small section of the longitudinal trench, or trench A, originally excavated in 2000. Aside from the vast amounts of mud, there were very few cultural materials within the excavated trench. While there was little in the form of individual artifacts compared to other sites, what set the site apart from other sites discovered in the harbor was that there was a coherent ship's structure beneath the silt. The team managed to clear a trench using a water dredge, which exposed the stern of the vessel, including the deadwood and keel. Nigel Nayling, University of Wales, Trinity St. David, took timber samples and attempted to date the shipwreck with dendrochronology. This was inconclusive at the time, but in the absence of whatever artifacts the British team used to conclude nationality and date, Kroum Batchvarov concluded, for the time being, that TRB-1 is probably not from the 17th century, based on ship construction (Batchvarov and Inglis 2013:20–21).

TRB-2

The TRB-2 site, which was rich in a scatter of artifacts including pottery and a swivel gun, was the first site dredged to any extent by Rockley Bay Research Project in 2013. After relocating the sites found in 2012, the team conducted circle searches to relocate features and artifacts, noting the direction and distance to create a rough map for future reference. Over TRB-2, the team placed a survey grid of polypropylene line, anchored to the bottom with rebar.

The grid was a 15-meter square, broken into 3-meter units. The grid served to help record the provenience and locations of artifacts and features of the site (Batchvarov and Inglis 2013:18–19). The team dropped control points along the outside of the grid, built from tires filled with cement and rebar poles. RBRP used the control points to measure distances from fixed positions to major features on TRB-2 for Direct Survey Method (DSM), a means of mapping by using hand measured distances taken using tape reels between objects and set datum, or control points. The team input these measurements with SiteRecorder to record the anchors and cannon with a residual error of less than 1 cm. RBRP initially used DSM for the purpose of providing a precise basis for mapping the rest of the site in detail, but as the site's excavation was put on hold, so was the digital mapping.

The cannon at the center of TRB-2 was consistent with an early style, perhaps from the 17th century, but the other artifacts indicate it likely deposited on site from elsewhere in the harbor. The project investigated the site further by dredging a small trench near the brick pile to find timbers for more precise dating. The artifacts found in the vicinity of TRB-2, except for the cannon and anchors, were all dated to the 18th and 19th centuries (Batchvarov and Inglis 2013:19) (Figure 20, 21).



Figure 20. TRB-2: lone cannon on a brick pile (Kroum Batchvarov 2013).



Figure 21. A photomosaic of the cannon at TRB-2, compiled by Doug Inglis.

The team tried to dredge beneath the cannon and brick pile to find timbers, or any indication that the site contained the structural remains of a wreck. Because the artifacts were dated to the 19th century and the conclusion was that the cannon, with a steel cable wrapped around its center, was likely moved onto a newer site by some attempt to salvage it in modern times (Batchvarov 2016), the prospects of the site being from the 17th century were unlikely. As the team did not locate timbers during the excavation and Nigel Nayling was soon joining the effort to pull wood samples from TRB-1, that site took priority and the team moved on after covering the small pit next to the cannon.

TRB-3 and TRB-4

The two sites called TRB-3 and -4, both discovered within the harbor center, were only the subject of brief surface surveys in 2013 and 2016, after initial discovery in 2012. TRB-3 consisted of a single cannon surrounded in a loose scatter of artifacts of varying ages. RBRP believed TRB-4 was a ballast pile, but over a few years of work within the harbor, the topography has become less noticeable. Like TRB-3, the artifacts on the site vary in date, from modern refuse to 19th-century pottery. Any structural remains in those two sites are still concealed beneath the mud and stones and the artifacts are loose on the surface, changing position from day to day due to currents and harbor traffic. Due to time limitations in funding and time, RBRP focused instead on the more accessible wrecks beyond the inner harbor.

TRB-5

The most significant find from the team's 2014 remote sensing expedition was a series of seven cannons spread over a field of ballast: TRB-5 (Figure 22, 23). Initially detected via magnetometer and confirmed by divers on surface surveys, TRB-5 is situated on top of a coral reef. Much of the ballast and a large quantity of brick have become encrusted in coral and

concretion. The reef is situated at 15 feet in depth and is 20 by 10 meters in extent, though the exact area is not thoroughly established because of its homogeneity amid the reef. TRB-5 consists of seven cannons and a concentration of Dutch bricks averaging 4 cm thick (Batchvarov 2016:106). The team focused its efforts here during the 2014 excavation, after some exploration and further probing of the unidentified sites. Because of the improved visibility compared to sites in the inner harbor, the site proved an opportunity to use Structure From Motion (SFM), the creation of three-dimensional images from long series of photographs from different angles and locations, to attempt to record the site and the progress of the excavation (Figure 24).

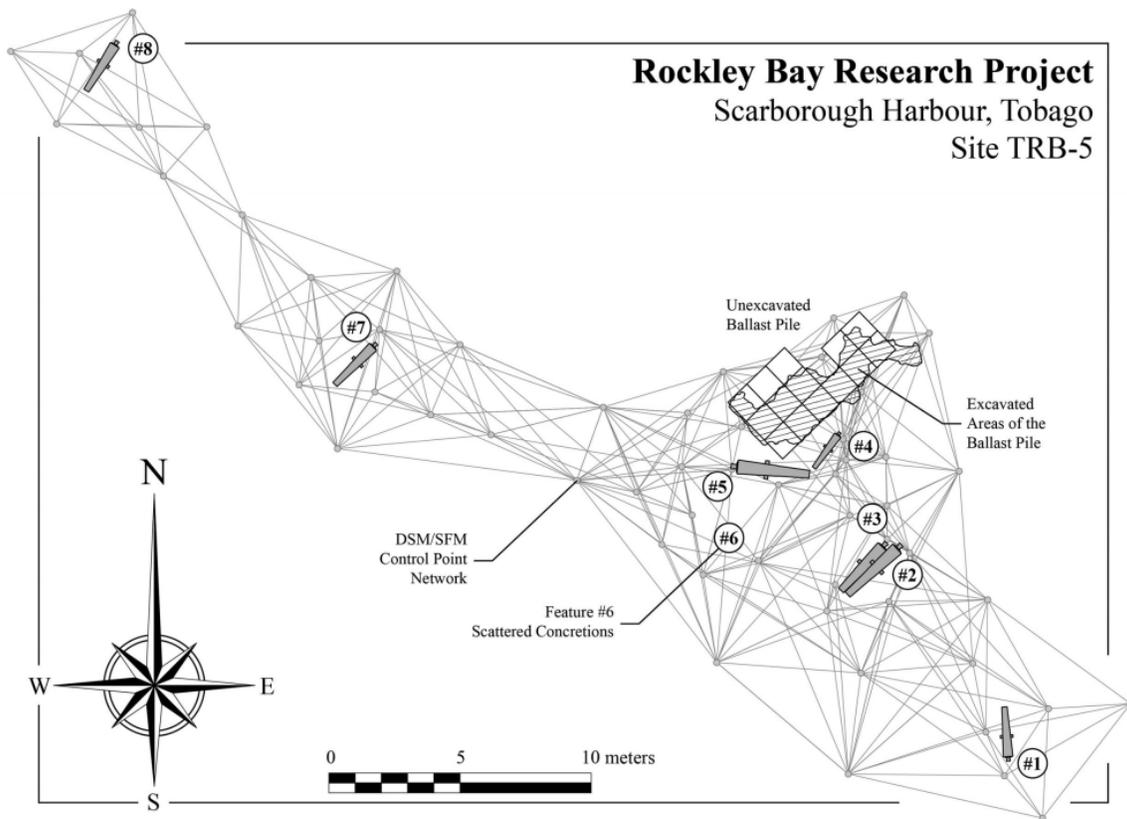


Figure 22. Site plan of TRB-5 with DSM lines, cannons, and the excavated trench (Doug Inglis 2014).



Figure 23. One of the seven concreted cannons found on TRB-5 (Photo by Doug Inglis).

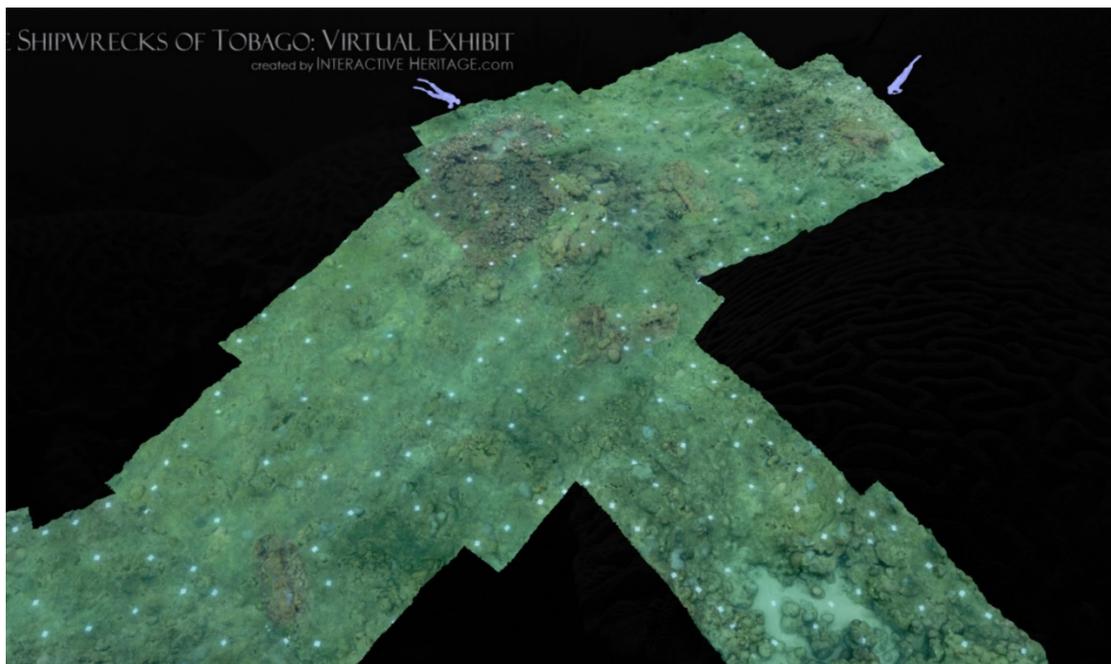


Figure 24. SFM model of TRB-5 (Doug Inglis 2016).



Figure 25. Kroum Batchvarov dredges in the TRB-5 trench (RBRP 2014).

The team opened a test trench 1 to 1.5 meters wide and 6.5 meters long, with a depth of just over 0.5 meters (Figure 25). The trench was difficult to excavate because of the concreted upper layer of ballast stone and brick. The cannons ranged in size from a 3 pounder to some larger than 18 pounders. The bricks provided some evidence that the site is from the 17th century, as they follow the dimensions of a 1645 statute in Leiden, which dictated the specifications for bricks (Batchvarov 2016:108). It is likely that the trench excavated part of the ship's galley.

Unfortunately, the team found no significant timber remains during the 2014 season, though they did discover several fragments, some from large timbers. Nigel Nayling could not properly date the remains with dendrochronology, due to their small size and highly eroded condition. Other items found in the trench include more than 100 pipe fragments, including 72 pipe bowls. These are consistent with Dutch pipes from the 17th century, both in the angle of the

bowl and in decoration (Batchvarov 2016:109). Excavators discovered fragments of pottery, as well as complete pieces, including a complete 17th-century Westerwald Jug featuring three motifs of David, Joshua, and Alexander the Great (Figure 26). The team discovered many other artifacts, including eating spoons and forks as well as shot and firearm fragments. At the end of the 2014 expedition, divers packed the artifacts together, tagged and labeled them, and returned them to the trench before it was backfilled with ballast and brick.



Figure 26. A complete Westerwald jug, in situ in a hollow area of the reef (Photo by Doug Inglis).

TRB-6

The 2015 survey found an anchor, labeled TRB-6. It replaced a pile of stones initially thought to be ballast as TRB-6 after the team realized that the pile was nothing more than a buildup of out-of-context rubble with loose cultural material. The anchor sits against the wall of the reef partially submerged in a sandy bottom, 20 meters east of the center of TRB-5. It remains to be seen whether it can be associated with TRB-5 or the ballast pile at TRB-7 (Figure 27). In

2016, after initial photography, the team used a water dredge to pull sand away from the base of the anchor, exposing the arms and flukes. The anchor is concreted to the coral wall, held in place by the shank. Below, the anchor freely hangs in the sand. The organic matter mixed on all levels with the sand substrate indicates that the anchor's provenience within the sand's stratigraphy is unreliable. After excavating the anchor, the team measured it in place and took some photogrammetry photos, though decreasing visibility limited their quality.

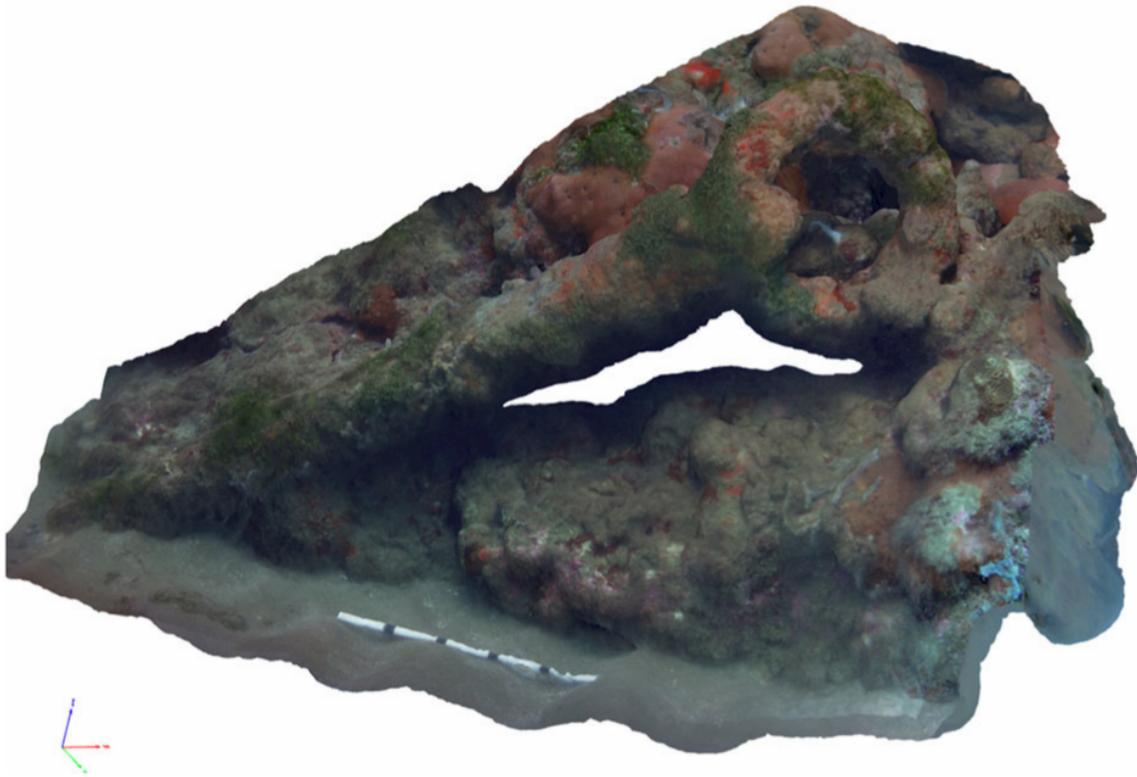


Figure 27. Model of the anchor designated TRB-6 (Doug Inglis 2016).

TRB-7

TRB-7 consists of a pile of rocks next to an inactive sewer pipe, initially believed to be a ballast pile. After hand fanning in the sand along the edges of the pile, which revealed little cultural material, the team excavated a trench from the edge of the pile inward using a water dredge. Below the stones, the team found mixed organic matter and a thick dark sediment. The

presence of leaves, fruit husks, and nuts implied the stones were deposited on top of, or mixed together with, the organic matter and piled against the pipe. TRB-7 is likely not a coherent wreck, but rather a product of other factors and activities in the harbor.

Time and budget constraints, mainly around the availability of boats for work in Rockley bay, pushed the team to move to the other side of the island to investigate a known shipwreck in Mount Irvine Bay rather than fully reopen TRB-5. While the shipwreck in Mount Irvine Bay, on the northeast coast of the island, lies outside the goals of the RBRP, it offers perspective on shipwrecks on the leeward side of the island and is a site that, unlike Rockley Bay, is exposed to recreational divers. There was a distinct lack of any other cultural material aside from the four heavily concreted cannons, likely due to looting and treasure salvage. The cannons remain, possibly because of the difficulty in discerning them from the surrounding concretions and reef structure. The late Teddy Tucker, Bermudan treasure hunter, visited the site and believed it to be a late 18th-century French vessel. Unfortunately, due to his passing, it is impossible to determine what led him to that conclusion and more archaeological work is needed to determine the wreck's date and origin. While the site did not contribute directly towards the specific search for 17th-century shipwrecks, it may be included in a wider study of underwater sites in Tobago in the future.

Conclusion

The information provided here created a baseline for studies in the processes at work on cultural material in the harbor. RBRP conducted work in the harbor over four years, but limitations in time and focus meant that work produced only glimpses into how the various sites came to be and their relative states of equilibrium in the harbor's modern conditions. It is through further examination and observations on the conditions, the archaeological excavation process,

artifacts, and application of archaeological theory that site formation processes become clear as a more cohesive picture in such a diverse environment.

CHAPTER 7: Protection of Shipwrecks in Trinidad and Tobago

The islands of Trinidad and Tobago have a diverse and rich cultural history. Trinidad was a Spanish-controlled island for many years before coming under British control. The much smaller Tobago remained a wild and unsettled island by European standards until it also became a British colony. Before European interests became involved in Trinidad and Tobago, the islands supported indigenous populations and Tobago served as a midway point between the South American continent and the Lesser Antilles. Studies of the site formation processes at work on these resources warrant a closer assessment of the legal framework intended to protect sites from human interference, as well as the that legislative foundation that enables constructive study and excavation.

In Trinidad and Tobago, terrestrial sites have been the primary subjects of archaeological work performed under the auspices of state and academic organizations. By comparison, there has been little investigation of the underwater cultural materials within Trinidad and Tobago's waters. Due to the discovery of historic shipwrecks during commercial dredging in 1990 in Scarborough, Tobago's harbor, the government of Trinidad and Tobago adopted new legislation to protect shipwrecks. There remains a question as to whether these measures protect underwater cultural heritage. RBRP has encountered many obstacles to the management and protection of cultural resources, including lack of enforcement, insufficient desire to comply with international standards, as well as a complicated political environment. The biggest problem may not be in the laws and regulations alone, but in a disconnect between the country's modern population, its colonial maritime history, and the archaeological ethics involved. Examination of Trinidad and Tobago's laws and management procedures highlight both inherent strengths and a need to improve management through more public involvement and education. Without protection,

human factors are the biggest threat to the preservation of underwater cultural resources and the stability and equilibrium of the sites within Rockley Bay.

National Trust of Trinidad and Tobago

The National Trust of Trinidad and Tobago (“the Trust”), established in 1991, is one of the governmental organizations responsible for national involvement in cultural preservation and the management of archaeological resources. This organization was created to establish and preserve “properties of interest” (National Trust Act 1991:7–9). The Trust is an agency under the direction of the Minister of Community Development, Culture, and the Arts; and official actions of the Trust must go through the Minister. The focus is not specifically on cultural heritage, but the protection and designation of heritage in general, including a strong focus on natural heritage. Comparisons can be drawn with the National Park Service in the United States, from a legal standpoint, in that it is the designator of protected areas. The Trust does not serve in a law enforcement capacity. The Trust is also granted the authority to “prepare a list of buildings and sites of particular national, historic or architectural interest which should be preserved as listed properties and can effectively be so preserved under the provisions of this act” (National Trust Act 1991:9). The act also grants the Trust the ability to demolish structures when repairs would make the structure fundamentally different: “an independent architectural report declares it to be incapable of being repaired or restored without such fundamental structural changes as would in effect be the creation of an entirely different or new structure” (National Trust Act 1991:9). According to Basil Reid, University of the West Indies, the Trust was poorly implemented, and, like other acts of legislation, it lacks enforcement or a plan of action. As of 2011, no sites had been designated properties of interest in Trinidad and Tobago (Siegel and Righter 2011:128).

The Trust could be an asset to heritage management with proper implementation. There are several aspects of the Trust Act that would be particularly beneficial toward protection and management of underwater cultural heritage. In addition to its role as a keeper of records and photographs, the Trust is also charged with providing and encouraging access for “public enjoyment of the properties of interest.” The Trust was established for the benefit of the people, as well as the cultural material and historic sites. As the act states, it is important to make “the public aware of the value and beauty of the heritage of Trinidad and Tobago” (National Trust Act 1991:7).

Archaeological Committee and the Archaeological Center

Another agency created for the protection and preservation of cultural heritage in Trinidad and Tobago is the National Archaeological Committee (“the Committee”), established in 1979. The Committee works closely with other agencies and serves a role as the keeper of the country’s inventory of more than 300 archaeological sites. It also serves to organize archaeological work on areas threatened by development and help protect those sites from damage. The Committee works in partnership with the Archaeology Centre at the University of the West Indies (UWI) (Siegel and Righter 2011:128–129).

The Archaeology Centre in UWI’s History Department (“the Centre”) conducts public outreach for cultural heritage and serves an important role in education in the country. The Centre exposes its students to excavations, as well as techniques and methods crucial to archaeological investigation. It also teaches the public through various media outlets (Siegel and Righter 2011:129–130).

Protection of Wrecks Act of 1994

The Protection of Wrecks Act, 1994, was modeled closely after the United Kingdom's equivalent of the same name passed in 1973. The legislation enacted by the United Kingdom is also nearly identical in every way, with exceptions made between the two slightly different forms of government (Protection of Wrecks Act 1973). Trinidad and Tobago's legislation was a reactionary piece of legislation, created after the discovery of shipwreck remains while dredging the harbor of Scarborough for new port facilities. The act specifically deals with the protection of historic wrecks in Trinidad and Tobago's waters, with "abandoned wreck" defined as "any wreck which has remained continuously upon the seabed within the limits of the waters of Trinidad and Tobago for a period of fifty years or more" (Protection of Wrecks Act 1994:4). The wrecks not only include the hull of the ship, but its contents, as well as associated materials in the surrounding areas. The jurisdiction of the protection provided by the act is also defined. The sea is "any estuary or arm of the sea" (Protection of Wrecks Act 1994:4) and the waters are defined by the territorial sea, consistent with the United Nations Convention on the Law of the Sea, as well as including "rivers within the ebb and flow of ordinary spring tides" (Protection of Wrecks Act 1994:4). Along the shore, the jurisdiction of the act extends to anything submerged by high tide during ordinary spring tides.

The Protection of Wrecks Act made it illegal to possess, export, or excavate cultural property without permission and a license. It also gave the Minister the power to designate restricted areas by two factors: "it is, or may prove to be, the site of a vessel lying wrecked on or in the sea bed;" or "on account of the historical, archaeological or artistic importance of the vessel, or of any objects contained or formerly contained in it which may be lying on the sea bed in or near the abandoned wreck" (Protection of Wrecks Act 1994:5). An order of the Minister defines the boundaries of the restricted zone of an appropriate size and area to protect the

abandoned wreck and related cultural material. Within restricted areas, diving operations, salvage, removal of artifacts, tampering or damaging the vessel or its related objects, and the deposition of anything that would move, damage, or obstruct the site is illegal. It is unclear if enforcement plans exist and whether any state agency oversees patrolling and enforcing these restrictions (Protection of Wrecks Act 1994:5–6). There is also a second type of designation under the Protection of Wrecks Act. If the wreck site is dangerous, the Minister may deem the area of the wreck a prohibited area, which bans access on and below the water, as well as any other controls placed on restricted areas. Prohibited wreck areas are based on and modeled after those restricted areas (Protection of Wrecks Act 1994:7–8).

One key section of the act is section 7, which defines the licenses that grant salvage rights to wrecks. The licensee has “(i) to be competent, and properly equipped, to carry out salvage operations in a manner appropriate to the historical, archaeological or artistic importance of any abandoned wreck which may be lying in the area and of any objects contained or formerly contained in the wreck; or (ii) to have any other legitimate reason for doing in the area that which can only be done under the authority of a license” (Protection of Wrecks Act 1994:6–7). This initially implies that salvage for commercial gain is not a condition worthy of a license, nor would removal of a wreck in the path of development be appropriate, except when a qualified team performs the work ahead of the dredging or construction with such a license in their possession. The second condition leaves the reasons for doing legitimate salvage work open to interpretation. This license is still subject to conditions and restrictions under the Minister’s discretion and can be changed or revoked at will because of violations of those conditions or restrictions. In addition, while licensed, the licensee receives additional protection under the Protection of Wrecks Act, since it is an offense to interfere with, obstruct, or prevent the licensee

from performing their work (Protection of Wrecks Act 1994:7). This statement is one of the few easily enforced parts of the act, as interactions between people are more likely to result in reports, complaints, and investigations.

The Minister also has the power to revoke an order for a restricted or prohibited area if under the opinion that there is no longer an abandoned wreck, or if it is no longer dangerous in the case of a prohibited area (Protection of Wrecks Act 1994:8). This clause states that the Minister has the final say over whether a site is restricted and is the decision maker when it comes to whether a site will remain restricted.

The act also states that possession of a wreck is illegal and that in cases where someone tries to claim possession of a wreck over 50 years old, the wreck is forfeited to the state (Protection of Wrecks Act 1994:6). This raises questions regarding when or where an individual would be able to make a claim for ownership of a wreck, with the assumption that all wrecks over the age of 50 years already belong to the state. This likely refers to individuals or groups who have claimed finds for salvage under past laws, or rather, the absence of any laws in the past. It may also refer to cases where parts of wrecks were raised and then stored and claimed as individual property on land. It is unclear how effectively this is enforced, or if there have been any cases of wrecks that were claimed and then forfeited.

There are several exceptions to the rules, and these include dealing with wrecks or obstacles in the case of emergencies, weather, or navigational hazards (Protection of Wrecks Act 1994:8). This does not explain precisely what might constitute an emergency or a navigational hazard but leaves room for interpretation at the discretion of the authorities. This clause means that in a matter of life or death versus the integrity of a wreck, life takes priority. Whether this

might include loss of property, such as a floating vessel or its cargo, is unclear, but it is possible this also is considered an emergency.

Although the 1994 Protection of Wrecks Act adequately lays out the restrictions and legal definitions surrounding shipwrecks, it does little planning for management and enforcement, or excavation, preservation, and recording. The Minister can license individuals or teams fit for historical and archaeological work, but there is little described in the act beyond excavation or wreck salvage and removal. There is also the question of wrecks that are not in danger or threatened and why, at least according to the act, these areas would also be heavily restricted. This act defines what is illegal, but it does not plan for enforcement, either by the Coast Guard or other agencies. While information within the act is sparse regarding implementation, the government did appoint an advisory committee to handle recommendations and management of the inventory and, as of 2011, they had documented more than 50 wrecks (Reid 2011:127–128).

Protection of Wrecks Act and Rockley Bay

The Protection of Wrecks Act was enacted in 1994 as a response to a sudden need for a plan to manage and protect shipwrecks, particularly in the port of Scarborough, historically Rockley (or Rockly) Bay. Dredging and installation of port facilities damaged or destroyed a significant amount of cultural material from the first wrecks discovered in the area. Rockley Bay Research Project, based on comments made by port workers, believes that the French flagship in the Battle of 1677, *Glorieux*, was among those vessels destroyed and redeposited, though accounts vary as to whether the material was deposited near the edge of the harbor, at the Red Rocks, or buried beneath the port facilities. That this is unclear even now reinforces the idea that there was no plan for managing underwater cultural heritage before 1994, and possibly for some time after. No one documented the locations of the material at the time and only the workers'

memories shed any light on what the harbor's environment and landscape were like prior to the remote-sensing survey by Wes Hall, Mid-Atlantic Technology, in 1991, a year after the first material was discovered (Paterniti 2012; Paterniti and Inglis 2013). After Hall's first survey, the Tobago House of Assembly invited him back to investigate the area in the path of the new Coast Guard jetty, where more material was discovered in the 1990s. The English dive team produced several reports in the next expedition, but everything except the Part II report from 2006 has disappeared from the public record. Additionally, the locations of artifacts, photographs and other documentation have likewise disappeared. According to the Part II report by McKewan (2006), Heritage Development Consultants were the last to have the documentation.

The disappearance of archaeological data leaves a major gap in information, especially since the raised artifacts were not returned to the bottom to keep them safe, nor are they in any known collection or conservation lab. Without the missing documentation, any information relating to the artifacts is gone. The mismanagement is potentially serious, but little can be done without government intervention. The loss of other potential reports from the NAS dive team is problematic, as certain events surrounding the past exploration of the harbor remain unclear. One question is how one cannon from the harbor, consistent with others raised from the site, ended up on land next to one of the port's warehouses. The lack of answers led to gaps in the narrative and RBRP often worked without any foundation to rebuild the knowledge base. The situation may indicate a need for more government involvement in the enforcement and management of archaeological resources, whether through tighter restrictions, or the presence of some law enforcement agency.

United Nations Convention on the Law of the Sea

It is necessary to briefly explain the limits of Trinidad and Tobago's sovereign waters according to the 1988 United Nations Convention on the Law of the Sea (UNCLOS), a multi-lateral convention to which Trinidad and Tobago is a party. UNCLOS was established to set the limits of sovereignty, in a legal and economic sense, on the world's oceans. For the sake of future conventions and laws, the most important limits to understand are the territorial waters and the exclusive economic zone. Territorial waters extend 12 nautical miles from baselines on shore, determined by the low tide line according to state-recognized large-scale charts. Internal waters are any waters extending inward from these baselines. The exclusive economic zone is an area over which the state has control, but not complete sovereignty. This zone extends no more than 200 nautical miles from the baselines on the coast and in cases where exclusive economic zones overlap, states must come to an agreement (UNCLOS 1988).

2001 UNESCO Convention

The 2001 United Nations Educational, Scientific, and Cultural Organization Convention on the Protection of the Underwater Cultural Heritage ("the 2001 UNESCO Convention") was constructed after a growing rise in interest in underwater cultural heritage and a need to protect it. According to the convention's website, it is "intended to enable States to better protect their submerged cultural heritage." (UNESCO). Trinidad and Tobago ratified the convention in 2010, joining countries from around the world, including many from the Caribbean, to improve cultural heritage management. Compared to the 1994 Protection of Wrecks Act, there are two differences that are evident when examining the 2001 UNESCO Convention. The first is that the document protects, or at least seeks to protect, underwater cultural heritage in general, as opposed to the specific intention of Trinidad and Tobago's reactionary protection of shipwrecks. Secondly, while the Protection of Wrecks Act sets the age requirement of historic wrecks at 50 years, the

Convention defines underwater cultural heritage as having been “partially or totally under water, periodically or continuously, for at least 100 years...” (UNESCO 2001:2–3). This is a positive aspect of Trinidad and Tobago’s protections, as they are more conservative, if enforced. The convention also excludes pipelines, cables, or other installations that are still in use from its definition, should they also be older than fifty years (UNESCO 2001:2). According to the 2001 UNESCO Convention, States Parties shall cooperate and preserve underwater cultural heritage (UCH) for the benefit of humanity. The convention also binds the States Parties to do everything within proper measures to protect UCH and to use the “best practicable means at their disposal in accordance with their capabilities” (UNESCO 2001:3). The 2001 UNESCO Convention recommends that in situ preservation should be the first choice and that “underwater cultural heritage shall not be commercially exploited.” Diplomatically bound by this convention, Trinidad and Tobago cannot license salvors or treasure hunters to raise wrecks for commercial gain. This strengthens the restrictions and limitations in the existing licensing framework in the Protection of Wrecks Act. The preference toward in situ conservation also benefits this rule, as States Parties should leave wrecks where they are whenever possible and excavate or salvage only for the purposes of research or rescue (UNESCO 2001). In this regard, the convention encourages non-intrusive documentation and observation of underwater cultural heritage for the benefit of the public. When wrecks or other underwater cultural heritage must be raised, the convention states that the artifacts must be conserved and protected appropriately.

Expanded research at UWI, publicity for international projects, and public involvement in archaeology and in recreational diving and exploration would increase awareness of the various sites and help protect heritage by making the public more aware that it is their heritage. The 2001 UNESCO Convention strongly states these objectives as the basis of the international agreement

and in many ways it fills the gaps of the Protection of Wrecks Act of 1994 with both expanded definitions and a more assertive stance on heritage protection (UNESCO 2001:3–4).

The 2001 UNESCO Convention does not impede state sovereignty relating to state vessels and it does not conflict with existing international law, including UNCLOS. The convention also does not interfere with bilateral, regional, or multilateral agreements concluded before state parties have adopted the 2001 Convention (UNESCO 2001:4–5).

Many of the 2001 UNESCO Convention’s articles urge countries and states to use “the best practicable means at its disposal,” meaning that for issues such as enforcement and protection, it is up to the State Parties and limited by their own capabilities, whether financial or security. In the convention’s Article 7, it addresses the issue of sovereignty within state-controlled waters, excluding the larger exclusive economic zone. The 2001 UNESCO Convention recognizes that the States Parties have exclusive rights to regulate activities in their territorial waters, but the convention is binding. Simply put, the convention acts as law, but the States Parties are responsible for enforcement (UNESCO 2001:4–5). This is problematic for nations with poor economies, or with limited means to enforce, investigate, or otherwise manage sites. Fortunately, Trinidad and Tobago is economically powerful, so they simply need to re-allocate money toward complying with the convention.

The continental shelf and exclusive economic zone’s rules under the 2001 UNESCO Convention are more complicated than in terrestrial waters. A State Party’s flagged vessel or national must report any activity they intend to direct to underwater cultural heritage. In these cases, it might be best that the United Nations and UNESCO become more involved and require cooperation between multiple nations (UNESCO 2001:6).

The greatest strength of the 2001 UNESCO Convention is that it is a binding multilateral agreement. This means pressure is applied to the government of Trinidad and Tobago as a State Party to the convention. Any transgressions cause negative publicity and may cause tension between Trinidad and Tobago and other States Parties. This will hopefully result in greater enforcement in the future.

RBRP and Public Outreach

RBRP has worked in Tobago's Scarborough harbor since 2012, investigating the naval battlefield from the Action of 1677 with the permission of the Ministers of Trinidad and Tobago, the Tobago House of Assembly, and the Port Authorities in Scarborough. Unlike other sites around the island, the shipwrecks near Scarborough are under the protection of restrictions already in place for the port and facilities. In addition, the conditions are not ideal for recreational diving, even outside the commercial area of the harbor. The shipwrecks in the harbor are associated with the adoption of the Protection of Wrecks Act in 1994 and over the past few years of excavation they have been the subject of considerable publicity (Paterniti and Inglis 2014).

During recent years, including those in which the RBRP has been in operation, it has become evident that the public does not recognize the shipwrecks as historically and culturally tied to their own lives in the modern day. They have grown receptive to the idea and shown interest in the finds of the foreign researchers. While they are only beginning to learn about the 1677 battle, a little-known episode in the island's history, other sectors are already more familiar. There is a moderately sized diving community on the island, serviced by a few dive shops, resorts, and natural attractions such as Buccoo Reef. Anglers are also aware of wrecks as hazards and as rich fishing grounds. There are commercial and recreational aspects to the wrecks outside

of Scarborough, but little archaeological work was conducted, and foreign firms and organizations performed much of the work. What the islands of Trinidad and Tobago could use most, in addition to legal restrictions and boundaries, are methods to advocate for the importance of the country's underwater cultural heritage to its people and the completion of efforts to establish an underwater archaeological presence permanently on the islands. The support and interest of the local population is not only beneficial to those people, but also crucial for the future of underwater archaeology in Trinidad and Tobago.

One recent attempt to expose the public to this area of Trinidad and Tobago's underwater cultural heritage, separate from the RBRP, is a docu-drama titled "Tobago 1677" (2014), directed by Rick Haupt and produced by Ocean's Discovery Tobago with redistribution rights sold to Skyvision. The film is an attempt to publicize the historical events and the archaeological heritage in the port of Scarborough. This is one avenue for gaining support and awareness when dealing with underwater cultural heritage.

Conclusions

Though there are several areas to improve upon, Trinidad and Tobago's 2010 ratification of the 2001 UNESCO Convention will bring about a great deal of change and improvement to the current system. The RBRP has helped lay the foundations for educational outreach about underwater resources. Past archaeological work, terrestrial and maritime, also helps bring publicity and awareness to cultural heritage. Future projects will do the same: aiding efforts to protect this heritage through increased public concern. In its current state, the legal framework can protect Tobago's resources, particularly those in Rockley Bay. That protection is crucial due to the high degree of human impact on the sites. Archaeological work has shown that the delayed reaction to archaeological material in 1991 caused significant loss of cultural material, and a lack

of protection in the future will lead to continued site instability and heavy influence of anthropogenic forces.

CHAPTER 8: Discussion and Conclusion

Through five seasons of recorded work from the Rockley Bay Research Project (RBRP), three of which included author involvement in excavations and surveys, a considerable quantity of observations and recordings contributed to the knowledge base regarding Tobago's underwater cultural resources. Overall, these observations helped answer several research questions for this thesis.

The first research question is: how have harbor development, commercial traffic, and the heritage management choice to contract a non-local underwater archaeological team compromised the historical integrity of the sites? The study of site formation processes acts as the primary archaeological theoretical framework for this question and further discussion warrants examination of those factors and how the sites focus fall into that framework.

Site Formation and Rockley Bay

One method of defining wrecks devised by Muckelroy (1978) is a system of five classes of wrecks, depending on their level of context and preservation, previously discussed in Chapter 3. Each increasing tier of classification indicates a more disturbed wreck, in which site formation processes scrambled the context. The classes are as follows:

Class 1: Extensive structural remains, many organic remains, many other objects, and coherent distributions

Class 2: Elements of structural remains, some organic remains, many other objects, and scattered ordered distributions

Class 3: Fragments of structural remains, some organic remains and other objects, and scattered ordered distributions

Class 4: No structural remains, little organic material, some other objects, and scattered or disordered distributions

Class 5: No structural remains and no organic material, few other objects, and scattered or disordered distributions (Muckelroy 1978:164)

Application of this system provides a simple and effective summary to the overall status of sites in the harbor and indicates the extent of past and current threats to the sites in Rockley Bay. There must be some flexibility to these classes, as modern cultural processes have interrupted a more orderly set of natural ones.

The first site excavated in Rockley Bay (TRB-1) by RBRP, requires adjustments to the guidelines on the five classes of sites. While the wreck is incomplete enough to suggest it has sustained damage for a very long time, having either flattened or eroded below the substrate level, it does contain intact and cohesive structural remains in the form of a keel, keelson, and timbers. Unfortunately, only one Phase II report from the team of NAS-trained divers is accessible. No extensive structural recordings or sketches are available from their excavations, nor are there any artifacts known in existence. The wreck has not undergone full excavation by either the NAS team or RBRP, but the brief survey by RBRP with a test trench revealed significant wood preservation, but very few artifacts, all of which are either unrelated to the site or otherwise out of context. The structure was thick and solid. Depending on the extent of the British team's survey, there may be few artifacts left on the entire site, meaning this wreck would be a combination of a Class 2 structure, with a Class 3 or 4 distribution of artifacts. In this case, it is highly probable that archaeology itself has had a significant impact on the preservation of the site and is the explanation as to why there are no artifacts within the test trench, now twice excavated.

The next three sites are also difficult to classify within a simple interpretation of this framework. TRB-2 consists of a 17th-century cannon with a steel cable wrapped around it and two small 17th or 18th-century anchors. The cannon sits on an arrangement of bricks. The cannon appears to be out of context if the dating is correct, as the bricks upon which it rests are thick and do not match the thinner Leiden bricks found on TRB-5. The team did not excavate deeper than the first layer of bricks, but they were at least 6 centimeters thick, compared to the thinner 4-centimeter bricks on TRB-5. The steel cable around the cannon indicates an attempt to salvage in modern time, resulting in re-deposition on its current site. The rest of the artifacts, including the bricks, are 18th or 19th century and include concreted fasteners, blue on white transfer pottery, glass, as well as butchered animal bones. Except for heavy objects such as bricks, or artifacts partially embedded in the substrate, the small artifacts often shifted daily, with significant variability, due to the flat topography and regular high-speed ferry prop wash. This site, like TRB-3 and TRB-4, is highly dynamic and encompasses a wide range of potential sources, from refuse to shipwrecks. It is entirely possible that these are Class 4 or Class 5 sites on top of deeper and more intact sites, a mixture of multiple Class 4 or 5 sites, or there is no shipwreck and only material dumped or moved from other sites. TRB-3 also has one cannon and similar small artifact scatter while TRB-4, formerly identified as a possible ballast pile, consisted of only a scattering of artifacts of mixed ages. Team members had difficulty identifying those two sites even after seeing them the prior year. It was also difficult to determine whether there were ballast piles, further proving the dynamic nature of the harbor's cultural material, as well as its topography. TRB-3 and TRB-4 are best classified as Class 5 sites at present, based on the evidence available. These two sites may be coherent wrecks upon further investigation and future excavation.

TRB-5 is a Class 3 site according to Muckelroy's scheme. The site is well hidden and the seven cannons identified on the site are heavily concreted to the coral and stones of the reef. Among the small pockets of sand and caves in the reef are small pottery fragments, lead sheathing, and modern debris. RBRP began excavating near cannons 4 and 5, adjacent to each other, and broke apart the rocks to reveal a cache of thin concreted bricks covered in coral growth and many small artifacts. Based on the concentration of the bricks and artifacts, which include eating utensils and more than 100 clay pipes, the trench may have uncovered the galley of the vessel. The bricks were consistent with the dimensional standard for those made in Leiden, in the Netherlands, from 1645 (Batchvarov 2016:7). Additionally, a Westerwald jug bearing the date 1589, likely the date of the mold rather than the manufacture date, reinforces the date and, possibly, the northern European region (Batchvarov 2016:10). Due to the protection provided by the reef, as well as the layers of bricks, the artifacts appear to be in situ.

Unfortunately, the only structural remains found have been soft wood fragments. East of TRB-5, TRB-6 is an anchor concreted to the reef. The upper 1.5 meters of the shaft were visible from the flat sandy bottom at the base of the reef and RBRP dredged beneath the anchor to survey for other cultural material. The identity of the anchor is currently unknown, but it may be related to TRB-6, or another wreck.

The site known as TRB-7, previously called TRB-6, was originally thought to be a ballast pile. After hand fanning and eventually dredging beneath the stones, the team concluded it is not a coherent shipwreck and is the product of dumping from elsewhere in the harbor. Though divers found 19th century bottles and other small artifacts, much like the sites elsewhere in the bay, there was no other evidence indicating it was a single ship at any point in time. As a result, the

team swapped its designation with the now-TRB-6 anchor, to place the anchor closer in RBRP's hierarchy to TRB-5.

Cultural and Non-cultural Transforms

Non-cultural (N) transforms comprise the factors and processes considered naturally occurring. In Rockley Bay, while these factors are considerable, the team mostly observed them in two forms: the worm-like clam *Teredo Navalis* and a single octopus and its collection of artifacts and pottery fragments. *Teredo* worms seemed to have a significant impact on the wrecks in the harbor. Given the Caribbean's warm waters, the burrowing worms are quick to take advantage of exposed wood. Fragments of wood on TRB-5 and TRB-1 contained many of the hardened tubes left by *Teredo* worms. There were no large timbers found in the TRB-5 trench excavated in 2014. The large timbers of TRB-1, such as the samples pulled from the keelson in 2013, had scattered worm holes and tunnels. It is unknown how much of this is due to exposure in modern times or historic exposure when it wrecked, if at all. These worm holes also interfered with Nigel Nayling's dendrochronological sampling and testing of timbers since solid samples proved a challenge to acquire, despite the abundance of timber on TRB-1.

Another animal to make an impact, albeit a small one, on the cultural material was an octopus living near TRB-5 in a small cave in the rocks and coral, observed several times on scouting dives around the edge of TRB-5. It had gathered fragments of pottery and ceramics but had not taken anything that appeared to be diagnostic or significant. While it had no major impact on the site's integrity, it should still be noted as one scrambling factor contributing to disorder among surface finds.

Biological processes undoubtedly include the breakdown of organic material by microbial organisms. Rockley Bay is rich in nutrients and run off from Tobago's rivers, as well

as some from the Orinoco River in Venezuela, which would be conducive to biological processes (LaPointe 2010). While RBRP has not tested the particulars and exact mechanics of these factors in Rockley Bay, sediment buildup and oxygenation play a large role in determining the presence of all biological processes, as well as some mechanical and chemical factors.

Sediment falls and flows downward to lower depths, depending on density and specific gravity. As it flows, currents and surf affect the sediment and cause accumulation in pockets and along objects. Very fine sediments create a protective layer around vulnerable materials, keeping wrecks from physical, biological, and human processes that would otherwise destroy them.

The area around TRB-1 is a perfect example of such an environment, where a fine gelatinous mud, in some parts over a meter thick, covers the wooden timbers and associated artifacts. The exact extent of this area is unknown and should be investigated. It is likely a result of river outflows, sediment shifted by the ferry prop wash, and the physical barrier of the nearby stone breakwater, which keeps currents and fresh ocean water out and the contents of the harbor in. RBRP observed during their time excavating a test trench on TRB-1 that the cloud of silt, disturbed by divers and dredging, resettled in the trench, nearly concealing it completely, but it was less congealed than the surrounding area. This quick re-deposition should minimize the impact of archaeological work on the site, but not completely negate the exposure.

Sediment in the central parts of the bay gradually shifts from silt to sand from east to west. In the areas where large boats are frequent and where the high-speed ferries turn in place to back into the slip, the sediment is very fine, but is compacted and mixed with stones, shells, and rougher sediment. Frequent prop wash blasts away and moves lighter substances and objects leaving a very level area. Some larger objects, such as bricks, ballast, or stones from dumping, cannons, and anchors, are partially exposed on the bottom. The substrate is composed of a

greater proportion of sand as it nears the reef's eastern ledge. On top of the reef, sediment is confined to the pockets, small caves, and crevices in the rocks and corals, where it also collects more shells and coral pieces.

Preservation of shipwrecks because of sediment is greatest in the eastern parts of the harbor, under the thick silt or the compacted material, but archaeological context is dynamic in all areas of the harbor. Apart from the compacted areas under the heavy ship traffic, the silt and sand of the harbor contain a mixture of old and new cultural material. While excavating the sand below the anchor at TRB-6, RBRP uncovered small organic objects such as leaves and nuts, beneath the level of the lowest points on the anchor, suggesting some degree of mixing. The same occurred near the TRB-7 rock pile, which indicates the site is a result of dumping old material and stones.

Cultural Transforms in Rockley Bay

The most significant cultural transform, within the scope of RBRP's research, was the Naval Action of March 1677. This historic battle deposited four French warships, seven Dutch ships, and three Dutch transports holding women, children, and slaves. The event was a human tragedy and should have resulted in an abundance of cultural materials and shipwreck remains. Where these remains are, or where they went, is the question RBRP sought and still seeks to answer. So far, only one vessel is a confirmed product of that battle, by its date and nationality (Dutch). This leaves at least 13 vessels unaccounted for in the archaeological survey. Some wrecks were likely the victims of the 1990 channel dredging and port construction, which covered a large portion of the coastline. One contributor to the lack of evidence could be historic salvage. Following the battle in March 1677, cannons would have been in high demand, especially when the Dutch were preparing for the return of the French. It is evident the Dutch

ships were short-handed and under-gunned to begin with (Figure 6), compared to the fully armed French attackers (Figure 7), and other valuables or armaments likewise may have been salvaged immediately after the battle to arm the terrestrial defenses. The lack of cannons, anchors, and other highly visible signs of a wreck does not mean there are no more wrecks in accessible parts of the bay and should not be interpreted as evidence of such a scenario.

Another process that would disturb and remove artifacts, especially cannons and anchors, is treasure hunting. While regulations and restrictions specific to the harbor should limit treasure hunting and looting, both of which are illegal in Trinidad and Tobago, RBRP observed evidence of successful treasure hunting and unsuccessful attempts.

As seen on TRB-1, archaeological work significantly affects the site formation of a shipwreck. Ideally, archaeologists attempt to preserve the wreck through documentation, recording, and recreating the wreck through everlasting information. Where information is lost, the only evidence left is the physical remains of the excavation underwater. The previous excavation, conducted by the English dive team in 2000, uncovered a long trench and a ballast pile remains, but within that trench only the structural skeleton of the ship is still present, where the artifacts and ballast once were. RBRP has tried to mitigate this on all excavations by recording the process, as well as returning artifacts that cannot be preserved to the sea floor. Archaeologists can only uncover a site in situ and in context once and exposure endangers the site to many other factors, such as treasure salvage and biological processes.



Figure 28. Metal buttplate from a rifle, found on the surface of TRB-4 (Photo by Doug Inglis 2016).

Prop wash is a regularly occurring process that affects the sites in Rockley Bay. Outlying sites are safer from the ferries and commercial vessels, but TRB-2, 3 and 4 become exposed daily. In the areas between those sites, the team found artifacts clearly out of context, such as the butt-plate of a firearm (Figure 28). It is possible that prop wash from the ferries has eroded the built-up sediment over ballast piles and other deposits and effectively leveled the topography of the harbor. The sites seem in equilibrium due to the packed sediment, but artifacts loosened and moved along the harbor floor. These three sites are also exposed to other commercial traffic and the future threat of more dredge work to deepen the channel.

The simplest way to map these cultural effects on site formation is to use a flow diagram, such as Muckelroy's (Figure 8) or Gibbs' (Figure 9). Muckelroy's flow diagram is the earliest and the most simplistic. Gibbs, on the other hand, presents a complicated picture of post-disaster salvage and other contemporary cultural factors. While it is most thematically fitting to modify

the latter, it presents too much information and continues a trend of adding more and more complex and detailed factors on to a growing chart, which is potentially an endless trend. Instead, this research will modify the original figure by Muckelroy. The result is the inclusion of a new set of factors, new inputs and outputs, post-equilibrium. Given the amount of time between the Action of March 1677 and steady colonial occupation and then the span between the Age of Sail and the introduction of steam and modern crafts, it is safe to assume the 1677 wrecks reached a state of equilibrium at some point in their existence.

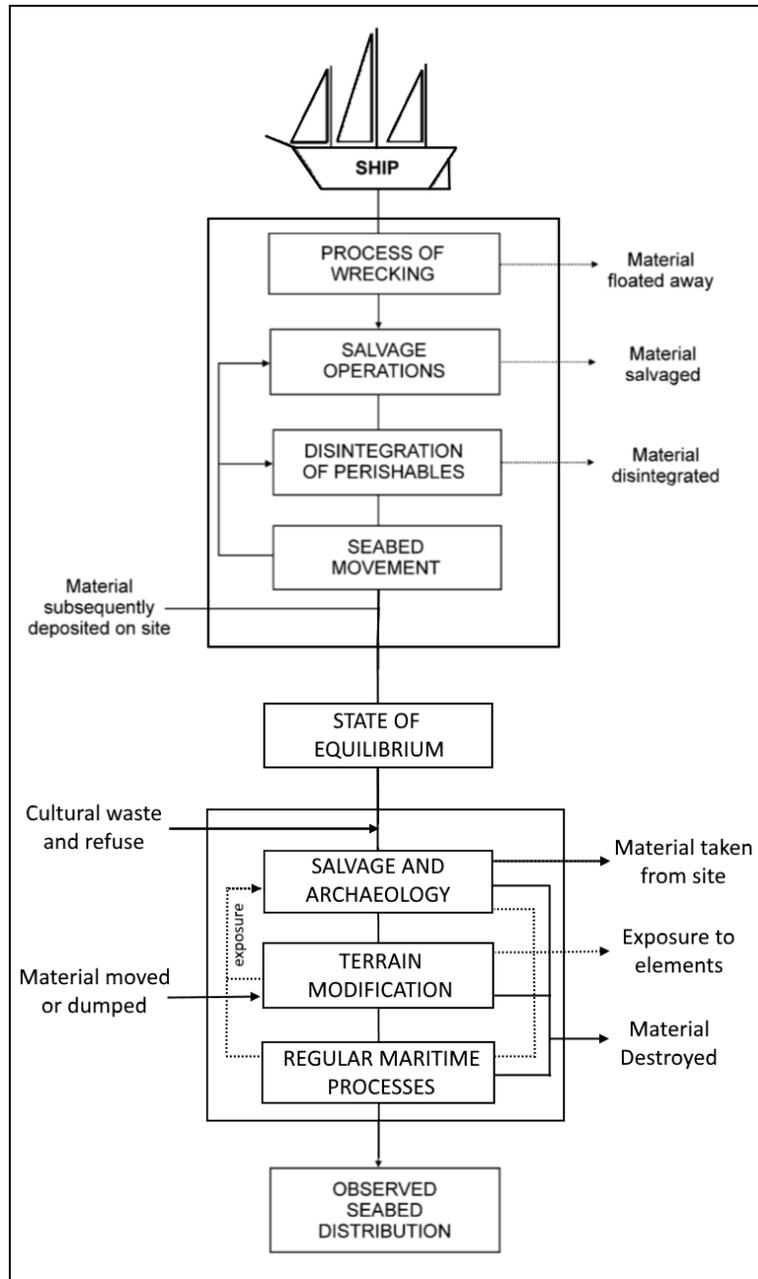


Figure 29. Site formation flow diagram, modified from Muckelroy (1978) by Thomas Lacey

The modified flowchart presented (Figure 29) adds modern factors as a new cycle in the lifetime of a shipwreck, separate from the initial closed system presented by other authors focused on historic factors. This modified diagram features three main processes. Salvage and archaeology refer to modern organized or unorganized attempts to unearth the site to observe or

salvage its contents. As previously discussed, there is some evidence of modern salvage in Rockley Bay and archaeology has had a repeated presence and role in exposing the wreck sites. Terrain modification defines those major cultural processes that act to dramatically alter the environment around the sites, such as dredging, construction, or the reclamation of land, it can also be used to encompass the byproducts of modification elsewhere, such as dumping or human alterations to tide or current flow. In Tobago, terrain modification includes the construction of the port facilities, alterations to freshwater outflows, dredging, and the protection of the breakwater. Regular maritime processes encompass the everyday or occasional wear and tear of marine usage, namely the operations of busy channels or harbors and the boat traffic that accompanies it. In the case of Rockley Bay, the biggest contributor is the daily ferry traffic, as well as occasional anchor scouring.

To summarize and answer the first research question, how the cultural transforms have affected the historical material in the harbor: they have affected the context and makeup of the artifact scatter, as well as the condition and presence of in situ artifacts. While only shipwrecks from 1677 can be entirely attributed to past cultural actions, other cultural transforms have removed, added, and scrambled materials. Past salvage and port modifications have altered, directly and indirectly, the sites on the sea floor, as is evident from the observations of the multiple projects conducted. Archaeology and modern salvage likewise either destroyed or removed cultural material. First-hand observations of the TRB-1 trench as well as the excavation process at TRB-5 are examples of alterations to the archaeological context by work that otherwise intends to preserve information through documentation. Finally, most evident to the observations of RBRP, the day-to-day actions of boats and harbor traffic, in conjunction with

regular, natural processes, continuously change and alter the environment and threaten the delicate equilibrium where it exists.

Management of Underwater Cultural Heritage

The second research question asks: how effectively have cultural resource managers implemented heritage legislation to protect the sites against development threats and to monitor archaeological compliance and best practices in field work? As discussed in Chapter 7, Trinidad and Tobago's national government has taken steps to adopt legislation and practices to align the country with other signatories of the 2001 UNESCO Convention and to imitate the legislation of the United Kingdom. Most of the legislation regarding underwater cultural heritage and shipwrecks is nearly identical to that of the UK, with alterations specific to the functions of the government in Trinidad and Tobago. Additionally, these acts were adopted early after the discovery of shipwreck material in Rockley Bay. The government enacted the Protection of Wrecks Act in 1994. Measuring its effectiveness since that time is difficult due to the specific circumstances of the known historic wrecks in Tobago and the impossibility of knowing exactly what is missing. There is one example: an unknown party took one cannon in the harbor out of the water and left it undocumented. The heavily concreted bronze cannon sat for years against the side of a warehouse in the port facility, before RBRP moved it out of the sun into the adjacent research lab. This demonstrates a lack of oversight, management, and protection, if only in one instance. Several cannons decorate the park to the west of the port facility as well. They are not documented in detail for the purposes of this thesis, but their origin is likewise unknown and there is no written evidence of any cannons raised during earlier excavations. In another example, a steel cable wraps the cannon resting on TRB-3, which appears to have snapped or been cut. Its location on top of a pile of 19th-century bricks and surrounded by 19th and 18th-

century material further indicates this 17th-century cannon was the victim of a salvage attempt. Unfortunately for all these cannons, they never received in situ documentation, nor is there any written record of when they were raised or moved. It is entirely possible that they moved prior to 1994, when there was no legal framework in place to protect underwater cultural heritage.

Another reason that makes it difficult to evaluate the effectiveness of heritage protection in Tobago is that the most well-known sites are in a protected harbor where diving is illegal. Both the Port Police and Coast Guard monitor the waters of the area that is small enough to easily patrol. Thus, in the case of Rockley Bay's shipwrecks, the protected status has been untested.

One positive sign for Tobago, and for Trinidad and Tobago nationally, is that they are showing reinvigorated interest in conforming to international standards of heritage protection, such as the 2001 UNESCO Convention (UNESCO 2001). This may have been a motivating factor in hiring an international team to assist in developing underwater archaeological research in Tobago and in documenting known shipwrecks in Rockley Bay. The Minister of Tourism also showed support for underwater heritage management by visiting the RBRP team in 2013. Embassy support from the United States and the Netherlands aids in promoting heritage preservation and provides additional backing for Trinidad and Tobago's efforts in management.

Despite these positives, there are several shortcomings to Trinidad and Tobago's efforts to manage their cultural resources underwater. These problems stem from the lack of any dedicated enforcement agency, as set out in the legal framework. While researching this thesis there seemed to be no evidence of any specific agency assigned to patrol or protect known sites. The legislative work also vaguely designated the ministers of government in charge of oversight. It is entirely possible that there is, in fact, enforcement in practice. However, the government may

adjust policies based on need and there may be too few examples of protected sites from which to expand. Finally, the problems with previous expeditions cast doubt on the outlook for Trinidad and Tobago's future in underwater archaeological research, including missing documents and artifacts from the English dive team in 2000 and a shortage of funding for future excavations. In addition to these problems, Trinidad and Tobago are pursuing further economic development and local team members and contacts dread the arrival of the all-inclusive resorts seen on other islands in the region.

Overall, the outlook for underwater cultural heritage in Trinidad and Tobago is good. It benefits from its status as a relatively untouched and lesser-known island. Though there are some gaps in the practice and legal framework, there is at least a framework from which to work and government and educational organizations such as the Historic Trust and the University of the West Indies which oversee the protection of terrestrial and submerged sites in Trinidad and Tobago. Finally, the islands' government pledges involvement in UNESCO and the 2001 Convention, giving support through several branches of government, including the National Museum, Ministry of Culture, and Ministry of Tourism, as well as aid through indirectly related branches like the Port Authority and Trinidad and Tobago Coast Guard.

The final question to address is: despite management challenges, what are the major contributions and significance of the extant material culture toward a greater understanding of the naval battlefield for the Action of 1677 and Tobago's connection to its maritime history? The nation of Trinidad and Tobago possesses a rich culture and history, as well as a tragic past, as Eric Williams (1962) has argued repeatedly. The Action of March 1677 is no exception, but prior to British and French colonization in the late 1700s, the early colonization attempts and capitulations appear disconnected and remote, decades removed from other events in Tobago's

history. While it is true that the battle was geographically and temporally isolated from other events, the battle connects Tobago to a period of colonialism and European rivalry. The archaeology of that battle helps connect modern Tobago to a brief episode in its past, in the context of a history where little else connects these two periods. Through further archaeological investigation, connections can be developed between the well-recorded colonial period of Tobago's history and this forgotten past. While RBRP has yet to draw any broader strokes from the archaeological remains of the battle, due to limitations in both the project's scope, time, and funding, as well as past heritage management issues, the project was able to shed a little light on smaller aspects of the Action of March 1677 and the people involved.

The lack of cannons found on TRB-5 is one of the most interesting points. RBRP discovered only seven cannons, while this vessel is most likely *Huis de Kreuningen*, a warship rated for 56 cannons (Figure 6). It is likely the Dutch relocated the vessel's guns to the star-shaped fort on land, either before or after the March battle. The latter would depend on the salvage capabilities of the Dutch following its Pyrrhic victory, but the fort did contain guns from the Dutch vessels. Another possibility for the location of the Dutch ship's guns is that salvage occurred nearer to modern times, taken from the seafloor to sell or to decorate a property. The guns on the site now are iron and heavily concreted. If the other guns were iron, they may not have been in salvageable shape. From most references to the dredging in 1990, the presence of shipwrecks was a surprise, so the chance of modern salvage contributing to the lack of cannons is small. The likelihood that an individual or group could have salvaged many guns from the sites without notice is low.

The unlikely scenario of modern salvage then points to a shortage of guns on board the vessels in the first place. Because they knew the French were in pursuit, the Dutch dug

themselves into their fort and the surrounding landscape and prepared for a land attack (Diligent Hand 1677). It was a mixed blessing for the Dutch that the French decided otherwise. D'Estrees did not focus on the terrestrial assault and simultaneously made a blunder by sailing into a small bay with the entire French naval force. The Dutch weakened their own squadron's fighting capacity, anticipating the opposite, and repelled the small landing force with ease. The French crippled the Dutch defenses and caused great casualties in destroying the transport vessels with slaves, women, and children. In turn, they lost their own flagship and had to retreat. There was no clear victor in the engagement and the French negated any true victory for the Dutch by taking the island later that year. The event is tragic and unique and stands out as a dramatic glimpse into an island that has a sparse history before the mid-18th century (Williams 1962).

The contents of the trench on TRB-1 also provided additional insights into the daily lives of the Dutch sailors. The abundance of silverware (Figure 30), pipes (Figure 31), and the large deposit of Leiden bricks (Figure 32), indicate the trench uncovered the galley. The pipes represent a sizeable proportion of all the artifacts found. The Westerwald jug, from the 16th or 17th century (Figure 33, 34, 35), narrows the window that determines the ship's age and also shows the presence of personal goods from other areas of Europe, in this case the German Rhineland. The date, 1585, indicates the jug was either around ninety years old at the estimated time of wrecking, or more likely, that it was a newer jug shaped from an old mold. Around it were other smaller ceramic and stoneware items, such as a white ceramic cup (Figure 36). An investigation into whether these items were personal goods or trade goods would be beneficial to the study of this wreck site.



Figure 30. Two-tined fork, possibly pewter and still very sharp (Photo by Doug Inglis 2016).



Figure 31. Gouda pipe with stippled markings on bowl (Photo by Doug Inglis 2016).



Figure 32. Leiden bricks, arranged for measurement. (Photo by Thomas Lacey)



Figure 33. Westerwald Jug, David, with 1589 year (Photo by Doug Inglis 2016).



Figure 34. Westerwald Jug, Joshua with 1589 year (Photo by Doug Inglis 2016).



Figure 35. Westerwald Jug, Alexander with 1589 year (Photo by Doug Inglis 2016).



Figure 36. Ceramic cup with white glaze, from the TRB-5 trench (Photo by Doug Inglis 2016).

Future Research

A prospective research question to acquire a better grasp on the cultural material in Rockley Bay would be the investigation into the other major events which contributed to the archaeological record. Hurricanes are contributors and wrecking events, but for the purposes of this thesis, their role was not researched at great length. Several histories of the island mention hurricanes, with no information regarding their impact on vessels or the harbor. In addition to other wrecking events, further research could also include more specific processes in the harbor, such as the composition of the sediment, or the geology and geography of the bay. This could include core samples or probing.

Due to time constraints, funding, and the size of the task, RBRP has only excavated a small portion of sites and probed a small number of the magnetometer targets. Tobago's tourism sector is small, but it is growing, and the Ministry of Tourism aims to introduce greater volumes of cruise ship traffic to Scarborough's harbor. In addition to searching for more material from the Action of March 1677, the bay needs emergency cultural resource management work if there are any further dredging and harbor improvements, including dredging for maintenance purposes. This means that any newly discovered wrecks and cultural material must be documented and any wrecks that RBRP only briefly explored deserve more research and documentation. TRB-1 requires expanded excavation to determine a more precise date and origin, as well as confirmation of whether there are additional artifacts not uncovered in 2000. TRB-3 and TRB-4 need probing and testing to measure the extent of any ballast pile.

Another research question outside the realm of this thesis was the extent of maritimicity and the local peoples' connections with the sea, as Charlotte Andrews (2010) has studied in Bermuda. The project caught glimpses into several sectors of society and while some embraced

the sea and the maritime world, such as fishers, others seemed less inclined. A study on this subject would be beneficial for public outreach, as well as the study of cultural perspectives for island and archipelagic countries. Similarly, investigation into the island's cultural connection to its past could be of benefit. These topics would address whether the history that Eric Williams (1962) described as sad, even among the islands of the Caribbean, is something that people would like to reflect on or look beyond in their own lives.

Conclusions

Tobago's waters contain unexplored maritime cultural resources and Rockley Bay Research Project has only just begun to investigate some of the most significant known shipwrecks, while discovering more wrecks and asking more questions as to their origins and contents. The theory of site formation processes in maritime archaeology, first explored by Keith Muckelroy, views shipwrecks and their formation as continual processes from the initial wrecking event up to their current states. Where conditions remain the same, the state of the wreck will continue to follow whatever pattern it has in the past, whether it degrades or stabilizes. In the case of Tobago's Rockley Bay shipwrecks, while the team observed the sites in covered and visibly stable conditions, the sites are threatened by gradual changes that may go unnoticed, as well as drastic changes likely to occur, but which have not yet started, such as future dredging or salvage attempts. While natural processes work to slowly destroy the sites, human intrusion in Rockley Bay threatens to expose or to destroy the remains of an historic colonial naval battle of 1677 to more significant natural processes. Examining the risks to these sites and exploring their importance, reveals the urgency with which the sites in Rockley Bay need public attention and thorough management plans.

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APPENDIX A: Tables

| Artifact quantities from TRB-5 from inventory re-taken in 2015 | |
|---|-----------------|
| Artifact type | Quantity |
| Pipes (bowls or stems) | 120 |
| Glass or ceramics | 30 |
| Weaponry (parts or shot) | 8 |
| Eating utensils | 10 |
| Miscellaneous metal | 12 |
| Wood (fragments) | 31 |
| Concretions | 21 |
| Faunal bone | 1 |

Table 4. Artifact quantities from TRB-5, from inventory re-taken in 2015.

| Brick | length | width | thickness | brick | length | width | thickness |
|-------|--------|-------|-----------|-------|--------|-------|-----------|
| 1 | 18.4 | 8.8 | 3.8 | | | | |
| 2 | 18.5 | 9.1 | 3.9 | 31 | 18.5 | 8.8 | 3.8 |
| 3 | — | — | — | 32 | 18.1 | 9.6 | 3.4 |
| 4 | 18.4 | 9.0 | 4.0 | 33 | 18.5 | 8.3 | 3.5 |
| 5 | 19.0 | 9.0 | 3.5 | 34 | 19.0 | 8.0 | 3.5 |
| 6 | — | — | — | 35 | 18.7 | 8.5 | 3.7 |
| 7 | 18.8 | 9.3 | 3.4 | 36 | 18.4 | 9.0 | 4.0 |
| 8 | 18.7 | 9.0 | 3.5 | 37 | 22.0 | 9.0 | 4.5 |
| 9 | 19.1 | 9.0 | 3.8 | 38 | 18.3 | 8.0 | 3.5 |
| 10 | 18.3 | 8.5 | 3.5 | 39 | 18.5 | 9.5 | 4.0 |
| 11 | 18.3 | 8.5 | 3.9 | 40 | 18.5 | 9.0 | 4.0 |
| 12 | 18.5 | 9.0 | 4.0 | 41 | 18.5 | 8.0 | 3.5 |
| 13 | 18.0 | 8.0 | 5.0 | | | | |
| 14 | 19.0 | 8.3 | 3.75 | 42 | 18.5 | 8.0 | 4.0 |
| 15 | 18.3 | 8.5 | 4.0 | 43 | 18.5 | 8.5 | 4.0 |
| 16 | 18.5 | 8.5 | 5.5 | 44 | 18.5 | 8.9 | 3.7 |
| 17 | 18.5 | 8.5 | 4.0 | 45 | 16.3 | 8.7 | 3.8 |
| 18 | 18.5 | 8.5 | 4.0 | 46 | 18.4 | 9.3 | — |
| 19 | 18.5 | 9.1 | 3.8 | | | | |
| 20 | 19.1 | 9.5 | 4.0 | | | | |
| 21 | 18.2 | 8.8 | 3.7 | Avg | 18.56 | 8.83 | 3.6639 |
| 22 | 18.5 | 9.4 | 3.7 | | | | |
| 23 | 18.3 | 8.8 | 3.8 | | | | |
| 24 | 18.8 | 9.0 | 3.7 | | | | |
| 25 | 18.5 | 9.2 | 3.8 | | | | |
| 26 | 18.5 | 9.0 | 4.0 | | | | |
| 27 | 18.3 | 9.0 | 3.7 | | | | |
| 28 | 18.2 | 9.5 | 4.0 | | | | |
| 29 | 18.2 | 8.9 | 3.8 | | | | |
| 30 | 18.3 | 9.0 | 3.9 | | | | |

measurements in cm

Table 5. Scan of brick measurements from TRB-5, originally recorded on mylar by Thomas Lacey.

APPENDIX B: Protection of Wrecks Act of Trinidad and Tobago

LAWS OF TRINIDAD AND TOBAGO
MINISTRY OF THE ATTORNEY GENERAL AND LEGAL AFFAIRS

www.legalaffairs.gov.tt

PROTECTION OF WRECKS ACT

CHAPTER 37:04

Act
13 of 1994

Current Authorised Pages

| <i>Pages (inclusive)</i> | <i>Authorised by L.R.O.</i> |
|------------------------------|---------------------------------|
| 1-9 | .. |

UNOFFICIAL VERSION
UPDATED TO DECEMBER 31ST 2015

L.R.O.

Note on Subsidiary Legislation

This Chapter contains no subsidiary legislation.

CHAPTER 37:04

PROTECTION OF WRECKS ACT

ARRANGEMENT OF SECTIONS

SECTION

1. Short title.
 2. Interpretation.
 3. Protection of sites of historic wrecks.
 4. Property in abandoned wreck.
 5. Discovery of abandoned wreck.
 6. Removal of wreck from Trinidad and Tobago prohibited.
 7. Licences.
 8. Prohibition on approaching dangerous wrecks.
 9. Orders subject to negative resolution.
 10. Revocation.
 11. Unlawful possession of abandoned wreck.
 12. Acts of emergency, etc., not an offence.
 13. Place of proceedings.
 14. Penalties.
-

3. (1) If the Minister is satisfied with respect to any site in Trinidad and Tobago waters that— Protection of sites of historic wrecks.

- (a) it is, or may prove to be, the site of a vessel lying wrecked on or in the sea bed; and
- (b) on account of the historical, archaeological or artistic importance of the vessel, or of any objects contained or formerly contained in it which may be lying on the sea bed in or near the abandoned wreck, the site ought to be protected from unauthorised interference,

he may by Order designate an area around the site as a restricted area.

(2) An Order under this section shall identify the site where the vessel lies or formerly lay, or is supposed to lie or have lain, and—

- (a) the restricted area shall be all within such distance of the site so identified as is specified in the Order, but excluding any area above the high water mark of ordinary spring tides; and
- (b) the distance specified for the purposes of paragraph (a) shall be such distance as is appropriate to ensure protection for the abandoned wreck.

(3) Subject to section 12, a person commits an offence if, in a restricted area, he does any of the following things otherwise than under the authority of a licence:

- (a) he tampers with, damages or removes any part of a vessel lying wrecked on or in the sea bed, or any object formerly contained in such a vessel; or
- (b) he carries out diving or salvage operations directed to the exploration of any abandoned wreck or to removing objects from it or from the sea bed, or uses equipment constructed or adapted for any purpose of diving or salvage operations; or

(c) he deposits, so as to fall and lie abandoned on the sea bed, anything which, if it were to fall on the site of an abandoned wreck, whether it so falls or not, would wholly or partly obliterate the site or obstruct access to it, or damage any part of the abandoned wreck,

and also commits an offence if he causes or permits any of those things to be done by others in a restricted area, otherwise than under the authority of such a licence.

(4) Before making an Order under this section, the Minister shall consult with such persons as he considers appropriate having regard to the purposes of the Order.

(5) The consultation referred to in subsection (4) may be dispensed with if the Minister is satisfied that the case is one in which an Order should be made as a matter of immediate urgency.

Property in abandoned wreck.

4. The claims of all persons to an abandoned wreck are barred and the property in such wreck is vested in the State.

Discovery of abandoned wreck.

5. A person who discovers an abandoned wreck within Trinidad and Tobago waters shall, within one month, notify the Receiver of same.

Removal of wreck from Trinidad and Tobago prohibited.

6. A person shall not—
(a) remove from Trinidad and Tobago waters; or
(b) export,

an abandoned wreck otherwise than under the authority of a licence granted under section 7.

Licences.

7. (1) A licence granted by the Minister, shall be in writing and—

- (a) the Minister shall in respect of a restricted area grant licences only to persons who appear to him either—
(i) to be competent, and properly equipped, to carry out salvage operations in a manner appropriate to the historical, archaeological

or artistic importance of any abandoned wreck which may be lying in the area and of any objects contained or formerly contained in the wreck; or

- (ii) to have any other legitimate reason for doing in the area that which can only be done under the authority of a licence;
- (b) may be subject to conditions or restrictions, and may be varied or revoked by the Minister at any time after giving not less than one week's notice to the licensee; and
- (c) anything done contrary to any condition or restriction of the licence shall be treated for the purposes of section 3(3) as done otherwise than under the authority of the licence.

(2) Where a person is authorised, by a licence to carry out diving or salvage operations, it is, subject to section 12, an offence for any other person to obstruct him, or cause or permit him to be obstructed, in doing anything which is authorised by the licence.

8. (1) If the Minister is satisfied with respect to a vessel lying wrecked in Trinidad and Tobago waters that—

- (a) because of anything contained in it, the vessel is in a condition which makes it a potential danger to life or property; and
- (b) on that account it ought to be protected from unauthorised interference,

Prohibition on approaching dangerous wrecks.

he may by Order designate an area around the vessel as a prohibited area.

(2) An Order under this section shall identify the vessel and the place where it is lying and—

- (a) the prohibited area shall be all within such distance of the vessel as is specified by the Order, excluding any area above high water mark of ordinary spring tide; and

(b) the distance specified for the purposes of paragraph (a) shall be such distance as is appropriate to ensure that unauthorised persons are kept away from the vessel.

(3) Subject to section 12, a person commits an offence if, without authority in writing granted by the Minister, he enters a prohibited area, whether on the surface or under water.

Orders subject to negative resolution.

9. An Order under section 3 or 8 shall be subject to a negative resolution of Parliament.

Revocation.

10. The Minister shall revoke an Order if—

- (a) in the case of an Order under section 3 designating a restricted area, he is of the opinion that there is not, or is no longer, any abandoned wreck in the area which requires protection under this Act;
- (b) in the case of an Order under section 8 designating a prohibited area, he is satisfied that the vessel is no longer in a condition which makes it a potential danger to life or property.

Unlawful possession of abandoned wreck.

11. (1) A person shall not without lawful excuse keep in his possession an abandoned wreck.

(2) Notwithstanding any other written law, an abandoned wreck referred to in subsection (1) shall be forfeited to the State.

Acts of emergency, etc., not an offence.

12. Nothing is to be regarded as constituting an offence under this Act where it is done by a person—

- (a) in the course of any action taken by him for the sole purpose of dealing with an emergency of any description; or
- (b) in exercising, or seeing to the exercise of, functions conferred on him by or under an enactment or a body for which he acts; or
- (c) out of necessity due to stress of weather or navigational hazards.

13. Proceedings for an offence under this Act may be taken Place of proceedings. and the offence may be treated as having been committed in the magisterial district located nearest to the Trinidad and Tobago waters within which the offence was committed.

14. A person guilty of an offence under section 3(3), 5, 6, 7(2), Penalties. 8(3) or 11(1) is liable on summary conviction to a fine of fifty thousand dollars and to imprisonment for three years.
