

Shipwrecks of St. John:

ECU Investigations of Submerged Cultural Resources
in the U.S. Virgin Islands National Park, 2002



Bradley A. Rodgers, Frank Cantelas, Nathan Richards,
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2006

Research Report No. 16

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ISBN 0-9741937-7-1 (Volume 16)

Cover: Heather White and Andy Weir working on the Leinster Bay site, 2002.

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Abstract

In 2002, faculty and students from the Program in Maritime Studies at East Carolina University coordinated a field season of remote sensing and site inspection of cultural resources located in the U.S. Virgin Islands with support from the National Park Service. Research focused on the island of St. John in an attempt to discover or re-locate shipwrecks in the Virgin Islands National Park. This report outlines the archaeological work done by East Carolina University in 2002. It additionally provides an outline of the maritime history of the U.S. Virgin Islands and the history of archaeologically oriented research there.

Acknowledgements

The series of activities undertaken by ECU in the U.S. Virgin Islands in 2002 required the assistance and cooperation of a large number of individuals, especially those associated with the Virgin Islands National Park (VINP). Participants in the initial remote sensing survey (January and February 2002) were Lori Lee (ECU Volunteer), Keith Meverden, Erica Seltzer (National Park Intern from Syracuse University), Ken Wild (Cultural Resource Manager, VINP), and local divers Scott Van Sant and Thomas Kelly.

Field crew participants in the September 2002 remote sensing and site investigations (in alphabetical order), were a variety of ECU MA and PhD students Sam Blake, Alena Derby, Kelly Gleason, David Krop, Russ Lewis, Brooke Lowry, Jimmy Moore, Jackie Piero, Drew Pietruszka, Will Spoon, Chris Valvano, Heather White, Andrew Weir, and volunteer Melissa Hendrickson. ECU Professors Dr. Larry Babits and Dr. Tim Runyan contributed expertise, organization, and difficult field hours. Ken Wild at the NPS proved an able guide – while organizing behind the scenes. Virgin Islands underwater archaeologists Dave Brewer also loaned a hand with advice and information. Thanks also to Gary Byrd for serving as the ECU Dive Safety Officer and international small motor mechanic. Larry Murphy and Daniel Lenihan also deserve our thanks for reading and commenting on National Park Service related work in the Virgin Islands.

Special thanks must be extended to John King (Park Superintendent, VINP), Joe Kessler (President, Friends of VINP), Rafe Boulon (Chief Resource Manager, VINP), and Thomas Kelly (DSO, VINP). Extraordinary help also came from Maggie Day, owner of Maho Bay Campground who gave us a deal on housing, David Knight, local historian also provided research materials, and Chip Elam boosted flagging spirits while contributing a strong back to equipment hauling. Finally, thanks to Jeremy Eamick for assisting with making changes to the various versions of this report.

Introduction

The submerged cultural resource survey of the Virgin Islands National Park outlined in this report was a two-part remote sensing survey conducted during the winter and summer of 2002. In January and February, project participants, under the direction of ECU Staff Archaeologist Frank Cantelas carried out a series of searches with side scan sonar and magnetometer in an attempt to locate and identify shipwrecks and other submerged cultural resources off the island of St. John. This was followed in June by a summer field school in underwater archaeology that focused on mapping submerged sites and additional remote sensing. The goal of the winter project was to evaluate the impact of a proposed mooring system on submerged cultural resources in several small bays adjacent to Hurricane Hole, located on the western end of the island. Several other areas were also examined for their potential to contain submerged cultural resources. Mr. Cantelas, staff archaeologist for the Maritime Studies Program at East Carolina University, and MA candidate Keith Meverden, conducted the initial survey using a proton precession magnetometer and side scan sonar. Several historic targets were identified including the relocation of an eighteenth century shipwreck.

From 1 June 2002 to 22 June 2002, East Carolina University led by primary investigator Bradley Rodgers and co-primary investigator Annalies Corbin conducted a field school in conjunction with the Virgin Islands National Park. One of the goals of the field school was to continue Cantelas' remote sensing survey. Parts of Hurricane Hole were re-surveyed along with Leinster Bay due to its close proximity to the historically significant Annaberg Plantation and discovery of submerged cultural resources in the area.

With assistance from the National Park Service (NPS), ECU staff and students participating in the summer field school conducted a visual archaeological examination of three sites in the waters of St. John. The activities included mapping the Leinster Bay wreck and ballast pile, a survey and test excavation in Water Creek, and documenting the wreck site of HMS *Santa Monica*, located in Hansen Bay. In addition to the didactic aspects of the field school, the goal of the 2002 fieldwork was to attempt an assessment of the submerged cultural resources of the U.S. Virgin Islands. The work on the *Santa Monica* wreck would eventually become a part of an interdisciplinary PhD dissertation in Coastal Resources Management completed by Kelly Gleason at ECU in 2006 (Gleason 2006).

While the clear, warm waters of the islands seem relatively benign, they are not without their challenges. This included rough sea conditions caused by winds, fire coral and other hazardous marine creatures, along with heat and sun. Nevertheless, the Virgin Islands are replete with a rich maritime history and archaeological opportunities. A primary objective of this research was to trace the

evolution of Virgin Islands society through the maritime activities that guided its development.

In this light, the archaeological sites investigated on St. John represent the diversity of the maritime cultural resources present in the United States Virgin Islands. In addition the variety of archaeological resources offered on St. John fosters a look into the multinational history of the Islands. The various maritime archaeological assets of the islands are inextricably linked to the story of the colonization and the dramatic maritime history of these small Caribbean islands.

A heavy reliance on trade forced nations to maintain military vessels in addition to commercial and plantation vessels in Caribbean waters. The various watercraft needed, from small plantation vessels to large warships, created a diverse maritime culture. The extensive history of these islands is stereotypical of many larger islands in the West Indies. Europeans originally colonized many of the islands to establish plantations, which in turn created an economic boom in Europe. Unsurprisingly, from the eighteenth century to the twentieth century, a period of sporadic colonial warfare resulted in nations fighting over the resources of the islands. Consequently, islands frequently changed dominion, a reflection of changing European authority in the quest for economic hegemony. From colonization, war, privateering, slave rebellions, disease, hurricanes, plantation life, and a transformation from an agricultural economy to a tourist economy, the history and development of St. John reflects the trends of other Caribbean islands.

The past two decades have witnessed an increasing awareness of placing Danish West Indian archaeology in a wider context, both in terms of the larger economic and cultural systems within which the colonies existed, and in terms of the international scholarly community of academic research and debate. The Danish West Indies, which originally included St. John Island, was a meeting ground between colonial and local systems, which is well-reflected through the investigation of the maritime heritage of the island. It is important to emphasize that Denmark was never a major colonial power. The colonial trade and plantations that flourished, for many years under Danish rule, are of interest precisely because they developed on the margins of the formal, European-controlled structure, where only creative local and regional systems could survive. The historical role of nearby St. Thomas as a center of economic activity set a pattern whereby the island became a regional urban center, attracting West Indians from the neighboring Virgin Islands as well as from the more distant Leeward islands. Local Creole systems were, in many ways basic to the later development of the Caribbean.

Project Location and Environment

The Virgin Islands are part of the Lesser Antilles, a chain of islands separating the Atlantic Ocean from the Caribbean Sea, and stretching from the Mexican Yucatan Peninsula to Venezuela. The Greater Antilles consist of the larger Islands of Cuba, Jamaica, Hispanola, and Puerto Rico while the smaller islands of the Lesser Antilles, including the Virgin Islands, make up the rest of the chain. The United States Virgin Islands are located in the extreme northwest portion of the Caribbean island chain referred to as the Leeward Islands, respectively between the Greater and the Lesser Antilles (Sleight 1965: 227) (Figure 1). St. Thomas, the northernmost island in the U.S.V.I., is west of the island of St. John. Separated by two or three miles St. John is approximately nine miles (14.58 km) long, varies in width from 2 to 4 miles (3.24 to 6.48 km), and totals a land area of 19 square miles (49.21 km) (Graves 1996: 23; Green-Pedersen 1996: 22).

Mostly volcanic in origin, St. John is characterized by mountainous topography with irregular coastlines, no coastal plains and very little flat land with numerous small islands adjacent to the coastline (Alminas et al. 1994:1; Graves 1996: 23; Hall 1985: 477; Sleight 1965: 227). The predominant features of the island are a main eastward trending ridge, sloping steeply to the north and descending to the ocean (Sleight 1965: 229). The southern side of the ridge has numerous spur ridges and gives St. John a maximum elevation of 1,227 feet (374 m) above sea level (Hall 1985: 477; Sleight 1965: 227). The island itself lies on an east-west axis.

The Virgin Islands are generally steep rocky prominences that project from deep ocean water. The Puerto Rico Trench is to the north and the Muertos Trough to the south. The islands are in the northern equatorial tropics and experience a very mild climate. They enjoy northeast trade winds most of the year, but are visited on occasion by devastating hurricanes during the summer and fall.

The largest natural harbor on St. John is Hurricane Hole. Hurricane Hole is a portion of Coral Bay on the southeast side of St. John. Within Hurricane Hole are four smaller bays along the north and east sides that cut deep into shoreline where high ridges protect the sheltered waters from strong winds. The four small bays, Borck Creek, Princess Bay, Otter Creek, and Water Creek, would provide the greatest protection within Hurricane Hole and are where modern moorings will be placed.

In these areas, shallow waters along the shore drop off quickly to deeper waters reaching 40 to 60 feet in the center and mouths of the bays. NOAA recently completed a benthic study of St. John that maps the distribution of coral reefs and other habitats (NOAA 2001). Within the project area the shoreline is bordered in mangrove forest. Seagrass and coral reef is found adjacent to the mangrove trees lining the shore. Deeper areas of the bays are covered in sand and silt. The island has a history of plantation agriculture with corresponding soil erosion. Rates of

erosion on the island and deposition in the bays are unknown but could be substantial. Sediments may have buried cultural material deposited in the bays making them difficult to find with side scan sonar or by visual survey. A magnetometer can detect buried ferrous metal objects.

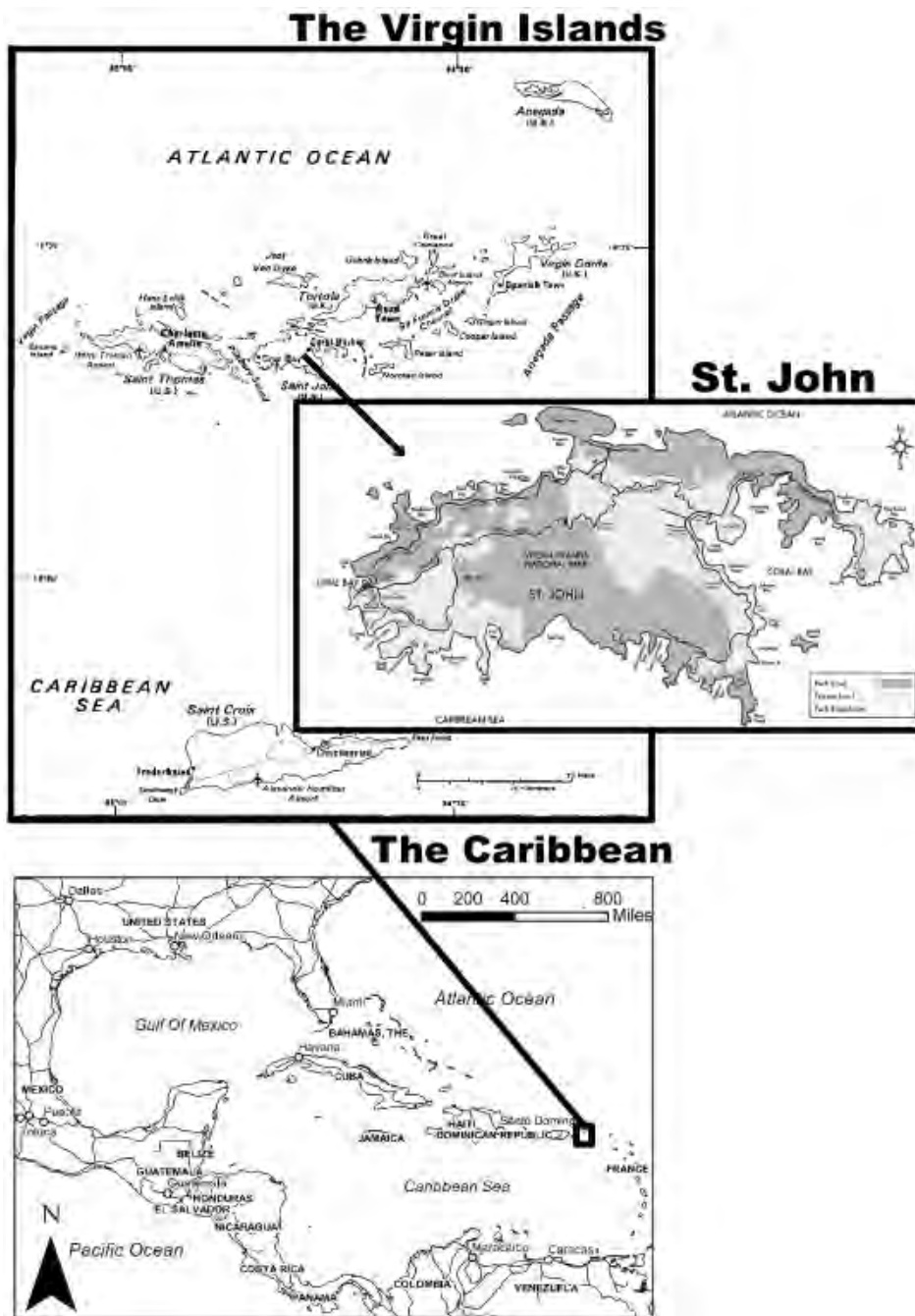


Figure 1. Location of the U.S. Virgin Islands (Program in Maritime Studies, 2006).

Geology

Geologically, St. John is composed largely of volcanic rock which is greenish to gray in color with horizontal and vertical fractures. Up to two feet (0.61 m) of topsoil often covers large amounts of alluvial soils present on the island. Two prominent rock outcrops dominate St. John. The Louisenhoj Formation runs the length of the northwest shore of the island. The sediments of the Louisenhoj Formation are largely pyroclastic in origin and geologists believe them to have originated from a vent in the underlying Water Island Formation (Alminas et al. 1994:5).

The Water Island Formation is composed largely of albite and quartz. Researchers believe the rocks in the Water Island formation to be of submarine origin and are the oldest rocks on St. John. The stones contained in the formation are very similar to Early Cretaceous forms which also exist in eastern Mexico (Alminas et al. 1994:6).

Based on the dates obtained from Potassium-Argon tests and fossil correlation it is believed that the island originally formed in the Early Cretaceous period, 105 to 110 million years ago (Alminas et al. 1996: 7). Following the deposition of Cretaceous sedimentary stones, the island was folded and faulted, allowing for the intrusion of igneous rock. During the Tertiary Period more volcanic and volcanoclastic sediments were deposited (Alminas et al. 1996: 4).

St. John also contains a large number of base metals in the soil. The most prevalent of these is tin, followed by silver. High levels of copper and barium are found as well. Gold occurs in larger amounts than on St. Croix but in lesser amounts than on St. Thomas. Lead is also present in small amounts (Alminas et al. 1996: 18).

The geological history of St. John includes volcanic episodes that are recorded in a number of igneous rock formations on the island. This volcanic history affects magnetometer survey and must be considered in remote sensing survey strategy.

The Caribbean Plate, bounded on the north and east by the North American Plate and to the south by the South American Plate, underlies the entire Caribbean Sea. The Greater Antilles island chain rides on a band overlying the convergent and transform zone between the Caribbean and North American Plates (Case et al. 1990: 16). Earthquakes and volcanoes are characteristic of geologically active areas. Evidence of past and present volcanic activity is prevalent in the Antilles. On St. John there is a geologic record of periodic volcanism as well as a number of sedimentary deposits associated with submergence (Mattson et al. 1990: 117-118). A number of fault zones are also present on St John very close to the project's area.

Important to the magnetometer survey is the effect of heating on the magnetism of rock, particularly the igneous rock found on St. John. When rock is heated it becomes magnetized in relation to earth's magnetic field. It will retain this remnant magnetism until heated again. Since the Earth's magnetic poles migrate over time, remnant magnetism may or may not be in the same direction as the earth's present magnetic field. Rock may have moved due to tectonic processes

and the earth's magnetic field has been known to change its orientation. Remnant magnetism is measured independent of the earth's present magnetic field (Breiner 1973: 8-9).

While conducting surveys in the Virgin Islands, Alan Albright encountered problems associated with remnant magnetism when using a magnetometer. He observed erratic background magnetism and determined the cause was remnant magnetism, which caused a wide variation in the earth's magnetic field. In his words, "This severely cut down the overall effectiveness of the magnetometer as the "background noise" from the rocks often gave a higher response ... than a wreck would" (Albright 1975). The problems encountered by Albright were obviously caused by the igneous rock composing the island.

Hydrology

Water is scarce on St. John, and locals often collect as much as they can through the use of cisterns set up to collect rainwater. However, groundwater does exist and is present in the volcanic rock and alluvial deposits. Depth below land surface to the water table can range from between eight and 60 feet (2.43 to 18.30 m) (Graves 1994: 27). This ground water contains a high degree of salt water. How this water is seeping into the aquifer has yet to be determined (Graves 1994: 35).

Vegetation

Approximately two-thirds of the island of St. John (about 14,418 acres) is part of the Virgin Islands National Park, established in 1956 (Little 1974: 26). Despite protection as a national park, no virgin forest remains on St. John after the Plantation Era (1718-1848) and most vegetation is secondary growth. Vegetation on the island varies according to precipitation, soil type, and elevation. The island's northern end and mountainous regions are densely forested. Thick mangroves generally border protected bays, lagoons, and estuaries on the coasts (Little 1974: 20). In southern areas, more exposure to the elements combined with shallow soil produces comparatively sparse growth of scrubby woodland and cactus on dry rocky slopes. The heavily forested areas below the mountains belong to four categories, moist coast, moist limestone, dry coast, and dry limestone (Little 1974: 21).

The moist coastal region vegetation originally included native evergreens, but deciduous trees currently dominate. The soil in this area is very moist, and is able to support a wide variety of trees and shrubs. The moist limestone regions are distinct from the moist coastal regions for several reasons. Limestone areas are closer to the central mountains, with drier soils due to the well-drained limestone hills, but valleys between the hills produce high humidity. Few of the same trees grow in both areas. The vegetation found in the dry regions is drastically different from the previous two areas. Most trees common to the north side of the island cannot survive in either the dry coastal or dry limestone regions (Little 1974: 21). These areas experience major soil drainage. This produces an extremely dry environment where only hardy shrubs, trees and cacti live (Little 1974: 21).

Climate

The climate of St. John is much the same as for St. Thomas and St. Croix. Characterized as a maritime tropical environment, the average annual rainfall is usually between 50 and 59.84 inches (127 to 152 centimeters) at altitude, and between 19.69 and 29.92 inches (50 to 76 centimeters) at lower elevations (Alminas et al. 1994: 1). The mean annual air temperature for St. John, as recorded by NOAA between the years 1982 and 1992 was 78.4 degrees Fahrenheit (25.78 degrees C) (Graves 1996: 23).

Historical Background

Many scholars studying the Virgin Islands have noted the difficulty of writing an accurate and concise history of them. There is little published on the subject, and finding primary source material can be difficult. William Boyer (1983: xvii) made the following comment regarding his research in the Virgin Islands:

. . . the Virgin Islands government has no archives, except in name only . . . The Government of the Virgin Islands has no filing or record system, no records retention system, and no archives system. Each government official decides what records under his or her jurisdiction should be retained or destroyed. As each Governor has left office, he has taken his files with him. The scholar, given such anarchy, is thus denied access to important public record.

Nevertheless, the Virgin Islands has a rich maritime history, and it is of pivotal importance that this be sought out to understand the nature of submerged resources that may be found in the waters there.

The following section focuses on the international, coastal, and inter-island trade that the Danish Virgin Islands' merchants and plantation owners were involved, and the way that European conflicts often positively affected the Danish Virgin Islands' trade. Additionally, it outlines a brief history of Estate Annaberg, which turned out to be the location off which most of the notable cultural resources discovered during the 2002 East Carolina University field school were found or re-located.

Discovery

Christopher Columbus discovered the Virgin Islands in 1493 on his second voyage to the New World. Impressed by the geographical uniqueness of the islands, he named them for St. Ursula and her eleven thousand sea-going Virgin of Christian mythology (Dookhan 1974: 2). The innumerable bays that dot the coastlines of the islands are notable geographic features that have made the islands attractive for settlement. Most of these bays are deep with relatively small openings, making excellent harbors for ships by offering shelter against rough seas and high winds. St. Thomas Harbor, Krum Bay in St. Thomas, and Coral Bay (Figure 2) in St. John are examples of this type of bay. The accessibility of bays like these contributed greatly to the Virgin Islands becoming an important maritime hub. The prevailing winds of the Virgin Islands for most of the year are the North East Trade winds – winds which also add to the economic viability of the islands.

The discovery of the Virgin Islands, like the rest of the West Indies, followed Spain's claim of exclusive rights to the islands (Dookhan 1974: 31). The Spanish monopoly lasted until the sixteenth century when the actions of privateers commissioned to attack Spanish West Indian possessions forced Spain to grant concessions to other European countries wishing to trade in the West Indies.

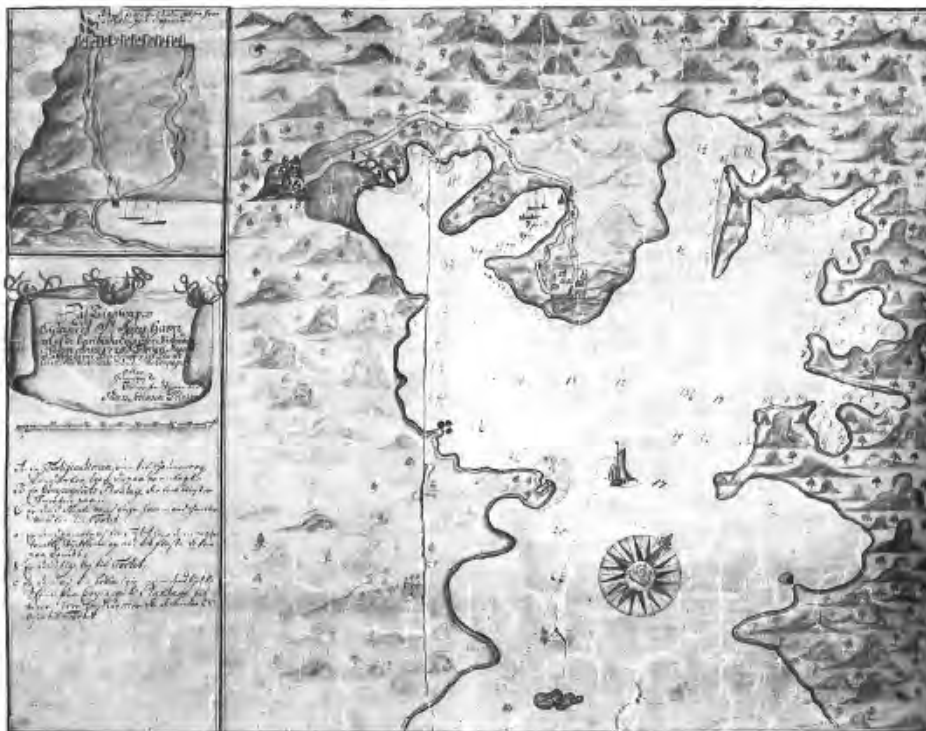


Figure 2. Map of Coral Bay Harbor, by Anders Sørensen Diinsen, 1720 (Low and Valls 1985: frontispiece)

Colonization

Initially named Santa Cruz, the area's dominant island St. Croix was the first of the Virgin Islands to be officially settled (by Dutch and English settlers) in 1625 (Boyer 1983: 3). Prior to the Dutch claim in 1625, English, French and Danish settlers coexisted on the island peacefully (Dookhan 1974: 43). This short-lived peace ended with the expulsion of all non-English settlers from the island.

In 1650, the Spanish government out of Puerto Rico attacked and captured St. Croix. Shortly after Spain gained control, the island was attacked again, this time by the French. The French were able to maintain control, and sent 300 settlers to the island. This settlement quickly fell victim to hurricanes and disease, and disbanded shortly after arriving. A series of failed colonization attempts by the French followed, eventually leading to the sale of the island to Denmark in 1733. By the time the Danes had full control over St. Croix there were over 150 British settlers living there, together with 400 to 500 slaves (Dookhan 1974: 45).

On the smaller islands to the north of St. Croix, the fading of Spanish power in the seventeenth century made it possible for the establishment of the first Danish colony, in 1665, on St. Thomas. The attempt failed due to numerous encounters with English privateers, hurricanes and disease that devastated the colonists (Dookhan 1974: 36). The Danes eventually abandoned the settlement in 1668.

In 1672, the Danish government made a second attempt to colonize St. Thomas. This attempt was much more ambitious than the first one. The Danish government sent over 190 people to St. Thomas consisting mainly of employees of the Danish West India Company and persons recruited from prison or other unsavory realms of society (Dookhan 1974: 38). Despite a new approach in choosing colonists, the voyage to the island and the first seven months there reduced the number of colonists to 29. Despite the staggering losses, the Danish government considered the colony a success.

The acquisition of this island and its successful colonization marked the emergence of Danish landholding in the New World; a relatively late phenomena when compared to the Spanish, English, French, and Dutch (Hall 1985:476). The Danes were principally engaged in the mercantile trade, a profitable enterprise in the Caribbean which caused them to look for additional islands to extend their commercial ventures (Feldbaek 1986: 209; Svalesen 2000: 8; Westergaard 1917). As mentioned, St. Thomas was the first of these islands claimed for the purpose of establishing a port at Charlotte Amalie, a well protected harbor on the south shore of the island (Olwig 1993b: 53). The Dutch and the English preceded the Danes in the occupation of St. Thomas, but as is known, they were at no time present in large numbers (Pendleton 1917: 269).

As the Danish utilized the land as a foothold in the Caribbean for their tobacco, cotton, indigo, and sugar plantations, St. Thomas became extensively developed (Knox 1852: 35; Pendleton 1917: 269, 271). Due to the scarcity of labor, enslaved Africans from the Danish-African possessions undertook the majority of the work. Under the encouragement of King Christian V, the first cargo of enslaved Africans from the Danish forts in Africa were brought to the West Indies in 1680 (Pendleton 1917: 269). The Danish colonies used the labor of enslaved Africans for both plantation and maritime activities. The profitability of this colony created the necessity for further annexation of land (Hall 1985:479; Armstrong 2003:26-27).

The small island of St. John was an attractive and easily accessible target for this expansion due to its close proximity to St. Thomas and was consequently taken by the Danes in 1718 (Feldbaek 1986: 209; Olwig 1993a: 14; Westergaard 1917: 127-130). The successful settlement of St. John also ended the ongoing debate between the Danish and British government concerning ownership of the island (Armstrong 2003: 26-27).

The history of St. John is inherently linked to Danish involvement in the slave trade, and the need for economic expansion from St. Thomas. The plantation systems which formed in the Danish West Indies were strictly controlled to maximize plantation profits (Olwig 1993a: 1). The fact that economic gain was the major determinant in establishing plantations on St. John significantly contributes to an understanding of the plantation dynamics and their reliance on shipping. Not only did St. John provide new lands on which to expand sugar production, but it also

afforded St. Thomas planters and maritime merchants a much-needed source of provisioning supplies, and the possibility of a better place to grow cotton, sugar, or other cash crops.

A primary reason for the colonization of St. John was the limited agricultural potential of St. Thomas, used to supply food to residents of Charlotte Amalie as well as incoming maritime traffic. Soil depletion, droughts, overpopulation, and plunging prices all spurred the economic need to increase production of cotton, sugar, and provisions. St. Thomas was cultivated with practically all fertile land exploited by 1715.

St. John is only two miles east of St. Thomas (Westergaard 1917; Larsen 1986:18). Because of this settlers attempted to colonize St. John many times, but failed due to competition between England and Denmark, both of whom claimed St. John. Unshaken by the protests of the British government, the Danes secured a settlement on the small island by 1718 (Dookhan 1974: 41). Reportedly an assembly composed of one colonial representative, 20 planters from St. Thomas, five soldiers, and twelve slaves raised the Danish flag on the island, “fired a few gunshots, drank to the health and prosperity of the Danish king and the West Indian Company, and decided on a site where a fort was to be located” (Knight 2002:3; Olwig 1993a:14). Once the clearance of the island began and plantations were founded, land owners and planters of St. John tended to maintain their permanent residences on St. Thomas, the nearby British Virgin Islands, or Europe, since St. John was only seen as an economic and administrative appendage of St. Thomas (Gøbel 1990: 113; Green-Pedersen 1996: 23; Olwig 1993a: 17).

During the first year of Danish settlement, ten land deeds were granted in the Caneel Bay quarter of St. John. The lands bordered the bays and inlets of this west end of the island, while the domestic and production facilities would have been established on the inland and often upslope portion of the property. A small community was established towards the eastern end of the island at the entrance to a large harbor, now called Coral Bay. This bay provided an attractive location for a settlement due to its desirable position, protection from storms and hurricanes, and its suitability for agriculture (Dookhan 1974: 41). From the fort dominating the heights above called Fortsberg, the Danes had a strategic command of the harbor and the surrounding countryside. In 1733, the year a great slave revolt rocked the island, this garrison only consisted of six infantrymen, one corporal, and a lieutenant (Hall 1985: 479; Pendleton 1917: 271). The plantations themselves also operated with only a skeleton staff of land holders, forcing a government ordinance that required each plantation to have one “white” person on the property within three months. Taxes were exempted for the first eight years, and sugar mills were to be erected within five years. By 1720-1721, 39 planters had received deeds for plantations on St. John, the majority of which were Dutch.

In the early eighteenth century St. John, had no real town, and no weekly market. Therefore, it was necessary for the local plantations to ship their goods to markets on the surrounding islands (Olwig 1993b: 51,140). The Annaberg Estate is a prime example of the inter-island trading network. During its existence, merchants regularly shipped cargo to the island of St. Thomas, Tortola, and Puerto Rico. This dependence on inter-island trade and subsequent distribution of cargo

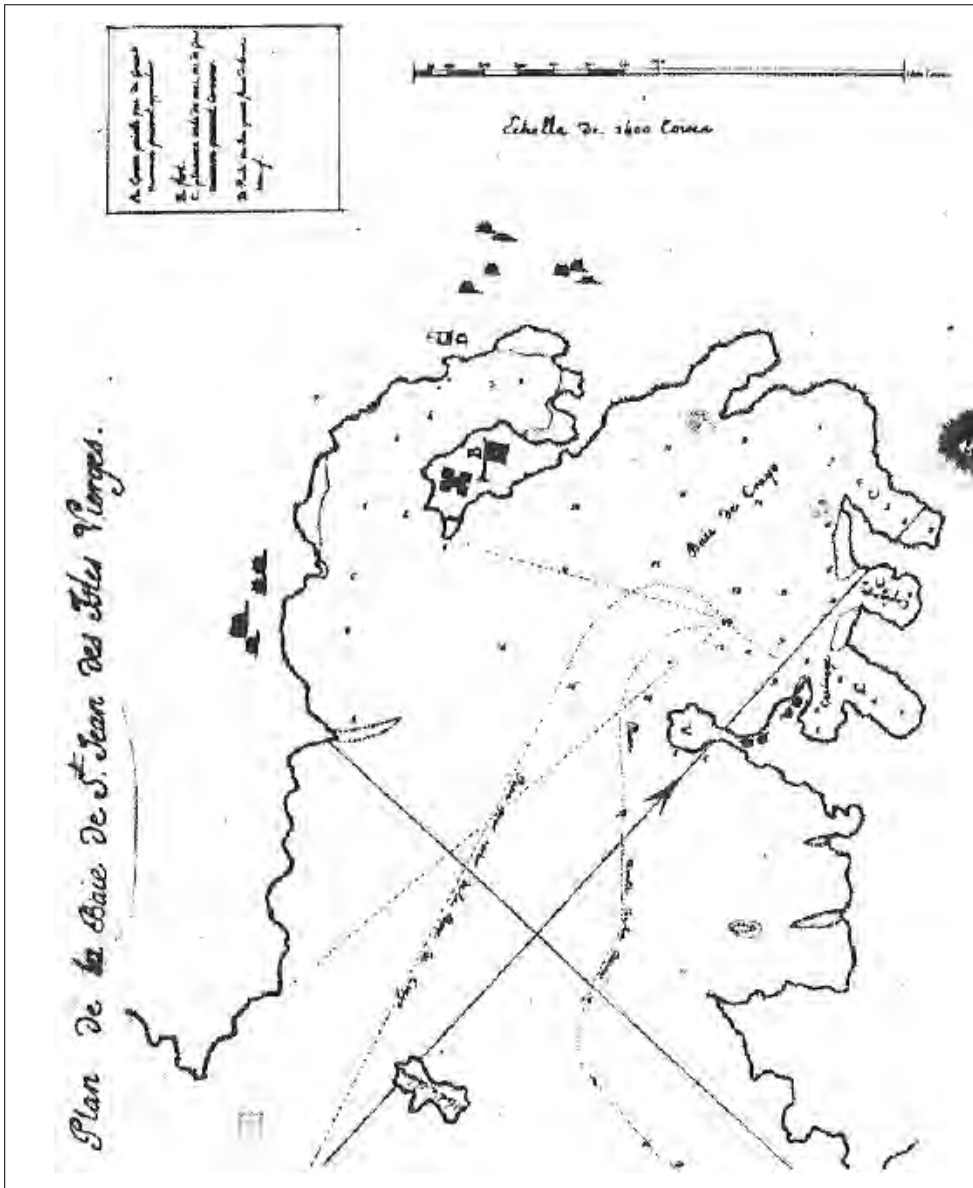


Figure 3. Undated French naval chart of Coral Bay (believed to be pre 1789) (Low and Valls 1985: 9).

throughout the Caribbean and onwards to European nations and colonies played a significant role for many plantations throughout the Caribbean islands.

Ultimately, St. John and St. Thomas were unsuccessful at yielding profitable amounts of sugar or cotton. This much-needed agricultural income was, however, provided by St. Croix, after it was purchased from the French (Feldbaek 1986: 210; Hall 1985: 476; Olwig 1993: 14-15). This purchase was initiated when the King and wealthy elites realized that St. Croix's greater cultivated acreage may alle-

viate the supply situation (Feldbaek 1986: 209). Under more stable Danish control, St. Croix made progress, becoming a Danish West Indies sugar colony, and by agricultural standards, the most profitable of the three Danish islands. Subsequently, the seat of government transferred from St. Thomas to St. Croix (Olwig 1993: 15; Pendleton 1917: 272).

By 1735, Denmark was in full possession of St. Thomas, St. John and St. Croix. However, this possession did not go unchallenged. Both Spain and England continually raised objections to the Danish control of the Virgin Islands. During the French Revolution and the Napoleonic Wars (1793-1815) the Danish West Indies were seized twice by Britain, once in 1801 and again in 1807 (Dookhan 1974: 47). The British eventually returned them to Denmark in 1815 when the Danish surrendered to Britain under the Treaty of Paris. The ease with which the British captured the Virgin Islands illustrated the weakness of Denmark's colonial defense. There was no organized system of naval defense on the islands; the Danes simply depended on their neutral position during war for their safety (Dookhan 1974: 47). Though colonial wars were a problem the biggest fears of the colonists living on the island were created by the numerous privateers and pirates that constantly roamed the Caribbean. Although the colonists may have disagreed with them, Danish authorities felt the three larger forts that occupy the islands, Fort Christian in St. Thomas and Christiansvaern and Frederiksvaern in St. Croix, and the smaller forts such as Fortsberg were adequate defense against this threat (Dookhan 1974: 47). Supplementing the forts were two small Danish naval vessels stationed off the islands.

Trade in the Virgin Islands

As mentioned, the origin of the Danish West Indies' maritime history in the New World began in the same way as other European nations, with Columbus' four voyages from 1492 to 1502 (Pendleton 1917: 268). These voyages marked the beginning of the transatlantic trading system, and the substantial network of European maritime economics that would follow. Spanish adventurers arrived in the Americas hoping to gain riches, and soon enslaved the Native American peoples in their search for gold and silver. Disease, malnutrition, and Spanish atrocities led to the death of millions of these Native Americans (Cook 1998: 201-216). By the 1520s, the depopulation of the Greater Antilles prompted the Spanish government to look for alternative sources of labor, beginning the first transatlantic slave voyages from West Africa to Hispaniola (Eltis 2000: 15; Thomas 1997: 100). The slave trade increased exponentially from the sixteenth to the eighteenth century. Although the largest traders involved in this odious investment were English, Portuguese, Dutch, and French, by the 1680s a variety of nations, private trading companies, and merchant-adventurers also sent slaving vessels to Africa. Among these were merchants from Germany, Sweden, Brandenburg, and Denmark (Curtin 1969: 32; Feldbaek 1986: 210; Odotei 2002: 11).

In spite of the restrictions placed upon individual Danish subjects wishing to profit from the slave trade, the Danish West India Company's monopoly was not absolute. Contraband trade arose, especially in the early years of Charlotte Amalie

on St. Thomas. In the West Indies piracy and privateering, particularly in the sixteenth and seventeenth centuries, flourished openly and many islands of the West Indies afforded safe anchorage and refuge for smugglers offering wood for repairs, water, and provisions. In addition, the colonies of the European powers grouped within a few days sail of one another were forever embroiled in current European wars which gave the stronger of the privateers an excuse to prey on the weaker nations, stirring constant disorder at sea (Barbour 1911: 529).

The number of enslaved Africans brought to the West Indies by the Danish trade was imposing, yet it is small compared to the total numbers for the African slave trade by all nations across the duration of history. According to Curtin's estimate, the Danish trade accounted for less than 2% of the total (Curtin 1969: 86). While all three of the Danish Virgin Islands utilized enslaved labor, St. Thomas became more a transshipment point, distributing new laborers to St. Croix and St. John. The Danish West Indies slave trade adopted two distinct functions: one that was African and import in nature, and another notably West Indian and export in function (Green-Pedersen 1996: 18). In this way, the Danish slave trade was both international and local; however, it appeared that the plantations established a local network of inter-island trading, exemplified through the workings of the plantation systems on the three islands.

For most of the 250 years during which Denmark possessed its small colonies in the West Indies and Africa, shipping and trade to these colonies was of great economic importance. Between 1671 and 1807, more than three thousand voyages were undertaken (Gøbel 1990: 107). An additional two thousand voyages from Denmark to the West Indies took place until the mid-nineteenth century. The Danish slave trade voyages were of importance only until the mid-eighteenth century during the monopoly of the West India and Guinea Company. After 1755, it became increasingly exceptional for Danish ships to sail to Africa (Gøbel 1990: 109-112; Svalesen 2000: 9). It seems likely that it became more economical for Danes to purchase slaves in the Caribbean from other nations.

Although transatlantic shipping was important, Caribbean inter-island shipping was most important to the plantation owners on St. John. The majority of goods produced on these plantations were reserved for direct Danish trade and controlled by the Danish West India Company. However, due to inconsistent service of the Company, plantation owners became more active in small scale trade with neighboring islands. The port of Charlotte Amalie, which remained neutral in times of European tensions and wars, attracted vessels from all nations, becoming a hub for inter island shipping. In Charlotte Amalie, the town limits extended, business establishments multiplied, and thousands of refugees, adventurers and capitalists sought its shores for commercial purposes (Hall 1985: 488; Olwig 1993b: 54; Pendleton 1917: 275-276).

In this manner, Danish West Indian colonies established strong trading relations with the surrounding West Indian and mainland North American British colonies. Positioned between Spanish Puerto Rico with its possessions to the west, and Britain's Virgin Islands to the east, the three islands prospered on inter island trade. It seems likely that all of the colonial powers prospered via this trade allowing the three islands to remain under Danish administration (Gøbel 1994: 156).

Economic openness and geography helped expand shipping from the Danish West Indies (Gøbel 1994: 161-165; Hall 1985: 481). As Hall writes, "the schooners, brigs, sloops, yawls, and snows that called these towns, especially Charlotte Amalie as it became a Caribbean entrepot," brought St. Domingue/Haiti and Jamaica in the Greater Antilles, the islands of the Leewards and Windwards, the North American continent, and even Europe within reach (Hall 1985: 490). In order to secure full cargoes on their ships, the Danish West India Company permitted trade with neighboring islands (Dookhan 1974:93). Once trade relations with the other colonies were established, merchants exchanged the products of the Virgin Islands, such as sugar, molasses, rum, cotton, and wood for other merchandise. This inter-colony trading system soon became an invaluable source of income for the plantation owners in the Virgin Islands and particularly for St. John.

During the eighteenth century, the various conflicts between competing European nations tended to benefit trade between the Virgin Islands and American colonies, even when war impeded European-Caribbean trade (Feldbaek 1986: 208; Gøbel 1990: 113). The Dutch, Danes and Swedes freely admitted U.S. commerce into the West Indian ports they administered. Goods sent to these islands were occasionally smuggled into the British and Spanish islands, but most evidence indicates that this illicit trade was not large (Coatsworth 1967: 247). With the outbreak of war among the European Colonial powers in 1793, there began a period of rapid expansion of United States trade with the West Indies (Coatsworth 1967: 250). This advantage was heavily influenced Danish neutrality during war, whereby its ports remained open (especially Charlotte Amalie), to all nations and colonies (Gøbel 1994: 157). The American Revolution had a depressing effect on this trade, but with the establishment of American independence in 1783, American traders were free from British laws. Subsequently, a great amount of illicit shipping took place throughout the 1780s. During these years, the Danish received American vessels, and often re-exported goods to the British West Indies (Keith 1948: 2).

This state of affairs continued until 1800 when Denmark became involved in a war with Great Britain, who blockaded the islands. The Danes endured for a while, but eventually surrendered to the British in 1801. After holding the Danish Virgin Islands for ten months, the British lifted the blockade and returned their possessions to the Danes in 1802. From this point on, America's trade with the Virgin Islands continually increased until 1807, when the British again captured the Virgin Islands. This occupation lasted until 1815 with the end of the Napoleonic wars in Europe (Gøbel 1994: 157; Green-Pedersen 1996: 25; Hall 1985: 476; Pendleton 1917: 276). During this eight year period, the majority of trade between the United States and the Virgin Islands occurred via smuggling, or through indirect trading with Canada. This ended when the British occupation of the islands ended, and trade once more resumed through traditional channels. The Danish colony survived economically, via coastal and inter-island trade which provided the security the plantations on the island needed. In times of peace, or in time of war, St. John's plantation owners shipped their products to market. As seen, sometimes these wars improved economic relations between the Danes and their trading partners.

The development of the Danish West Indies economies and the slave trade are inter-twined. Throughout the slave trade, the Danes played a small yet persist-

ent role on the African coast and in the Caribbean. Sailings by private merchants and ship-owners from Gluckstadt in Holstein, and from Copenhagen to Africa during the 1640s resulted in the establishment of the Gluckstadt Guinea Company in Copenhagen in 1651 and the Guinea Company in Copenhagen five years later. Hamburg capitalists principally financed these excursions by Danish subjects to the Gold Coast (Feldbaek 1986: 205; Gøbel 1990: 103). According to historian Ole Feldbaek, this was an “institutionalization of an existing private trade” and neither of these new companies received a monopoly in the business (Feldbaek 1986: 209). Danish sailings from the African Gold Coast to the Caribbean began on an experimental basis as early as the 1650s. However the colony's permanent settlement on the island of St. Thomas did not assume real importance until the establishment of the Royal Chartered Danish West India and Guinea Company in March, 1671 (Gøbel 1983: 21; 1990: 104; Williams 1984: 138).

Before the Danes secured their colonies in the New World, Danish commercial enterprise on the Gold Coast began with the seizure of Swedish trading lodges in 1659 by Henrik Caerloff, a Dutchman who had changed from Dutch service to Swedish and then to Danish service (Feldbaek 1986: 209). After seizure, the Danes initiated agreements with the local people for consent to build. The principal forts from which the Danes carried on their commercial activities in the seventeenth century were Fredericksborg in Cape Coast, and Christianborg in Accra. Unable to withstand the competition from other European powers, the Danes sold their headquarters at Fredericksborg in 1685 to the British (Hopkins 1999: 406; Odotei 2002: 17). Upon the loss of Fredericksborg, the Danes established their headquarters at Christianborg, and began to add more facilities along the coast. With a hold on the Gold Coast and a foot in the Caribbean, the Danish government could now focus its attention on its new colonies.

As mentioned, a significant milestone in Danish commercial activities on the coast of Africa was the acquisition of the Danish West Indies; St. Thomas in 1671, St. John in 1718, and St. Croix in 1733. This created a demand for enslaved Africans to work on the plantations, and soon “politics and commercial activities were virtually inseparable” (Odotei 2002: 12). The Danish Atlantic and West Indian slave trade flourished from 1672 until 1803 with anywhere from 30,000 to 120,000 enslaved Africans forcibly brought to the islands of the Danish West Indies (Palmer 1994: 7; Highfield 1994: 11-32; Curtin 1969: 85-88). Rarely did the Danish West India and Guinea Company have more than two ships at a time on the Copenhagen-Guinea-West Indies route. From the archives of the company, there has been compiled a list of slave cargoes arriving in the Danish West Indies between 1687 and 1754. This research lists the numbers of slaves carried, the cost to the company, and the prices at which the islanders purchased these human cargoes. Westergaard estimates that between 1687 and 1700, thirteen vessels brought in 4,239 enslaved Africans (Westergaard 1917: 151, 320-326). There were drastic and constant fluctuations observable in the Danish voyages, which were outside the control of the West India and Guinea Company, since the Company was inoperative during 1675-79, 1690-97 (Gøbel 1983: 24). In 1697, administrators reorganized the company to exploit good conditions following the Nine Years' War (Gøbel 1990: 108). Between 1671 and 1754, the Danish West India and Guinea Company controlled practically

all the nation's trade and shipping to its possessions in Africa and the Caribbean because the Danish Crown gave it monopoly (Feldbaek 1986: 209). The Danish King bought out the Company in 1754, and in 1755, the trade that had formerly been the monopoly of the Company was opened to all Danish subjects (Feldbaek 1986: 210; Gøbel 1983: 22; 1990: 112; Pendleton 1917: 276; Westergaard 1917: 240; Williams 1984: 174).

History of a St. John Plantation, Estate Annaberg

By 1733, the colony on St. John was at its peak production with 109 plantations (Armstrong 2003: 31). Among these plantations was the Estate Annaberg, deeded to the French Huguenot refugee, Isaac Constantin, by the Danish West Indies and Guinea Company on April 27, 1723 (Knight 2002: 5). Constantin died in the fall of 1732, and the plantation passed to the ownership of Mads Lasrsen, who married Sarrie Constantin, Isaac's daughter. No children were born within this union, and after Sarrie's death in 1746, the Constantin plantation came under the administration of the court (Knight 2002: 8).

It was not until 1779 that the number of enslaved laborers increased on the plantation and the initial development of the property was completed. Between 1779 and 1870, the plantation flourished, and its proprietors acquired surrounding parcels of land. However, by 1871, the Estate Annaberg was no longer yielding commercial products, and no one resided on the property. The ruins of the Annaberg sugar factory, located on a coastal projection about midway between the Annaberg Point and the mouth of Mary Creek, stand as a testament to the multiple sugar factories that once dotted the island of St. John. Estate Annaberg is situated on the northern shore of St. John, was adjacent to Water Lemon Bay, and by 1808 comprised six formerly independent properties with a total land area of nearly 1,300 acres; the largest sugar producing plantation in the history of St. John (Figure 4) (Knight 2002: 3).

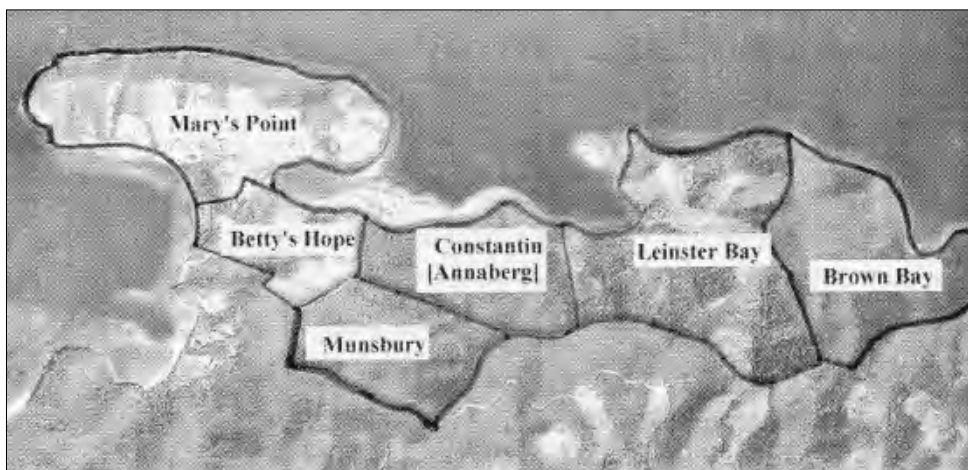


Figure 4. This aerial shows the boundaries of the various plantations circa 1807 (Knight 2001: 4)

D. W. Knight (2001, 2002), has compiled a history of this plantation. Included in his reports are inventories of the plantation. From these records, it is possible to piece together the reliance of this plantation on shipping their products to market. In 1797, a 1,300 foot wooden shoot for conveying sugar down the mountain to the factory was among the list (Knight 2001: 34). The estate's sheltered deep water anchorage on Water Lemon Bay became a center for supporting activities for sugar production. Spaced along the shoreline stood warehouses, boat sheds, a lime kiln, blacksmith and carpentry shops, with a complete sugar-works to process the cane grown on the eastern section of the plantation (Knight 2001: 35). These works were to manufacture the dark colored "muscovado" sugar produced on Annaberg. Barrels of muscovado were sealed, and the sugar conveyed down the wooden shoot to a warehouse on the bay to await shipping. Danish authorities prohibited the refining of muscovado into white sugar in the Danish West Indies. That right was reserved for the large and powerful sugar refineries in Denmark. Rum, made with the byproducts from the sugar production process, was the only true refined end-product exported from the Annaberg factory during the colonial period (Knight 2001: 46).

The shipping area of the plantation was notable. This shoreline was continuously in use from the establishment of the estate through 1936 when the last resident, Carl Francis, his wife Aimy, and their family moved away (Knight 2002: 19). Two sketches by Reverend Henry Jackson Morton give us a glimpse of the plantation. Figure 5 is a sketch completed by Reverend Henry Jackson Morton when he visited the island in 1844 and shows the brig *Mercurius* anchored in the distance (this is the vessel he traveled aboard). On the hill is the main house of the Annaberg

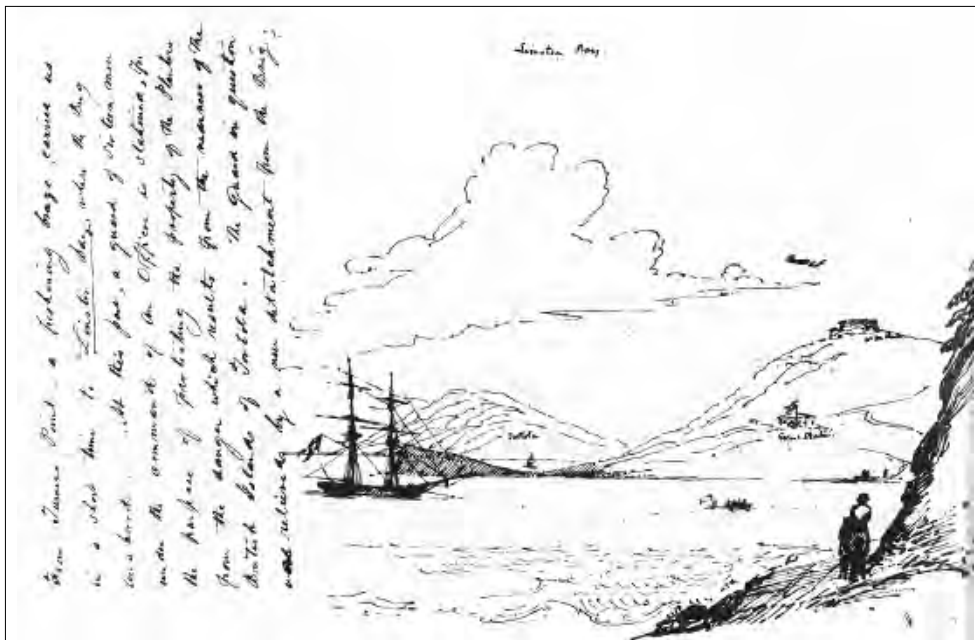


Figure 5. Sketch completed by Rev. Henry Jackson Morton when he visited the island in 1844 (Morton 1975).

Estate. Foundations of the guard house below the main house still exist. Tortola is the island off in the distance with a small vessel in front of it, in Water Lemon Bay. The roads leading to the guard house and main house are visible, and it is likely that the dark patch shown along the shore shows the loading dock for the plantation. Figure 6, also a faint sketch completed by Morton during his visit to St. John in 1844, shows part of the Leinster Bay Industrial Compound on the left, and part of the enslaved African's housing on the hillside to the right. The vessel depicted is also the brig *Mercurius*.

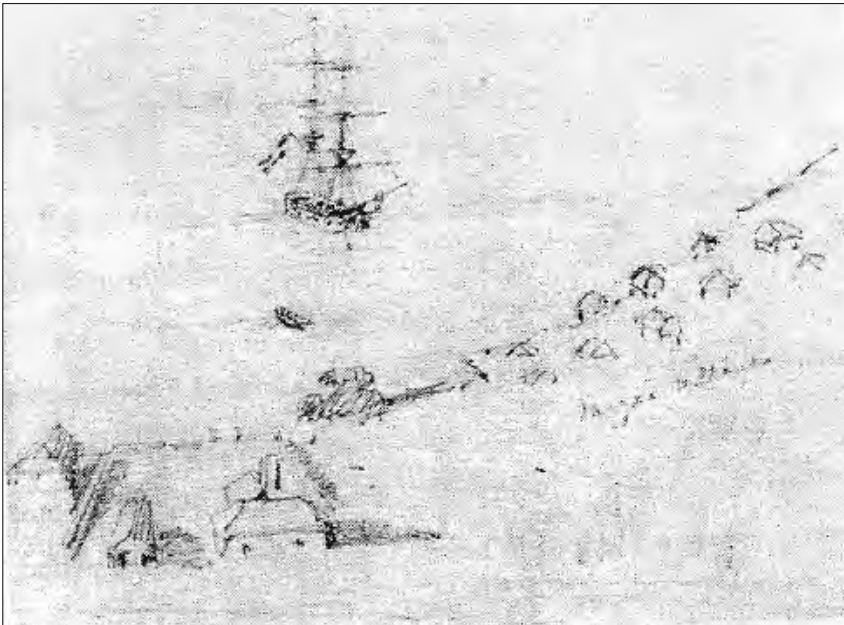


Figure 6. Faint sketch produced by Morton during his visit to St. John in 1844 (Morton 1975).

Lack of use in the twentieth century, however, allowed the plantation to go to ruin. The peak production for the Annaberg factory complex and Leinster Bay estate would cover almost five decades between the turn of the nineteenth century and 1848. By 1808, the estate consisted of 530 acres of cane fields serviced by the largest labor force on the island of St. John. It also included a boathouse 45 feet by 20 feet, and five boats of different sizes (Knight 2002: 13-14). Due to their small size, these boats were most likely plantation vessels used to load and unload cargo to larger vessels in the harbor. The central portion of the plantation set the stage for a diversity of activities necessary for the development and maintenance of the estate's sophisticated infrastructure (Knight 2001:100-101). Without this harbor, planters would have to ship their goods over the mountainous land. Subsequently, the placement of the plantation adjacent to such a convenient harbor defined its success.

Annaberg's rapid downfall was initiated after the emancipation of enslaved laborers in 1848 and the newly discovered and exploited use of the cheaper and more temperately grown sugar beet. Yet throughout its existence on St. John, and

even during its failing days, Estate Annaberg remained one of the most profitable sugar estates on the island of St. John. Competition from sugar beets, growing soil depletion, a sagging colonial economy, and labor shortages served to finally drive down production (Knight 2002: 16). The last resident of the property left in 1936. Twenty years later the property, now overrun with tropical growth, became the property of the National Park Service (Knight 2002:19).

The importance and reliance of shipping was essential for the plantation to survive, especially on the island of St. John. The structural remains and the historic records concerning Estate Annaberg stress the reliance on direct shipping. The significance of marine transportation was inescapable even for the enslaved laborers, who were required to participate in maritime related jobs. It is assumed that most male slaves were occupied in maritime work, loading and unloading vessels, driving the wains that delivered or removed cargo, and laboring in warehouses or as crew in inter-island or other seagoing traffic (Figure 7) (Armstrong 2003: 25; Hall 1985: 479, 488).



Figure 7. Enslaved laborers loading hogsheads to ship to the market (Clark 1823: n.p.).

The involvement of the enslaved laborers in the sugar industry, and the fact that many of the plantation owners did not physically reside on St. John made regulations and slave laws extremely harsh. For example, legislative prescriptions against marronage authorized such physical deterrents as leg amputations, hamstring attenuation, and leg irons or neck collars (Hall 1985: 484; Westergaard 1917: 162). Such measures hampered, but did not prevent escape by water. Later laws established rules for access to, and use of boats, since vessels were a means for enslaved Africans to escape to the nearby British Virgin Islands (Olwig 1993: 50).

It is no surprise that Estate Annaberg, located directly adjacent to the island of Tortola, a part of the British Virgin Islands, included a detention center for enslaved laborers undergoing punishment. Knight's (2001: 67-68) description of the Annaberg detention cell ends with a call for preservation. He writes:

Below the sick house floor in the southern section of the foundation is a vaulted detention cell that is accessed by way of a south-facing door at grade level. A small window is located in the east wall of the cell. Perhaps the most important and least appreciated features of the Annaberg factory complex are the numerous images scratched into the walls of the detention cell. Among them are drawings of at least two ships, one closely resembling a type known as a Baltimore Clipper. Because of their speed and nimble handling characteristics, Baltimore Clippers were often used in the illicit slave trade during the mid to late nineteenth century. But more important than the ship drawings is the rendering of a large building that is believed to be a depiction of the Annaberg and Leinster Bay estate house, which was clearly visible directly out the window on the east wall of the cell...actions are immediately required to preserve and protect the nineteenth-century drawings of buildings and sailing ships that are etched into the walls of the detention cell.

Before 1750, in an effort to keep slaves from escaping by sea, legislation limited the size of canoes and barges that white planters could keep, and specified conditions of ownership. Regulation of boats persisted until the very end of the era of slavery (Hall 1985: 484). Governor-General Ernst von Walterstorff attempted to introduce a boat registry in St. Croix in 1791, and insisted that all canoes must have bungs that were to be put away, along with all oars and sails, when the canoes were not in use. All craft were to be stamped with the royal arms and bear registration numbers as well as the owner's name (Hall 1985: 485). Finally, in 1845, three years before emancipation, Adam Sobotker, the acting Governor-General, promulgated a decree permitting plantations to keep only flat-bottomed boats, as slaves were unlikely to try to escape in such craft (Hall 1985: 486).

The Economic Decline of the Virgin Islands

The commercial importance of the Virgin Islands stemmed from its central location in the West Indies, which accessed most of the American and European shipping lines bringing merchandise from different parts of the Caribbean. The main harbor of the Virgin Islands, Charlotte Amalie in St. Thomas, had a large deep harbor that could accommodate many large vessels and had a reputation of offering adequate shelter against hurricanes (Dookhan 1974: 220). St. Thomas eventually established all the facilities of a major shipping port such as coaling stations or bunkers for refueling, wharves for unloading cargoes, tanks for watering, and after 1867, a dry-dock for cleaning and repairing vessels (Figure 8).



Figure 8. A scene from the St. Thomas coaling station. This illustration was drawn by a man whose vessel stopped to refuel before carrying on to Brazil (Codman 1867:20).

Despite having all the modern conveniences of a major economic hub, St. Thomas suffered several major disasters during the second half of the nineteenth century. Two cholera epidemics devastated the island, leaving behind the notion that the islands were inherently unhealthy. The final blow to the island came in November 1867 when a hurricane, followed by an earthquake and a tsunami almost destroyed the island. During the storm, the force of the waves tossed many

of the vessels anchored in the harbor upon the shore, and destroyed the lighthouse at the entrance of the harbor. The earthquake and tsunami following the storm finished anything left standing. The net result of these disasters was a setback in the island's expansion, which caused shipping companies to contemplate alternative ports for their business.

The physical environment of the harbor also aided in the demise of the economic center at St. Thomas (Dookhan 1974: 221). While the harbor could easily accommodate sailing vessels, it was too small and too shallow for steamships of more substantial length and draught. Difficulty in obtaining sufficient space for turning was evident when several large ships simultaneously arrived in the harbor.

All these factors caused St. Thomas to lose its importance as the distributing center of trade in the Caribbean. The island soon became a stopover for various shipping lines moving between the Caribbean and Europe, such as the Hamburg-American Line, the West India and Pacific Steam Ship Company, the Harrison Line of Liverpool, the French Compagnie Generale Transatlantique, the Bordeaux Line and the Quebec Steam Ship Company (Dookhan 1974: 221). These lines continued to sustain St. Thomas as a coaling station even though much of the shipping business was transferred to other West Indian ports.

Despite intensive attempts to revitalize the economy in St. Thomas, by 1916 shipping had all but disappeared (Dookhan 1974: 237). The onset of World War One further worsened this situation, when some of the remaining shipping companies operating out of St. Thomas pulled their business out due to the uncertainty of the safety of the harbor.

The United States

The United States had for years desired to purchase the Danish West Indies (Koht 1945: 762). The Civil War demonstrated very clearly the need for a naval and coaling station in the West Indies (Finch 1917: 414-415; Gøbel 1994: 156; Pendleton 1917: 284). For although the ports of the Southern States were blockaded, it was difficult to maintain the blockade when several ports in the West Indies, especially Nassau, received and serviced blockade runners, but shunned Union vessels (Hamilton 1999: 43; Pendleton 1917: 284).

The prospect of the U.S. purchase of the three islands began in earnest in 1865 (Hamilton 1999: 50). On March 31, 1917, for the sum of 25 million dollars, the two countries completed their transfer (Dookhan 1974: 243; Rogers 1917: 736). Denmark's primary motivation for selling the islands was the depressed economic conditions. The United States' primary motivation for buying was strategic (Dookhan 1974: 243). According to the treaty drawn up between Denmark and the United States, the United States agreed to pay Denmark in return for the possession of the entire Danish West Indies. The treaty included the stipulation that private property was to continue unimpaired, and the United States could determine the civil rights and the political status of the inhabitants of the islands.

The economic decline of the Virgin Islands prevented the purchase from becoming a worthwhile business venture. To the United States, the main value of the Virgin Islands lay in the harbors, and in the possibility of setting up naval bases

there. Of lesser importance to the United States were the production modes of industry that pre-existed on the islands. As mentioned, the Civil War, during which it was necessary for the Union Navy to find a harbor that allowed them to repair their ships and to locate a holding-place for captured Confederate vessels, demonstrated the need for a suitable port in the West Indies (Dookhan 1974:248). This urgency for a port in the Caribbean was continually evident whenever the economic interests or national security of the United States was threatened. The projected construction of the Panama Canal made it even more important that the United States should have a military base at a strategic point in the Caribbean, by allowing the United States to defend the approach to the Panama Canal and, secondly, it prevented the islands from falling under the control of a nation such as Germany that was perhaps hostile to U.S. interests (Dookhan 1974: 250; Gøbel 1994: 170-172; Pendleton 1917: 286).

The Panama Canal also emphasized the need for the United States to have a coaling station in the mid-Atlantic for ships traveling from Central America to Europe. The importance of this coaling station from a military standpoint also strengthened the notion of acquiring the islands. A coaling station located in the Virgin Islands would mean that American fleets could move freely around the Caribbean and observe the activities of any European vessels that were operating in the area. Rumors that Germany was desperately trying to acquire territory in the West Indies became another reason behind the acquisition of the Virgin Islands. In hindsight, the fear of Germany operating in the Caribbean was more conjecture rather than fact, but the fear was real whether or not the threat was (Dookhan 1974: 249).

As it turned out the Virgin Islands, acquired largely for military purposes, never played any significant role as a naval base during World War One. After the end of the war in 1918 whatever military importance the islands had declined. Besides the military need, the United States had very little reason to purchase the islands. Agriculturally and commercially, they were in decline long before acquisition. Only a persisting fear that the islands could prove dangerous if they fell under a hostile nation's control made their retention a viable option.

A fundamental change took place in the Virgin Islands after 1936 when agriculture based largely upon peasant farming was abandoned, and the islands started to concentrate on the development of tourism and industry. This turning point came after World War Two when tourism became viable, largely due to the post-war American economic boom. Today, tourism is still the economic base of the Virgin Islands.

Conclusion

In the eighteenth and early nineteenth centuries, Danish Virgin Islands' shipping relied heavily on Charlotte Amalie as a means to trade with many different nationalities. Inter-island trade took vessels to St. Domingue/Haiti and Jamaica, and the Lesser Antilles. The flow of goods created chances for commercial purchases within the islands and lessened the need for Danish trade.

This branch of eastern Caribbean intercourse in the early nineteenth century was part of the expanding seaborne commerce into St. Thomas, and opened a

major route of trade to St. Thomas from islands in the northern Leewards and from far away as Curacao and Barbados (Hall 1985: 492; Westergaard 1917: 252). In addition, since the West Indies was closed to the British North American colonies it tended to increase the extent of trade throughout the Caribbean, making it was significantly international, but not cross-oceanic, in character.

The St. Thomas market and widely utilized port of Charlotte Amalie was advantageous for the plantations on St. John. The plantations on this island were required to ship their goods off island. Warships involved in constant colonial conflicts and commissioned vessels belonging to various European and American nations were frequent throughout the Danish Virgin Islands waters. A good example of one such vessel whose remains still lie in the waters of Round Bay, HMS *Santa Monica*, will be discussed further in this report.

St. John's history is linked to not only Danish settlement, involvement in the slave trade, or the West Indian plantation economy, but also to the various wars of European colonialism. The West Indies were a dynamic region where a clash of nations fought for control of the valuable resources the islands offered.

Previous Maritime Archaeological Investigations in the U.S.V.I.

The numerous bays and coves that surround the U.S. Virgin Islands contain historical information in the form of undiscovered and undocumented archaeological resources. Unfortunately, archaeologists have done very little work within these waters. The following is a chronological listing of underwater archaeological efforts in the region.

The 1960s

The first documented archaeological venture undertaken in the U.S. Virgin Islands came in 1968 when Edward L. Towle, Director of the Caribbean Research Institute in the U.S. Virgin Islands, compiled a comprehensive shipwreck inventory. The first edition of the inventory came from the research of Robert F. Marx, an independent researcher. Marx obtained the majority of his information for the inventory from Spanish and British archives, concluding the summation at 1825 (Marx and Towle 1969). The efforts of the Government of the Virgin Islands to prepare a full-scale management plan for the coastal zone resources of the Virgin Islands prompted a second edition in 1976 (Towle et al. 1976: 2). This completely revised edition extended the list to cover the period after 1825. Towle's research in American and Caribbean libraries in this second edition added substantially to Marx's research (Towle et al. 1976: 3). The inventory, although by no means a complete listing, included 134 shipwrecks, ranging in dates from 1523 to 1833. Information on each shipwreck includes date of wreck, country of origin, source and other pertinent information.

The 1970s

Three years after Towle's work, between March 1, 1971 and June 30, 1973, Alan Albright, a researcher with the Caribbean Research Institute of the Virgin Islands (a division of the College of the Virgin Islands) conducted an excavation of HMS *Santa Monica*. This vessel was a Spanish-built 28-gun frigate sunk in 1782 while under the possession of the British Royal Navy (Albright 1973: 1). The excavation concentrated on an undisturbed mid and stern section of the vessel, with the main excavation tool being an airlift. The excavation included the entire area outside the wreck, and the sediments that had collected on top of the wreck (Albright 1973: 5). A large number of artifacts were collected from the site, including an impressive ceramic assemblage that reflected a state of flux in the British Staffordshire ceramic

industry (Albright 1973: 6). Although a detailed analysis of the ceramics is not included within the report, it does offer a detailed inventory and photographs.

After concluding his work on *Santa Monica*, in 1973, Albright conducted a proton magnetometer search, and a series of visual survey in areas highly probable as ship loss locations, such as harbors, harbor approaches, reefs, bars, headlands, anchorages, and along traditional inter-island shipping lanes. The surveys areas included the harbor at Charlotte Amalie and East Gregory Channel, which extends from the north to the south tip of Hassle Island and the north side of St. John. The survey produced 22 sites representing significant historical remains. The scope of this survey limited site activity to recording, and possibly identifying archaeological material. Researchers carried out no further investigations on the 22 sites within the parameters of this project (Albright 1975: 11). Larry Murphy, Archaeologist for the Submerged Cultural Resources Unit, in a memorandum to the Associate Regional Director of Planning and Cultural Resources for the National Park Service, stated that Albright had communicated informally to Dan Lenihan in 1983 that this report had been written from memory since all the project records except the motorboat log were lost in transport (Murphy 1985: 4).

Shortly after Albright's survey, in March 1974, Daniel Lenihan, who later became the chief of the National Park Service's Submerged Cultural Resource Unit, developed an Archeological Resource Management Plan for the Virgin Islands National Park. Although the majority of the plan concentrates on the prehistory and history of the island of St. John, Lenihan outlines a research design for an underwater archaeological survey of Cinnamon Bay, on the island of St. John. Lenihan suggests that the research design follow predetermined steps, keeping in mind the available time and funding. The first step should be that the area of submerged bottom, which is scattered with cultural debris, be measured and plotted on a base map, which would show its relation to land features. The second step is a random sampling of three squares beginning from the water's edge and going by 1/3 increments seaward. The next step would be the taking of coring samples the length and breadth of the site to determine how deep the wave action has penetrated, and to ascertain the vertical dimension of the site and how much of the site wave action had churned up. Lenihan also stressed that research should be undertaken to determine if there is a possibility of the site encompassing an aboriginal habitation area (Lenihan 1974: 9-11).

After a few years of archaeological inactivity on the islands, George Tyson, of the Island Resources Foundation (IRF), put a proposal together in 1978 to carry out historical research and archaeological survey to locate the slaver *General Ambercrombie*, thought to have been wrecked off Buck Island, St. Croix in 1803. The proposed project was to be a joint National Park Service/Island Resources Foundation one; however, the NPS declined the opportunity to work with the IRF. In 1988, the IRF applied for, and gained a research permit to carry out a one-day magnetometer survey of the Buck Island reef (National Park Service Permit #SER 5370 9500). The survey never happened, due to logistical problems within IRF (Brewer 1993: 22).

The 1980s

The next segment of archaeological activity came in June 1980 when Edward L. Towle, President of the Island Resources Foundation, in a letter to Joe R. Miller, Superintendent of the Virgin Islands National Park, outlined the cultural resource management goals for the Park resource management team. Towle recommended a focused, long-term research effort focused on St. John, where an interpretative program based on primary source materials and/or systematic field research would be located. To do this Towle suggested that there needed to be an effort to identify and copy archival documentation overseas as a prelude to historical research, a systematic inventory of archaeological sites or excavation of key sites. Towle also recommended that there should be extensive ethnographic research done on St. John to coincide with the field data (Towle 1980).

Also in 1980, Roger Anderson, a marine archaeologist from the British Virgin Islands, located an uncharted shipwreck inside the Virgin Islands National Park (Pachta 1980). The vessel was located in Leinster Bay near the Annaberg Plantation ruins. Anderson reported the wreck to Noel J. Pachta, the Superintendent of the Virgin Islands National Park. Pachta sent a small crew to the site to retrieve some preliminary information. The staff working on the wreck came back with some photographs and a rough field map, but nothing concretely diagnostic. After an extensive literature search, the National Park Service was unable to come up with a definite date for the vessel (Fisher 1983).

One of the largest remote sensing surveys ever undertaken in the Virgin Islands is the next major archaeological work. In 1981, prior to plans that would expand the existing freight terminal facilities and provide deep water access to the cruise ship docking facilities for Crown Bay, St. Thomas, the Virgin Islands Port Authority arranged for a preliminary magnetometer and side-scan sonar survey of the bay to identify any submerged archaeological remains which might have historical value. Tetra Tech, Inc. of Jacksonville, Florida, completed the initial survey in February 1981, under contract to the Port Authority and under the direction of Erik Olsen, with the assistance of J. Barto Arnold, III, from Austin, Texas (Towle 1984: 1-2).

The project area was located adjacent to the Crown Bay Marine Freight Terminal along the southwestern portion of Charlotte Amalie, St. Thomas. The area is within the Crown Bay Harbor, directly north of Water Island, east of Haypiece Hill and the former Submarine Base docking facilities at Little Krum Bay (Towle 1984: 3). The survey resulted in the identification of 29 anomalies within the bay (Olsen 1981). Nineteen of these anomalies were determined to be either modern debris or eliminated for other technical reasons, leaving ten possible high priority marine archaeological sites for assessment.

In July 1984, the Island Resources Foundation performed the task of relocating and evaluating the ten priority magnetic anomalies reported previously by Tetra Tech. The National Park Service required that where anomalies were proven to have significance upon inspection, archaeological evaluation was to be undertaken prior to any dredging activity (Towle 1984: 9). Using a proton magnetometer, the survey team relocated each of the ten anomaly sites and pinpointed the anomaly's epicenter on the seabed. At the request of the Port Authority, they also inspected

three low priority sites in a prospective dredge area. During the course of this survey, the team identified and investigated three new anomalies. Subsequent to relocation and inspection, the ten promising anomalies were subjected to a pattern of sequential high-pressure water jet probes that penetrated up to 16 feet (4.9 m) of unconsolidated bottom sediments, seeking evidence of the presence of archaeological remains. Divers also carried out test excavations using an airlift (Towle 1984: 36). The 13 relocated magnetic anomalies sites and their individual environs to a radius of 12 meters (39.4 ft) contained no historical material on or in the unconsolidated seabed sediments. Two anomaly areas proved to be geological in origin, while modern ferrous objects appeared to cause other anomalies (Towle 1984: 37).

While the surveying of Crown Bay was taking place George Tyson, an independent researcher, published, in 1983, a Register of Virgin Islands shipwrecks from written English source material found in repositories in the United States Virgin Islands, the United States mainland, England, and Denmark (Tyson 1983: 1). The Register encompasses both British and United States Virgin Islands, and its scope extends from 1523 to 1917, terminating at the date when sovereignty over the Danish West Indian islands of St. Thomas, St. Croix and St. John passed from Denmark to the United States (Tyson 1983: 1). The author stressed that this is was not a complete inventory of shipwrecks but is considerably more comprehensive than the previously mentioned *Shipwrecks of the Virgin Islands (1523-1825)* by Robert F. Marx and Edward L. Towle (Tyson 1983: 1). The author also included a brief history of the island and a comprehensive listing of sources which he used to compile the inventory. In total, Tyson lists 576 shipwrecks. The inventory includes the date of the shipwreck, point of origin, source, and other pertinent data (Tyson 1983: 3).

A few years after the publications of Tyson's Register, a memorandum, dated July 1985, to the Associate Regional Director of Operations, Tom Bradley, Superintendent of Christiansted and Buck Island for the National Park Service, outlined a submerged cultural resource management plan for the Buck Island Reef National Monument. Bradley proposed that an historical literature search of all shipwrecks in the waters of Buck Island Reef National Monument and the Virgin Island National Park up to 0.5 mile beyond park boundaries be completed under the supervision of the Virgin Islands Resource Management Specialist John Miller. Next, Bradley suggested they bring in Larry Murphy for an assessment of submerged cultural resources. Bradley also recommended that a magnetometer survey be conducted at Buck Island utilizing optic and/or infrared plotting that would locate any submerged cultural resources that were visible to divers. Bradley suggested that no invasive testing should occur, only videotaping and mapping of wreck sites (Bradley 1985).

In September of the same year, Larry Murphy, at the request of the National Park Service, visited numerous archaeological sites around the Virgin Islands. The objective of the trip was to observe the range of topographical features, both terrestrial and submerged, and oceanographic conditions, as well as to identify potential for setting survey instruments, and to determine logistics in making recommendations for future cultural resource surveys within the park. Murphy visited the site of HMS *Santa Monica* in Round Bay and the ballast pile in Leinster Bay, previously reported in 1980 by Roger Anderson. He also observed the range of natural

resources and bottom topographical variations that might affect survey design in Haulover Bay, Brown Bay, and Mary Creek. Murphy also visited two sites near Buck Island; one site consisted of two anchors and the other the remains of an unidentified vessel (Murphy 1985).

After completing his inspection, Murphy offered a few recommendations for the evaluation and management of submerged cultural resources in the Virgin Islands. Murphy suggested that since the rapid growth of sport diving and the tourism industry would exert continual pressure on the wrecks of the Virgin Islands, a long-range submerged cultural management plan should include a survey of Park waters for shipwrecks. Murphy suggested that a total remote-sensing survey of the Virgin Islands would be a formidable task, complicated by the difficulty of shore access and the remoteness of much of the land bordering Park waters. Murphy's solution entailed a multi-phased survey design based on research to delineate areas of high probability for wreck occurrence. The research suggested was to include both historical inquiry and consultations with sport-divers on the islands. Murphy stressed the importance of involving the local population in the research phase. The initial survey portion of the plan would concentrate on a limited number of priority areas for remote sensing, or an assessment of known wreck sites. Murphy also recommended a strategy for the management of the Buck Island National Monument, off the island of St. Croix. He suggested that remote sensing, specifically magnetometer survey, would be the appropriate methodology for the location of submerged sites (Murphy 1985).

In the month after Murphy's visit, Stephen R. James, Jr., staff Nautical Archaeologist for Espey, Huston & Associates, Inc., an engineering and environmental consultant out of Austin, Texas, proposed a nautical archaeology field school to the School for Field Studies in conjunction with the National Park Service. The proposed field school was to take place on the island of St. John, as well as offer students from the University of the Virgin Islands an introduction to nautical archaeology and offer them access to some submerged shipwrecks. James proposed that the students would be trained in the use of a magnetometer, archaeological excavation techniques, and artifact sampling. This proposal never developed into a field school (James 1985, 1986).

The next major archaeological effort came in June 1987. In a memorandum to the Chief of the Southeast Archaeological Center, Richard H. Maeder, Superintendent of the Virgin Islands National Park enclosed a completed submerged cultural resource questionnaire. The questionnaire covered subjects such as the National Park Service's jurisdiction over cultural resources and their strategy for continuing the current level protection for submerged cultural resources (Maeder 1987).

The 1990s

Five years after Maeder's memorandum, in December 1992, David M. Brewer from the Southeast Archaeological Center for the National Park Service created *An Archeological Overview and Assessment of Submerged Cultural Resources in Virgin Island National Park (St. John and Hassel Islands), Buck Island National Monument and Salt River National Historic Park and Ecological Preserve*. In the assess-

ment, Brewer lists any work done by archaeologists in the targeted areas that mention submerged cultural resources. Not all projects mentioned in Brewer's overview are pertinent here, however, some are directly relative to ECU's 2002 summer field school. Several of the projects that Brewer mentions have already been discussed.

Brewer references an October 1977 memorandum to the Chief of the Southeast Archaeological Center from Research Archaeologist George Fisher discussing the deficiencies of the previously mentioned excavation of *Santa Monica*. Fischer complains that there was no attempt to record provenience information during the excavation. Fisher also states that no architectural information were reported or recorded, even though the excavation contributed to the destruction of the architectural details of the vessel. Additionally, that there were no maps, charts, drawings or diagrams detailing any aspect of the excavation included in the final report (Brewer 1992).

Brewer also offers an overview of Prokopetz and Hamilton's survey in 1976, for the Southeast Archaeological Center. The survey was primarily designed as an assessment of pre-historical archaeological sites and offers some useful information historical sites. Of interest are the unfruitful exploratory investigations in Lameshure, Francis and Maho Bays, and the mention of a suspected ballast pile in Cinnamon Bay, where samples of ballast were taken. The Prokopetz survey team also visited a shipwreck on the northwest reef of the Buck Island Reef National Monument. The wreck was described as "a mid 19th or early 20th century coal carrying ship" (Prokopetz in Brewer 1992).

Brewer also outlines a November 1988 project where Toni Carrell, of the Submerged Cultural Resources Unit, and Brewer, under the direction of John Ehrenhard, Chief of Interagency Archaeological Services for the Southeast Region, conducted a preliminary submerged cultural resource reconnaissance and survey of Salt River Bay, St. Croix. The project had two objectives. A magnetometer survey of the central Salt River Bay area, directed by Carrell, and a visual reconnaissance of the bay perimeter, directed by Brewer. Carrell's magnetometer survey consisted of approximately 0.46 square miles and recorded six large magnetic anomalies. Efforts to identify the anomalies were unsuccessful because Carrell had no authority or equipment to disturb the sediments that likely covered them. The visual survey identified 21 anomalies including shipwreck parts, isolated artifacts scatters and modern debris. A separate combined magnetometer and visual survey off Whitehorse Reef, St. Croix, located a cannon muzzle and some pig-iron ballast. These artifacts were reported to be near an exposed modern steel barge located atop the reef.

In 2002, the Program in Maritime Studies at East Carolina University would carry out six weeks of field work in the U.S. Virgin Islands.

Methodology

Introduction

In 2002, the Program in Maritime Studies commenced work in the U.S. Virgin Islands. There were two phases of research – remote sensing, and site inspection. Initial remote sensing was carried out by a small group in June, 2002, in the lead up to a larger group of people who carried out additional remote sensing, diving, and site recording in September of the same year.

Remote Sensing

The National Park Service provided the 25-foot research vessel *Beluga* to be used as the survey platform. *Beluga* is a fiberglass custom built “lobster style” boat powered by a single screw diesel engine with a covered work area for survey equipment. The vessel was outfitted with a Garmin differential global positioning system (DGPS), a Geometrics 886 proton precession marine magnetometer, and a 600-kHz Marine Sonics side scan sonar. The survey team employed Coastal Oceanographic's *Hypack Max* hydrographic survey software to plan and design the survey, and to control navigation and magnetometer data acquisition. Sonar data was recorded using a Marine Sonics Sea Scan PC, which receives data collected through a towfish cable connected to the sonar. The computer converts the acoustic data collected by the sensor and converts it into a viewable real time waterfall digital image of the sea floor.

For each survey area, a block of parallel survey lines was created in *Hypack* to cover the area. The overall size of survey blocks was determined by the shoreline of each bay and the extent of the planned mooring system. A line spacing of ten meters was maintained throughout the entire project. During the initial survey in the winter of 2002 the researchers completed the survey of the four primary bays in 4.5 days and surveyed the secondary locations over an additional three days. The additional surveying that took place during the summer field season was conducted sporadically over a period of three weeks.

All surveys were conducted using a boat speed of four knots to insure maximum clarity of the sonar image. The areas were surveyed utilizing both side scan sonar and magnetometer for collection of data with the exception of the secondary survey of Water Creek which will be discussed in further detail in the Water Creek section. The magnetometer was deployed manually by the crew with a layback of 80 feet. The length of cable deployed and the speed of the boat determine the depth at which the magnetometer sensor is towed. Both factors remained constant during the survey ensuring a constant depth below the water surface. Distance between

the magnetometer and the seafloor varied with the bathymetry of the bay. The side scan sonar was deployed using a short tether that was attached to a cleat on the side of the research vessel. The tether system allowed for a sonar depth of only four feet below the surface. This method was used to prevent the sonar from being caught on any coral heads resulting in damage to the equipment.

Data was recorded using a Dell Inspiron 5000e laptop computer running *Hypack Max* hydrographic survey software. Both the Garmin DGPS and the Geometrics magnetometer were linked to the computer for data collection and the Marine Sonics side scan sonar contains its own internal DGPS. During the survey, position and magnetic field strength were recorded two times per second. This synchronization allowed every magnetic reading to be assigned a specific position. The sonar data acquired during the survey was combined with the Seascan DGPS, which provided accurate coordinates for all potential sonar targets. Positions were recorded in Universal Transverse Mercator (UTM) coordinates (Zone 20) using the WGS 84 ellipsoid.

Data Analysis

Frank Cantelas and MA candidate Andrew Pietruszka conducted analysis of the data collected from Water Creek in Greenville North Carolina during October and November of 2002. The goal of the analysis was to compare the findings from the original survey of Water Creek conducted in January of 2002 with the findings from the second survey in order to make recommendations to the National Park Service on a proposed mooring system to be installed in Water Creek. The team utilized three programs, *Hypack Max*, *Surfer*, and *ArcView GIS*, to interpret and display the data.

The first step in the data analysis was to edit and remove poor quality raw data that could skew the magnetic field in Water Creek and lead to false conclusions. This process was conducted using the single beam editor function of *Hypack Max* to delete poor quality data. This function allowed the team to compare the actual boat course to planned track lines, determine the magnitude of magnetic fluctuation, and find the location of magnetic anomalies. The initial phase of data processing was done in two parts. The first part compared the path of recorded survey lanes to the planned survey lines. Four lanes were determined to be unsatisfactory because they overlapped adjacent lanes and were not used in data analysis.

The second part of data processing involved removing anomalies that were not congruent with expected signatures of historic cultural resources. Parameters were developed for editing the raw data to represent the potential for submerged cultural resources in the bay. The two factors considered when determining these parameters were the history of the area and the geological make up of the island. Compiling a history of the area allowed the team to establish a set of hypotheses describing the possible submerged cultural remains to be found in the area.

A representative model was established for a mid-eighteenth century merchant vessel of 140 tons. Such a vessel would contain approximately 19 tons of iron including four anchors, six guns, fasteners, and rigging. The tropical marine environment of the Virgin Islands promotes concretion formation and a corresponding

loss of iron through corrosion processes. An expected maximum of two-thirds of the iron from the vessel could be lost in these conditions leaving approximately six tons of iron to be distributed throughout the site. The amount of iron present, and the distance between the magnetometer sensor and the object determine the magnetic signature of an object. A magnetic signature of less than 500 gammas was estimated by the researchers for the six tons of iron based on the estimated distance created by the lane spacing and water depth. These predictions would establish a guideline for the possible magnetic signatures of anomalies representing cultural remains located in Water Creek.

The geologic makeup of the island was studied to assess what affects the geology would have on the magnetic fields recorded in the bay. The geological history of St. John includes volcanic episodes that are recorded in a number of igneous rock formations on the island. When rock is heated it becomes magnetized in relation to earth's magnetic field and it will retain this remnant magnetism until heated again. The remnant magnetism of these rocks may or may not align with the earth's present magnetic field (Breiner 1973: 8-9). The remnant magnetism caused by volcanic rock will be picked up by the magnetometer and may mask anomalies caused by cultural remains.

The raw data was reviewed using the parameters that the team established based on the geological and historical data. The initial editing removed all anomalies that were over 500 gammas with a duration of two seconds (or one data collection interval) or less. Several large spikes averaging 5000 gammas from a single data collection point were removed from the data. These large anomalies with extremely high magnetic fluctuations and short durations are not representative of expected cultural remains and are instead believed to represent poor quality data collected from the magnetometer or geologic features. These outliers skew the results and do not allow slight variations in the magnetic field, indicative of cultural remains, to be viewed.

Once the data was edited with the single beam editor it was sorted using the sort function of *Hypack Max*. During this step, a filter of two meters was used during the sorting process. This deleted any data points that were within two meters of another recorded point. Data points that are too close together can cause a false anomaly. It was calculated from the boat speed that data points should be at least two meters apart. The final product of the sort function was saved as a XYZ ACSII file.

The researchers then used Golden Software's *Surfer* topographical modeling software to project the data in a form that would best demonstrate the magnetic variance established in Water Creek. Researchers decided that a contour map would be the best way to represent the magnetic field of Water Creek. *Surfer* projects survey data into a three dimensional (XYZ) grid system where X represents the Easting UTM position, Y the Northing UTM position, and Z the magnetic field strength at that position. To contour data in *Surfer* a geostatistical gridding method must be determined. The grid method parameters control how data interpolation is conducted by *Surfer* software. A "kriging" method was used for the Water Creek data. Kriging was chosen for its flexibility and versatility on all types of data sets. After processing the data using the selected geostatistical gridding method, the

data is then smoothed using the spline smooth command. This command inserts additional rows and columns into the existing grid file, which forms a rounded contour line instead of straight linear contour lines. After the *Surfer* program has prepared the data it is ready to be displayed as a contour map. A contour interval of ten gammas was chosen to display the data so researchers could identify small changes in the Earth's magnetic field that may be related to submerged material culture. The completed contour map generated in *Surfer* was exported as a DXF (drawing exchange format) file to be used in ESRI *ArcView* 3.2.

Sonar data was collected by the Marine Sonics *Sea Scan* PC software. The program saves the sonar images as a Marine Sonic Tagged Interchange file with a MST file extension, which along with the image contain GPS data, speed, and heading. During the analysis of the sonar data MST files were reviewed using *Sea Scan PC Review* software, Version 1.5, which was obtained through the Marine Sonics website. During the analysis process, several factors were considered in evaluating the identification of a sonar image as a potential submerged cultural resource and a model was devised for the hypothetical returns of various features that would be recorded by the sonar which are shown in Table 1. Researchers used these parameters to identify anomalous objects with features such as straight lines, right angles, regular shapes, or isolated features located on a smooth ocean floor. These characteristics indicate the possibility of the object being artificial.

Type	Appearance	Location	Size	Environment
Geology and Coral	Hard return, well defined edges	Not located within a magnetic anomaly	—	—
Unknown	Lacks well defined appearance of geological features	Not located within a magnetic anomaly	—	—
Possible Debris	Straight lines, right angles, geometric shapes	Within a magnetic anomaly/known shipwreck area	Larger or smaller than surrounding features	Does not appear to be part of surrounding area.

Table 1. Criteria used to sonar determine feature designation.

When an image of an object was determined to be a potential target the researchers recorded its length, width, and height and placed a marker in the sonar data. The marker is recorded by the *Sea Scan Review* software in a separate, conglomerate marker file with the file extension MKR. The marker file contains an identification number assigned to the individual markers, location (latitude/longitude, UTM coordinates), the name of the original MST file, and other important information from the survey. Once a marker file is created containing all of the targets representing possible submerged cultural resources it is exported to Microsoft *Notebook* where it's format is reconfigured to better suit the researcher's needs. During this process only the format is changed and no alteration is performed on the actual data. The reconfigured *Notebook* file is then exported to Microsoft *Excel* for a final reconfiguration that allows the researchers to import the locations of sonar targets in a tabular form that can be used in a georeference program. ESRI's

ArcView 3.2 was used to simultaneously view the location of sonar targets, magnetometer anomalies, and shoreline boundaries.

ArcView 3.2 is a geographical information system (GIS) designed to process spatial data into information used to make decisions about a specific portion of the earth (DeMers 1997: 7). The use of a GIS program allowed the team to display and interpret the magnetic, sonar, and geographical data, revealing relationships, patterns, and trends. GIS allows the user to import layers, known as “themes,” into the program that can be viewed individually or in combination. For example, a background map can be displayed separately or can be viewed with sonar target positions and an overlaid magnetic contour map. The use of these various themes allow the researcher to observe relationships between the shoreline, magnetic anomalies, and sonar targets. Using *ArcView* 3.2 researchers can simultaneously view the shoreline of survey area, magnetic contour maps created in *Surfer*, sonar targets, and the boat path traveled by the research vessel during the survey. The use of a GIS program enhanced the team's analysis of the data by allowing them access to all available data at one time making comparison of the data easier.

Site Inspection and Documentation

On the three sites in St. John, the intended methodology was consistent for all three site locations. The primary objectives for Leinster Bay, Coral Bay, and Hansen Bay were to locate the wreck sites within them. Once located, the goal was for surveyors to work from a shore datum with divers to map each bay in its entirety, including the incorporation of each wreck site. Additionally, researchers hoped to conduct remote sensing and visual surveys to locate any additional submerged cultural heritage. Finally, located sites would be examined and documented through mapping, photography, and video.

In Leinster Bay, visual surveyors found the wreck off the Annaberg Plantation. After locating the ballast pile marking the wreck, divers laid a baseline on the wreck site oriented to the ballast pile. Once they had the baseline, divers tried to find the stem and stern of the vessel to determine the orientation of the wreck by conducting test excavation pits. Divers shot buoys from the baseline for surveyors to tie the location of the wreck into the overall site map. In addition, divers documented the site through still photography and video. Using a fixed shore datum, surveyors mapped the shore line and the bay. In addition to locating the wreck site and associated material, researchers conducted additional visual surveys of the near shore and bay regions. Remote surveying of the entire bay was done with the magnetometer and sonar to locate any other submerged cultural resources in the bay.

The primary objective of the work on the Water Creek site was to locate the “Creamware Wreck” through remote sensing and test trenching. Surveyors conducted an extensive visual and remote sensing survey of the Water Creek area, in an attempt to locate both the reported wreck site and additional submerged cultural heritage. The wreck site was not found, but divers dug test trenches on survey hits.

The final objective of the project was to relocate the wreck *Santa Monica* in Hansen Bay. Once located, divers and surveyors mapped the bay from a shore

datum, including incorporating the wreck site using buoys on the baseline. Divers documented the wreck by mapping units along a baseline. A photo mosaic of the site was created.

Description of Findings

Introduction

The findings of the 2002 field work relate to the two components of the project; remote sensing and diver-based site inspection.

Remote Sensing

■ BORCK CREEK

The survey of Borck Creek was completed on 1 February 2002. Borck Creek is a small bay with water depth ranging from less than five feet to about 20 feet. Survey lines transect the area from the southwest to northeast spaced ten meters apart (Figure 9). Several lines followed the shoreline along the edge of the bay.



Figure 9. Magnetic anomalies and sonar targets in Borck Creek (Program in Maritime Studies, 2002).

Two anchored boats and several mooring balls near the eastern end of the bay obstructed the survey lines. Portions of the bay's eastern side were too shallow for *Beluga* to enter and were not surveyed. The northeastern portion of Borck Creek is very shallow with water depths averaging four feet or less. As a result, the survey vessel did not adequately cover this area as shown in the figure of Borck Creek. In the future, Divers using a metal detector should survey this portion of the bay. Out of the nine targets identified two were sonar and seven were magnetometer.

Target 1 (sonar, Figure 10) is an isolated sonar target near the northern shoreline (320309E 2030314N) that appears as a long, low, linear mound. It meas-



Figure 10. Borck Creek Target 1 (Program in Maritime Studies, 2002).

ures L 18.0m x W 4.5m x H 0.4m. The target's shape is similar to a ballast pile and warrants further investigation, although coral and rock outcrops are commonly found in similar locations.

Target 2 (sonar, Figure 11) is a series of linear sonar returns located at 320389E 2030221N. Divers ground truthing the location did not find anything on the flat sandy bottom. A re-examination of the target shows that the sonar record was slightly distorted by a sudden movement of the sonar sensor. This occurred when waves struck the survey boat and caused the sonar tow cable to jerk imparting an erratic movement to the sensor.

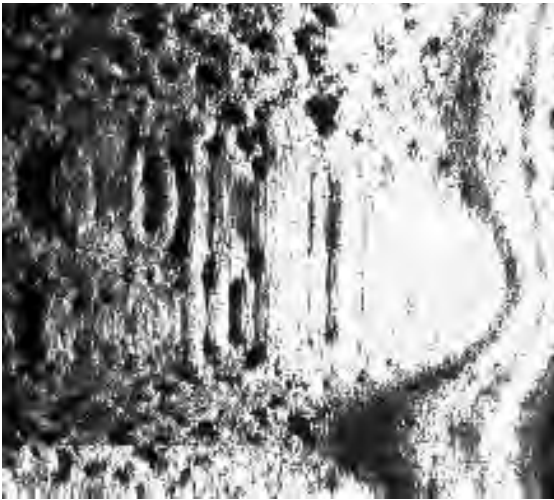


Figure 11. Borck Creek Target 2 (Program in Maritime Studies, 2002).

Target 3 (magnetic) is a small monopole located in the southern portion of Borck Creek at 320390E 2030216N. Survey lines passed the anomaly on each side isolating it from the shore. Although the anomaly's strength is small, further visual investigation and metal detector survey is recommended.

Target 4 (magnetic) is monopole located on the southeast shoreline at 320423E 2030250N. It could not be isolated from the shore and could have a geologic origin. Further investigation using visual and metal detector survey is recommended.

Target 5 (magnetic) is a monopole detected by a single survey line close to shore at 320438E 2030341N. Preliminary ground truthing discovered a discarded lead-acid storage battery at this location accounting for the source of the anomaly.

Target 6 (magnetic) is a monopole located in the center of the bay at 320400E 2030279N. The anomaly is located near one of the moored boats and appears to be caused by the vessel's anchor. A visual and metal detector survey is recommended in case the anomaly created by the anchor is masking the magnetic signature of any ferrous cultural material in the area.

Target 7 (magnetic) is a monopole (320264E 2030295N) associated with the second vessel moored in the bay. It appears to be caused by the vessel's anchor or ground tackle. Although the anomaly is small a visual and metal detector survey is

recommended in case the anomaly created by the anchor is masking the magnetic signature of any ferrous cultural material in the area.

Target 8 (magnetic) is a strong monopole anomaly on the northern shoreline at 329384E 2030343N. It could be associated with the shoreline geology but its strength indicates otherwise. Visual and metal detector survey is recommended to isolate and identify the anomaly's source.

Target 9 is a monopole located in the southern portion of the bay at 320368E 2030215N. The anomaly was only detected on one survey line near the shore and is possibly associated with geology. Due to its location relative to the shore and its presence on one survey line no further investigation is recommended.

■ PRINCESS BAY

The entire area of Princess Bay was surveyed except the upper portions that were too shallow for *Beluga* to reach. Survey lines paralleled the long axis of the bay from southwest to northeast and are spaced at 10 m intervals (Figure 12). A mooring area is located in central portion on the eastern side. This area contained several boats and mooring balls that obstructed the survey lines and was avoided by the survey boat. Divers did a visual survey and found numerous anchors used for mooring boats. Four sonar and eight magnetic targets were identified.

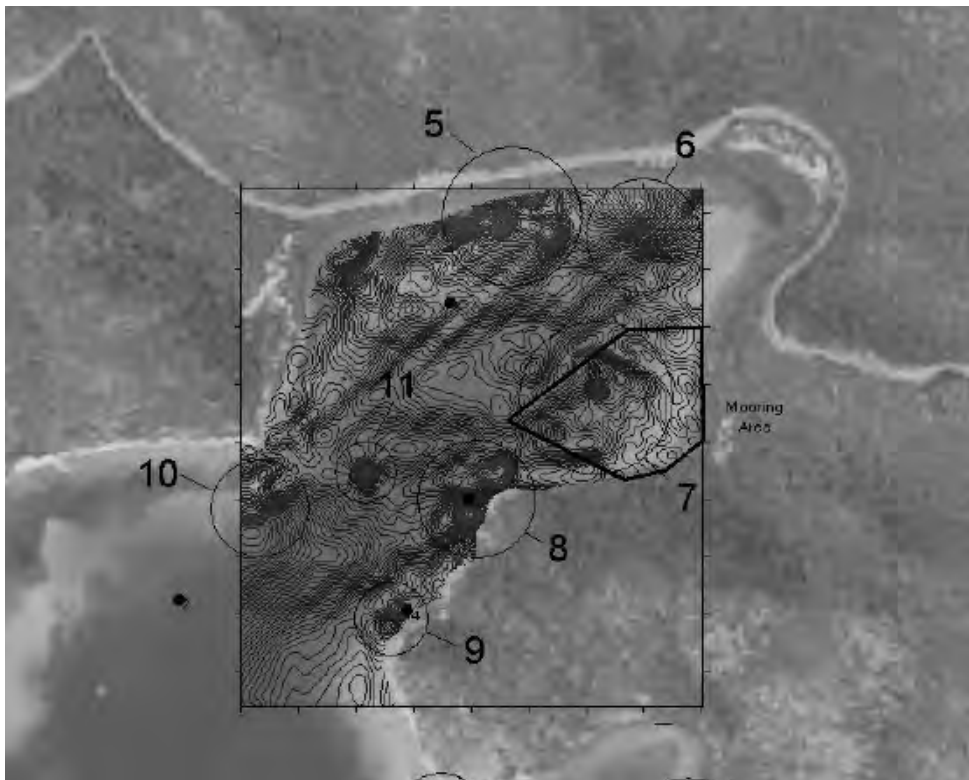


Figure 12. Magnetic anomalies and sonar targets in Princess Bay (Program in Maritime Studies, 2002).

Target 1 (sonar, Figure 13) is a smooth fan-shaped area on the bottom located at 321081E 2030319N. Initial evaluation of the sonar data identified several areas where the anchor chain of moored boats sweeps back and forth across the bottom as the boats swing in the wind. Target 1 was ground truthed to verify the cause of the anomaly.

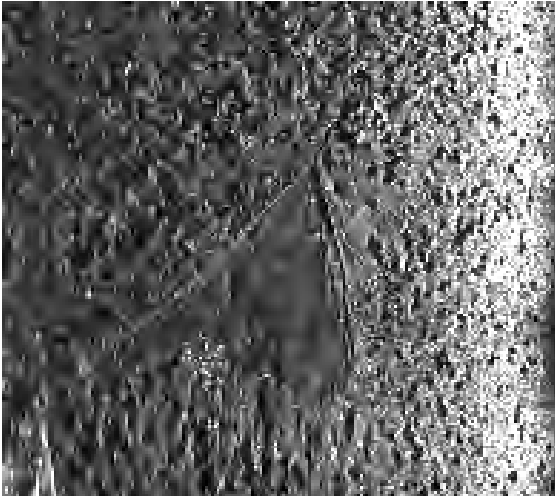


Figure 13. Princess Bay Target 1 (Program in Maritime Studies, 2002).

Target 2 (sonar, Figure 14) is a series of parallel lines 10 x 9.5 m and incorporates a small patch reef or rock outcrop located at 320845E 2030061N. Divers ground truthing the target observed coral in the area. The lines appear to be caused by the unexpected movement of the sonar sensor.

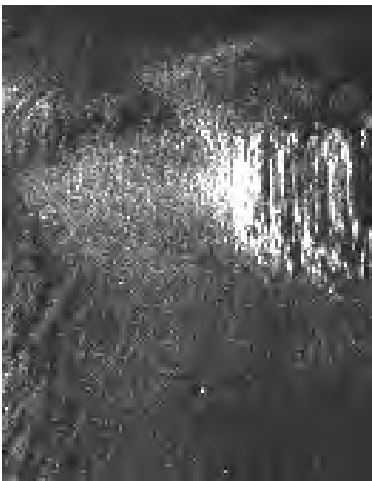


Figure 14. Princess Bay Target 2 (Program in Maritime Studies, 2002).

Target 3 (sonar, Figure 15) is a hard isolated object protruding from the bottom and does not appear characteristic of the flat surrounding area. It is located at

321097E 2030149N. The target measures L 3.25 x W 0.90 x H 0.40 m. Divers found a coral head at the location but while inspecting a larger area discovered a ferrous metal pot near the shoreline. The pot is discussed under Target 8.

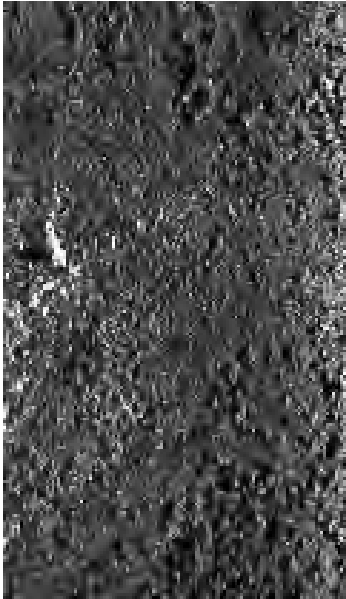


Figure 15. Princess Bay Target 3 (Program in Maritime Studies, 2002).

Target 4 (sonar, Figure 16) is a low mound near shore that measures L 5.0 x W 2.5 x H 2.5 m. It is located at E321044 N2030051 within magnetic Target 9. A visual survey of the area did not locate any cultural material.

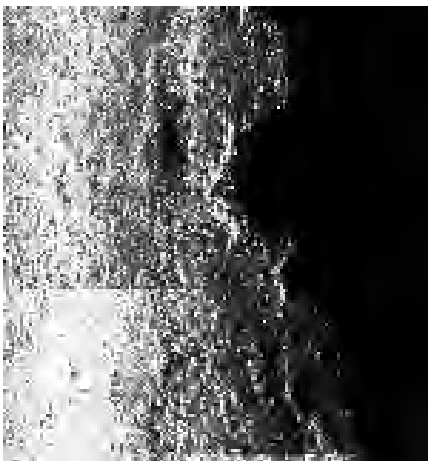


Figure 16. Princess Bay Target 4 (Program in Maritime Studies, 2002).

Target 5 (magnetic) is a cluster of four monopoles along the north shore centered at 321141E 2030398N. Several survey lines converge where these anom-

alies appear. The magnetometer will often record different magnetic intensities for the same area when surveyed from different directions. This is due to the object's field vector, or the direction of the magnetic field. The converging lanes recorded different magnetic values for the area and when the data was contoured, it created several false anomalies. A visual and metal detector survey in this area will determine if ferrous cultural materials are present and masked by the false anomaly.

Target 6 (magnetic) is a dipole anomaly located at the upper end of Princess Bay (321273 E 2030410N). Survey lines were terminated due to shallow water at the point where this anomaly was first detected. A boat anchored in the upper end of the bay may be responsible for the anomaly. Survey coverage, however, is not adequate to determine the anomaly's cause. Visual and metal detector survey is recommended for the extreme upper end of the bay, which was too shallow for the survey boat.

Target 7 (magnetic) is a group of anomalies clustered in an area of moored boats and mooring balls. Figure 12 shows Princess Bay as a mooring area centered at 321213E 2030236N. Within recent memory, this location has been a popular mooring area. Most of the mooring area was not surveyed because of the hazard of snagging remote sensors on numerous mooring balls and boats anchor lines. Divers visually inspected the area and found numerous mooring anchors and sand screw anchors in the bottom. Traditional use of this location as an anchorage and the presence of modern anchors suggest that older historic materials could be present in bottom sediments. These materials would include artifacts discarded from moored vessels and early mooring anchors. A thorough visual and metal detector survey is recommended for this area to locate cultural material.

Target 8 (magnetic) is a strong dipolar anomaly located at 321101E 2030146N. An iron pot was found at this location while ground truthing Target 3. The pot was briefly examined underwater with rough measurements taken. It measured approximately 12" in diameter at the top and 8" at the base. The 6" sides flare out from the base to the rim in a curve. The pot's function has not been determined but fire pots used for cooking have a similar form. Target 8 is a much bigger anomaly than would be expected from the artifact discovered. A metal detector survey is recommended to isolate and identify the anomaly.

Target 9 (magnetic) is a dipolar anomaly. It is located off a point of land at 321032 E 2030048N. Sonar target 4 falls within the anomaly's area. No cultural material was found during preliminary visual survey. Two survey lines detected the anomaly but did not completely isolate it from shore. A metal detector survey is recommended to isolate the anomaly and determine if there is an association with Target 4.

Target 10 (magnetic) is a dipolar anomaly located at 320924E 2030143N. Three survey lines only partially defined the anomaly on the southwest edge of the survey area. Because the anomaly was not completely isolated, visual and metal detector survey is necessary verify its presence and identity.

Target 11 (magnetic) is a strong monopole anomaly located at 321010E 2030173N. The anomaly is centrally located in Princess Bay and detected on two lines. Since the magnetic shift is so large in an isolated area, it is unlikely that the source is geologic. A visual and metal detector survey is recommended to isolate the anomaly's source.

Target 12 (magnetic) is a dipole anomaly near the northwest shore at 321000E 2030351N. Three survey lines partially isolate the anomaly and it does not appear to be associated with shoreline geology. Visual and metal detector survey is recommended to identify the source of this anomaly.

The extreme northeastern portion of Princess Bay was too shallow for the survey boat to enter. A visual and metal detector survey should be completed to isolate the source of Target 6, which borders on this portion of the bay.

■ OTTER CREEK

Otter Creek is a small bay that is oriented slightly northeast to southwest. Survey lines followed this orientation at 10 m intervals (Figure 17). Within the survey area three buoys marked the location of mooring anchors and one boat was anchored in the bay. A shallow area near the head of the bay could not be reached by the survey boat and must be visually surveyed and examined with a metal detector. Six side-scan sonar targets and five magnetometers targets were identified.

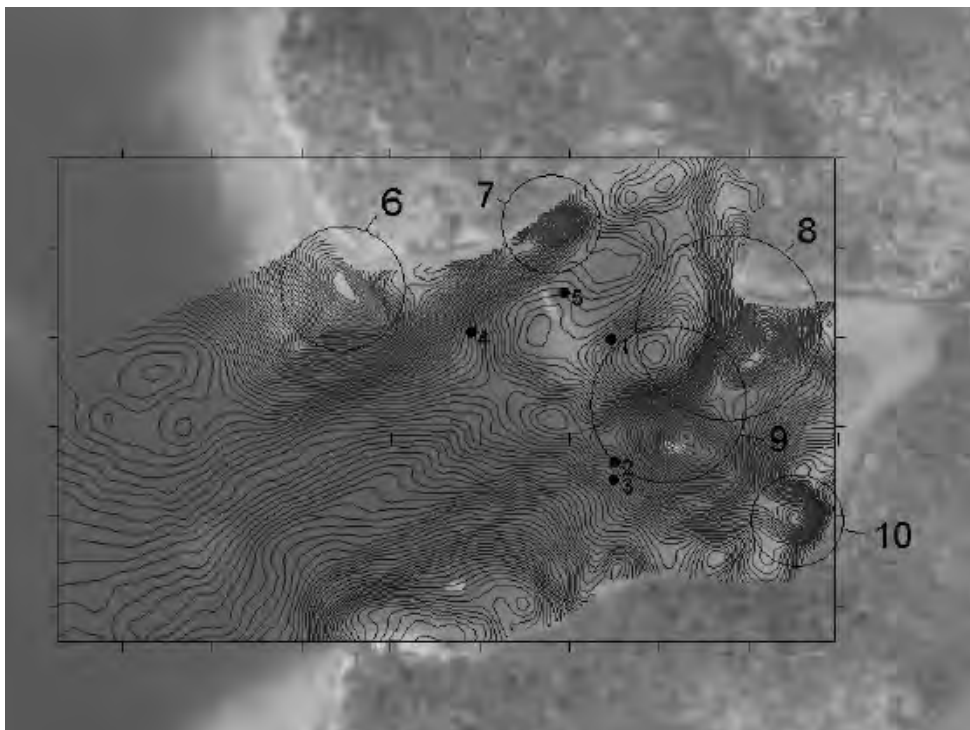


Figure 17. Magnetic anomalies and sonar targets in Otter Creek (Program in Maritime Studies, 2002).

Target 1 (sonar, Figure 18) is a linear object lying among a group of taller coral heads. It is located at 321223E 2029847N and measures 2.5 meters long. Divers did not locate the object while ground truthing but did find a metal grate measuring approximately 1 by 1 ft composed of thin metal.

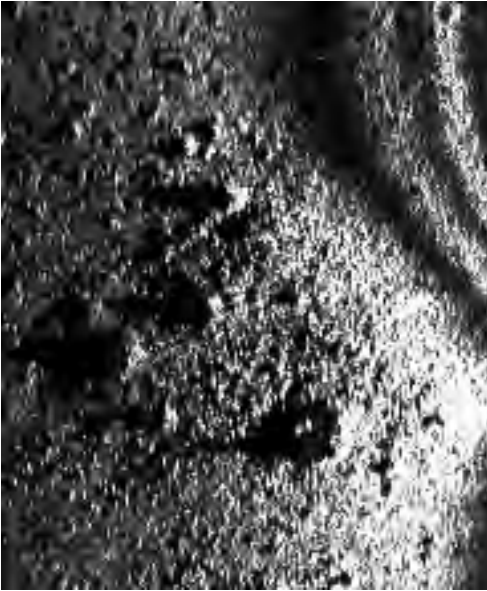


Figure 18. Otter Creek Target 1 (Program in Maritime Studies, 2002).

Target 2 (sonar, Figure 19) is a linear object detected at the edge of the sonar range. Because water depth is shallow in this portion of the bay only one survey lane passed close enough to detect the target. It is located at 321298E 2029860N and falls within the area designated as magnetic Target 8. Divers found a rock outcrop very close to shore at this location.



Figure 19. Otter Creek Target 2 (Program in Maritime Studies, 2002).

Target 3 (sonar, Figure 20) is a linear mark detected in the bottom sediment at 321225E 2029779N. It was suspected to be an anchor drag mark and this was verified during a visual inspection.

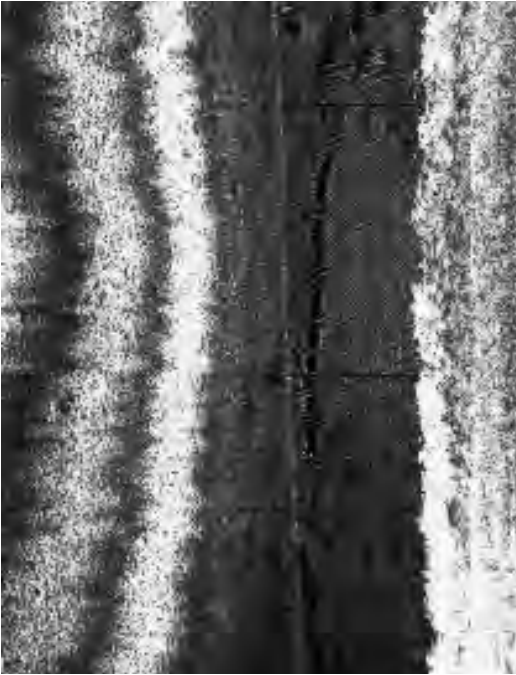


Figure 20. Otter Creek Target 3 (Program in Maritime Studies, 2002).

Target 4 (sonar, Figure 21) is a linear mark similar to Target 3 located at 321224E 2029769N. Divers determined this was an anchor drag mark.

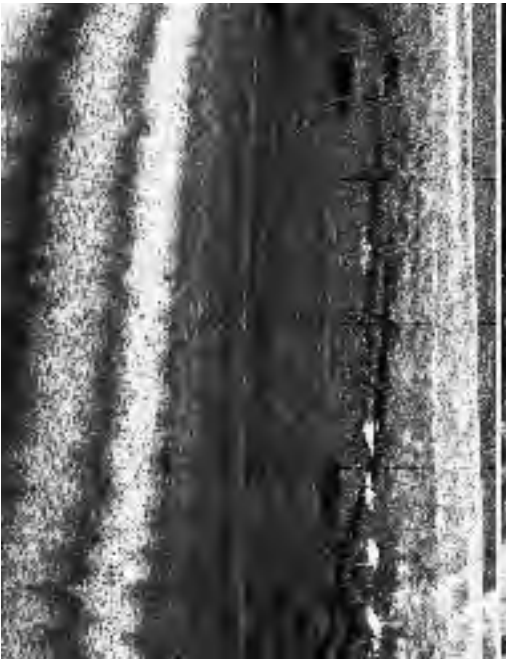


Figure 21. Otter Creek Target 4 (Program in Maritime Studies, 2002).

Target 5 (sonar, Figure 22) is a linear mound on the north side of Otter Creek located at 321145E 2029852N. It measures 15.5m long x 7m wide x 0.90m high. The target's shape is similar to a ballast pile and requires visual inspection and use of a metal detector.

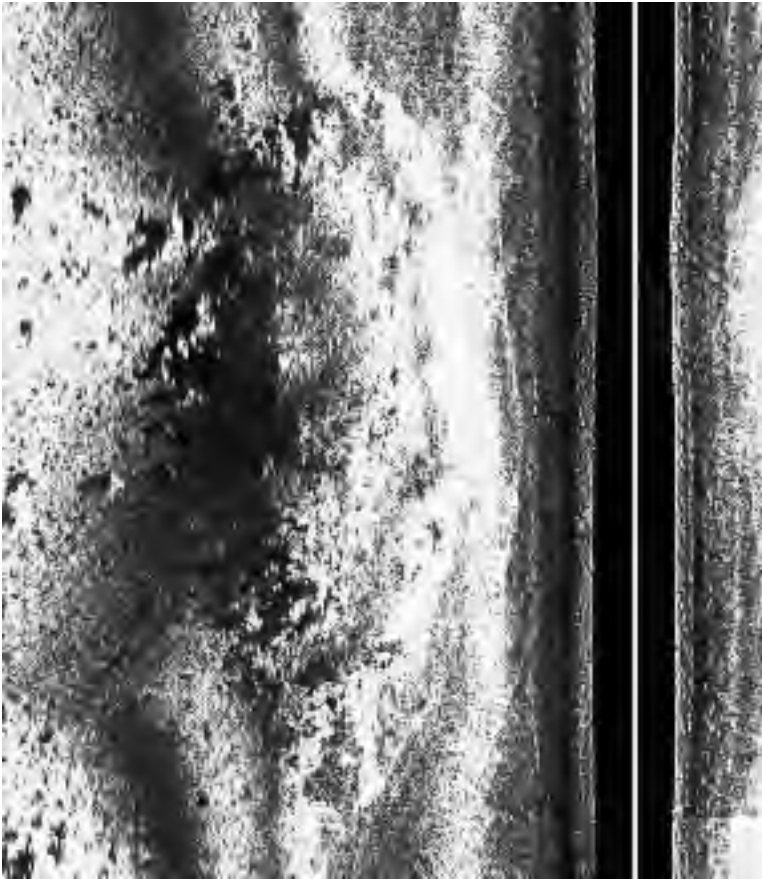


Figure 22. Otter Creek Target 5 (Program in Maritime Studies, 2002).

Target 6 (sonar, Figure 23) appears to be a small coral head measuring 5 x 4 m. It is located at 321196E 2029874N. The sonar record reveals a tall linear projection extending 1.8 m straight up from the top of the coral head. Ground truthing will determine if this is cultural material embedded in the bottom.

Target 7 (magnetic) is an E-W oriented dipolar anomaly located at 321178E 2029913N on Otter Creek's north shore. Three survey lines detected its presence although its location near the shore makes it a possible geologic anomaly. Ground truthing with a metal detector is recommended to isolate the anomaly.

Target 8 (magnetic) is a dipolar anomaly located at 321178E 2029912N along the northern shoreline. Although close to shore the anomaly is defined on four survey lines. Visual and metal detector surveys are recommended to locate and identify the anomaly's source.

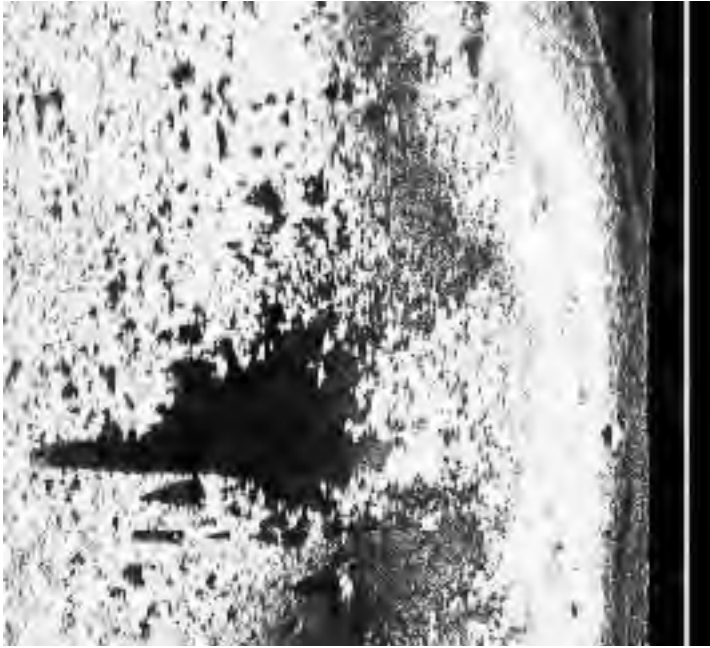


Figure 23. Otter Creek Target 6 (Program in Maritime Studies, 2002).

Target 9 (magnetic) is a monopole anomaly located off the rocky point near the head of the bay at 321312E 2029851N. The anomaly lies at the extreme end of two survey lines and is only partially defined. Shallow water did not allow extending survey lines further. While this anomaly may be associated with geology it should be further isolated by visual and metal detector survey.

Target 10 (magnetic) is a dipolar anomaly located near the center of the bay at 321257N 2029812E. This anomaly is well defined in an isolated area and is unlikely to be associated with shoreline geology. Visual and metal detector surveys should be completed to locate and identify the source of this anomaly.

Target 11 (magnetic) is a monopolar anomaly located at 321327E 2029749N, along the southeast shoreline. The steepest gradient of the anomaly is close to shore and was detected by two overlapping survey lines that followed the perimeter of the shoreline. The close proximity of this anomaly to the shore suggests its source is geologic in origins. It is, however, recommended that the area be surveyed visually and with a metal detector to determine the anomaly's cause.

■ BROWN BAY

Brown Bay was surveyed on 7 February 2002. The survey was conducted using the magnetometer only because the sonar was damaged the previous day in the Hurricane Hole survey. Survey Lanes were established running from northwest to southeast and covered most of the bay except the innermost shallows (Figure 24). Two supplemental passes were made that conformed to the contour of the shoreline to ensure maximum coverage of the bay. Two magnetic anomalies were recorded and ground truthing dives were performed after the survey.

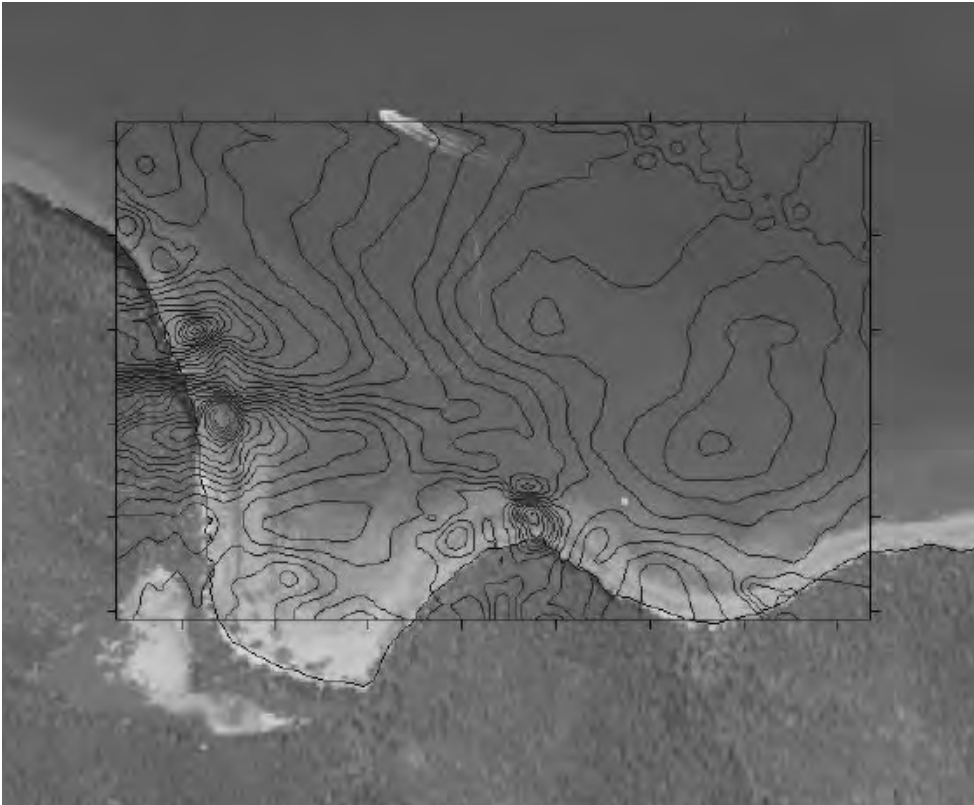


Figure 24. Magnetic anomalies and sonar targets in Brown Bay (Program in Maritime Studies, 2002).

Target 1 (magnetic) is a large dipole anomaly with an initial decrease of 619.29 gammas and a rise of 831.53 gammas from the background magnetism. The anomaly is present on both survey lanes that followed the shoreline of the bay. The target is located at 319731.62E 2031251.91N and occupies an area approximately 175 meters in length. The northern extremity of this anomaly was dove and a metal rod was discovered in the area.

Target 2 (magnetic) is a monopole magnetic anomaly with an intensity of 244.46 gammas marked by an increase from the background magnetism. The target is present on both survey lines that followed the contour of the shoreline of brown bay. The target is located at 320069.80E 2031117.05N the target was ground truthed by divers after the survey and no material culture was found.

■ HURRICANE HOLE

A large section of the main body of Hurricane Hole was surveyed on 6 February 2002. Survey lines were established running north to south in the bay with a lane spacing of 10 meters. The survey was conducted using side-scan sonar and magnetometer for data acquisition. Due to the water depth of the survey area, the sonar was deployed using a layback of 80 ft to allow the sonar to travel at depth and

provide a better image of the seafloor. During the initial pass of the survey, the vessel was traveling in a northerly direction when a sudden change in water depth occurred. The abrupt change in depth prevented the team from retrieving the sonar and it was subsequently snagged on a coral head. The team was able to recover the sonar fish but found that damage had occurred to the data cord, which transmits the data collected from the sonar to the processing computer on the boat. With the sonar damaged beyond use, the survey continued using only the magnetometer.

The magnetic map of Hurricane Hole reveals contours related to submerged geological features (Figure 25). Some of these are submerged portions of ridgelines that extend on shore and others appear to be large reef. One target was located in the northwest quadrant of the survey area at 320419.71 E 2029608.04N. This anomaly may be caused by crossing survey track lines.

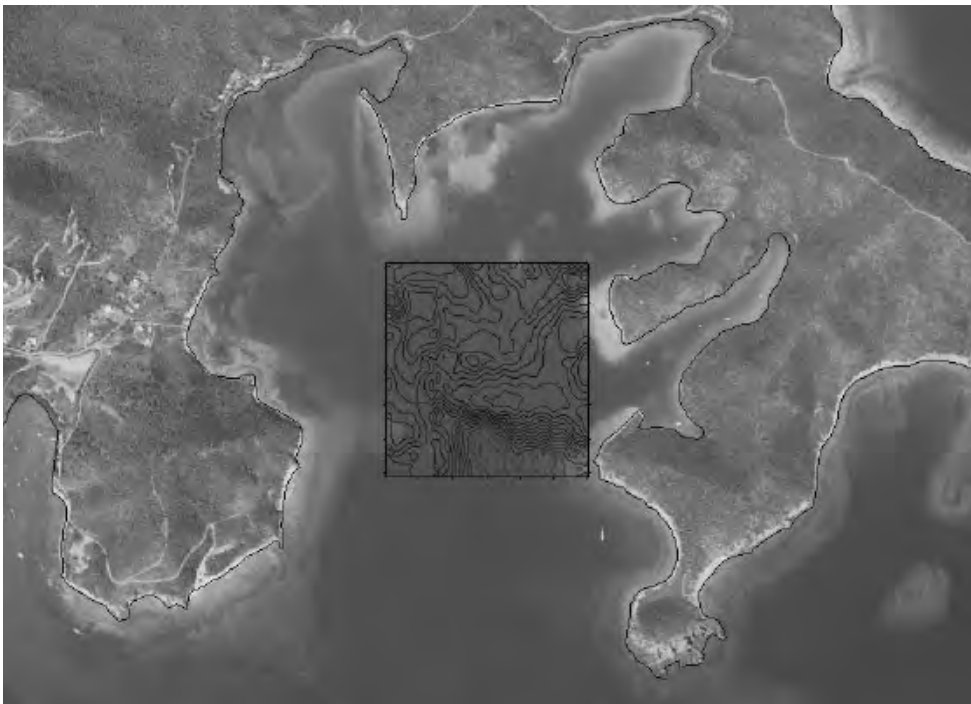


Figure 25. Magnetic contour of Hurricane Hole (Program in Maritime Studies, 2002)

■ ROUND BAY

On February 5, 2002, the *Santa Monica* site was surveyed by ECU to obtain the magnetic signature of the wreck and capture its images using side-scan sonar. The remains of *Santa Monica* were located after a brief tow board search of the general area where the wreck was known to be. After confirming the location of the wreck the team made several passes over the site with the side-scan sonar and magnetometer successfully acquiring the desired data (Figure 26). The survey was conducted making random passes over the site.

Target 1 (magnetic) is the magnetic signature recorded for HMS *Santa Monica*. The anomaly is a dipole magnetic moment lasting 20 seconds. The gammas of the magnetic variance lower from a background magnetism of 39240.19 gammas to 39051.89 for a difference of 188.30 gammas. The intensity of the anomaly then rises to 39653.63 gammas and then drops again to the background magnetism of 39294.99 for a difference of 359.64 gammas. The magnetic anomaly created by the *Santa Monica* was recorded over several passes. The target location is 322850.82E 2028796.72N. The survey lanes ran from southwest to northeast during the survey.



Figure 26. Magnetic signature of HMS *Santa Monica* (Program in Maritime Studies, 2002).

Target 2 (sonar) is the sonar image recorded from the *Santa Monica* site. The images recorded are shown in Figure 27 and 28. Figure 27 shows the remains of the vessel in the lower right hand corner of the image and shows the rapid depth change associated with the site in the upper left hand corner of the image. Figure 28 is a close up of the vessel. The remains in the image measure approximately 46 ft in length and 20 ft in width. The survey vessel was traveling southwest.

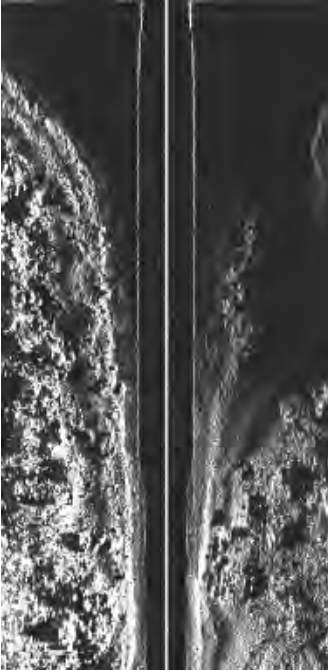


Figure 27. Sonar image of HMS *Santa Monica* and surrounding coral (Program in Maritime Studies, 2002).

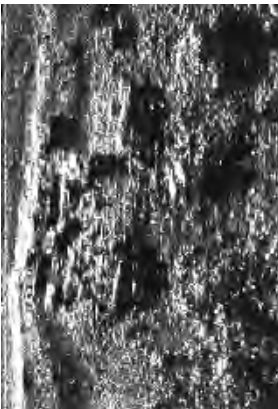


Figure 28. Sonar image of HMS *Santa Monica* (Program in Maritime Studies, 2002).

■ LEINSTER BAY

The greater area of Leinster Bay, centrally located on the northern coast of St. John, is composed of Leinster Bay, Mary's Creek, and Water Lemon Bay. The coastal lands along Leinster Bay were some of the first settled by the Dutch.

During the summer of 2002, Leinster Bay became an area of focus for the ECU field school. Investigations at Leinster Bay were focused around a ballast pile located by the National Park Service. A survey of the area was conducted on June

7, 2002 to ascertain if any other wrecks were present and to provide instructions in remote sensing for students attending the field school. The survey, utilizing the side-scan sonar and magnetometer, was conducted in the central part of Leinster Bay but excluded Mary's Creek due to navigational hazards and Water Lemon Bay because of moored boats present. Survey lines ran parallel to shore from east to west and extended from the shoreline to the end of Mary's Point. Surveying the lines close to shore was not possible due to shallow coral heads that could potentially damage the survey equipment.

Several targets were recorded as potential sites of submerged cultural resources. Of these targets, 11 were sonar images and one was a magnetic anomaly. The magnetic anomaly is a monopole and has several sonar targets that may be associated with it due to the close proximity of the sonar targets and the magnetic anomaly.

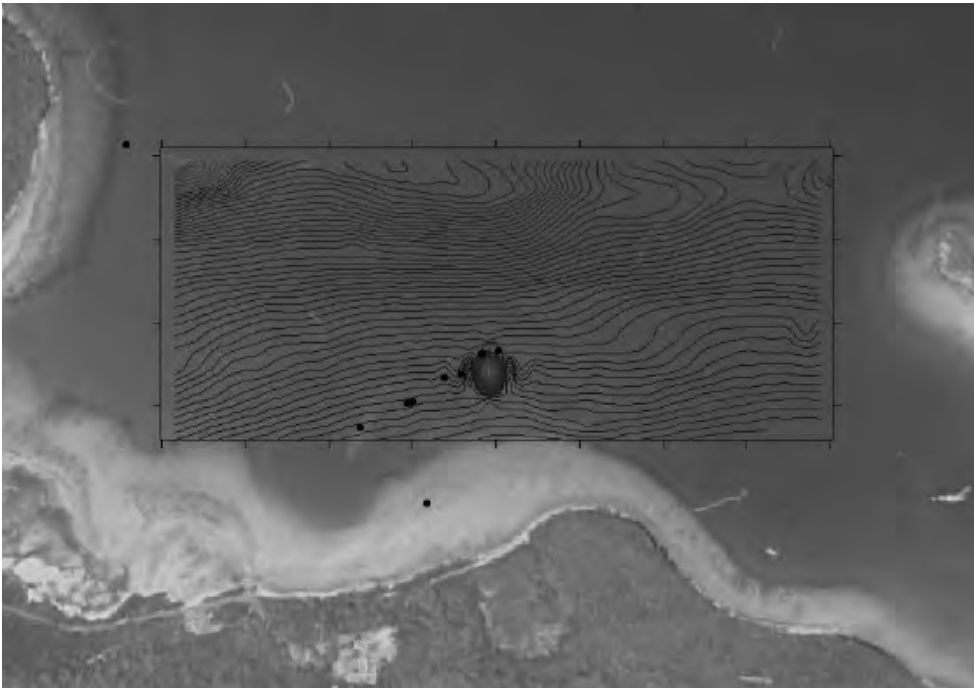


Figure 29. Magnetic anomalies and sonar targets in Leinster Bay (Program in Maritime Studies, 2002).

Target 1 (magnetic) is a monopole magnetic anomaly with an intensity of 895.94 gammas. It is only present on one survey line and has duration of six seconds. The anomaly is located at 2031544.33E 317386.03N and has several sonar images associated with it. All three sonar images (Target 4, Target 8, and Target 9) associated with Target 1 are believed to be fish traps and may be causing the magnetic anomaly.

Target 2 (sonar, Figure 30) is a sonar image of the Leinster Bay Wreck Site examined during the 2002 summer field school. Data from the image correlates

with that recorded during the examination of the wreck by divers. The image shows dimensions of approximately 20 ft in length and 8 ft wide with a height of 4.5 ft. The recorded measurements were L25 ft x W10 ft x H 5 ft. The image is of poor quality due to the low gain of the image yet still shows the distinct shape of a ships ballast pile and shows a large shadow cast from the pile, which would be expected from a target of this type. The target is located at 2031393.85E 317313.87N. The vessel was traveling in a northeasterly direction when the image was recorded.

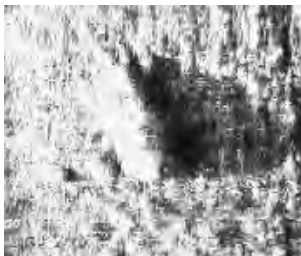


Figure 30. Leinster Bay Target 2 (Program in Maritime Studies, 2002)

Target 3 (Figure 31) consists of two linear objects associated with several smaller objects in front of them. The largest linear objects dimensions are L 21.0 ft x W 1.6 ft x H 0.35 ft. The smaller linear objects dimensions are L 5.5 ft x W 1 ft x H 0.35 ft. The largest of the smaller objects that are associated with the Target 4 has dimensions of L 2.5 ft x W 0.5 ft x H 0.35 ft and is oval in shape. The multiple images for Target 4 are located in a cluster with the furthest distance between objects being 25 ft. The image for Target 4 is of poor quality hindering the accuracy of the analysis of this target. Target 4 is located at 2031812.73E 316957.90N. The survey vessel had an easterly heading when the image was recorded.



Figure 31. Leinster Bay Target 3 (Program in Maritime Studies, 2002)

Target 4 (Figure 32) appears to be a square object that is approximately 1.5 ft in height with an estimated length and width between 0.5-1 meters and may represent a fish trap. The object is associated with a large circular formation of coral located in a sandy plain 75 ft southeast of the target. The possible fish trap is located at 2031598.34E 317383.76N. Target 4 may be associated with the magnetic anomaly (Target 1) due to its close proximity. The survey vessel was traveling west when the target was recorded.

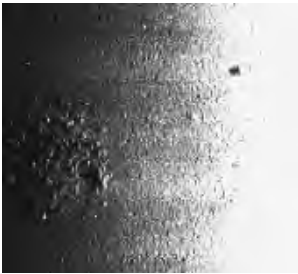


Figure 32. Leinster Bay Target 4 (Program in Maritime Studies, 2002)

Target 5 (Figure 33) is a linear object located 132 ft east from a large coral patch. The dimensions are L 17.84 x W 2.88 x H 1.66. Target 5 is located at 2031537.78E 317358.24N. The survey vessel was traveling east when the image was recorded.



Figure 33. Leinster Bay Target 5 (Program in Maritime Studies, 2002)

Target 6 (Figure 34) is a 4 ft square with a height of 2 ft. This target appears to be a fish trap. It is located at 2031532.56E 317338.84N. The target is approximately 165 ft west of a large coral patch. The survey vessel was traveling west when the image was recorded.

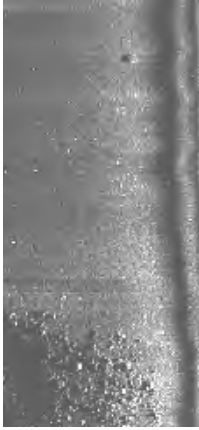


Figure 34. Leinster Bay Target 6 (Program in Maritime Studies, 2002)

Target 7 (Figure 35) is a large oval shaped object resting on the sea floor. The dimensions are L 11.0ft x W 5.3ft x H 1.5 ft. The target rests alone on a sandy bottom. It is located at 2031503.63E 317302.01N. The survey vessel was on an easterly course when the image was recorded.



Figure 35. Leinster Bay Target 7 (Program in Maritime Studies, 2002).

Target 8 (Figure 36) is a 3.5 ft square with a height of 2 ft. This target appears to be a fish trap. It is located at 2031565.04E 317404.52N. Target 8 may be associated with the magnetic anomaly (Target 1) due to its close proximity. The survey vessel was traveling east when the image was recorded.

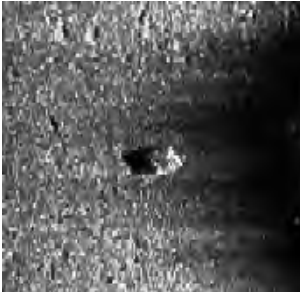


Figure 36. Leinster Bay Target 8 (Program in Maritime Studies, 2002).

Target 9 (Figure 37) appears as a rectangular shape protruding from the bottom. The dimensions are L 6.5 ft x W 4.5 ft x H 0.7 ft. The target lies 65 ft south of a coral head and may be a fish trap. It is located at 2031560.08E 317381.25N. Target 9 may be associated with the magnetic anomaly (Target 1) due to its close proximity. The survey vessel was traveling west when the image was recorded.

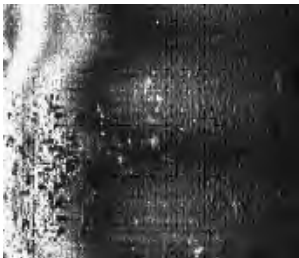


Figure 37. Leinster Bay Target 9 (Program in Maritime Studies, 2002).

Target 10 (Figure 38) is 4 ft square with a height of 2 ft. This target appears to be a fish trap. It is located at 2031474.51E 317238.09N. The survey vessel was traveling west when the image was recorded.



Figure 38. Leinster Bay Target 10 (Program in Maritime Studies, 2002).

Target 11 (Figure 39) is a 2.5 ft square with a height of 2.5 ft. This target appears to be a fish trap lying 150 ft east of a large coral head. Target 11 is located at 2031537.10E 317358.24N. The survey vessel was on an easterly course when the image was recorded.



Figure 39. Leinster Bay Target 11 (Program in Maritime Studies, 2002).

Target 12 (Figure 40) is 4 ft square with a height of 1.75 ft. This target appears to be a fish trap. It is located at 2031502.81E 317293.83N. The survey vessel was traveling east when the image was recorded.



Figure 40. Leinster Bay Target 12 (Program in Maritime Studies, 2002).

■ WATER CREEK

Water Creek is a long narrow bay approximately 650 meters long and 200 meters wide across the mouth. The bay consists of two bodies of water. The largest section of the bay is the main body, which opens into Hurricane Hole and extends in a northeastern direction for 650 meters where it narrows forming the shoreline. Near the mouth of the main body of Water Creek lies a small bay extending to the southwest. Water Creek is known to have been used as a careening site for vessels. Historical French and English maps from the late eighteenth century mark Water Creek as a careening site. Cultural remains have also been discovered in the smaller portion of Water Creek after a barge dragged its anchor revealing porcelain and possible ships timbers.

The submerged cultural resource survey of Water Creek was a two-part remote sensing survey conducted during the winter and summer of 2002. The goal of the project was to evaluate the impact of a proposed mooring system on submerged cultural resources in the creek. Frank Cantelas, staff archaeologist for the Maritime Studies Program at East Carolina University, and MA candidate Keith Meverden, conducted the initial survey using a proton precession magnetometer and side scan sonar. The initial survey methodology and conclusions have been previously discussed in the draft project summary (Cantelas et al. 2004). Findings for Water Creek during the initial survey were inconclusive. A large number of boats outfitted with engines, anchors, and chain were anchored in the creek during the survey and affected the magnetometer's performance. These vessels appeared as large magnetic anomalies and masked any anomalies caused by archaeological material.

From 1-22 June 2002, East Carolina University conducted a field school in conjunction with the Virgin Islands National Park. One of the goals of the field school was to conduct exercises in remote sensing for the students involved. Frank Cantelas led these exercises. Due to the initial survey's inconclusive findings, and the discovery of submerged cultural remains in the area, the team re-surveyed lower Water Creek with a magnetometer.

Water Creek was first surveyed February 4, 2002 using the magnetometer and side-scan sonar. Survey lines paralleled the long axis of the bay from southwest to northeast and are spaced at 10 m intervals. Six boats, two with steel hulls, and a mooring buoy were encountered in Water Creek. Several of these boats produced strong magnetic signatures, which would obstruct the magnetic signature of any archaeological materials nearby. The magnetic survey of Water Creek boats was not as effective as planned. The upper end of Water Creek was not surveyed because the water was too shallow for the survey vessel to enter. A visual and metal detector survey of this area is recommended. Three lead-acid storage batteries were found in the southwestern area of the bay (see the map of Water Creek).

Target 1 (sonar, Figure 41) is a small mound measuring L 3.5 m x W 3.0 m x H 0.2 m. It has the appearance of a heavily encrusted, partially buried cylindrical object located 3m from the southeast shore. Its UTM position is 321354E 2029484N. The target is not associated with a magnetic anomaly and could be a rock outcrop or a nonferrous object. Diver visual survey is recommended to identify this target.

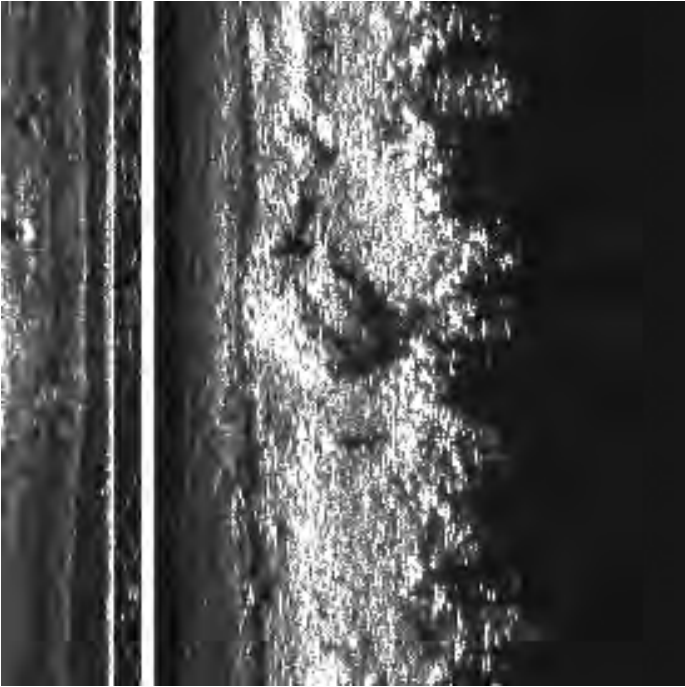


Figure 41. Water Creek Target 1 (Program in Maritime Studies, 2002).

Target 2 (sonar, Figure 42) consists of a series of faint parallel lines among a group of small coral heads. It is located at 321220E 2029512N. This target is associated with a cluster of monopole magnetic anomalies along the northern shore. Due to the shape of the target and its association with Target 3 magnetic anomalies diver visual inspection is recommended.

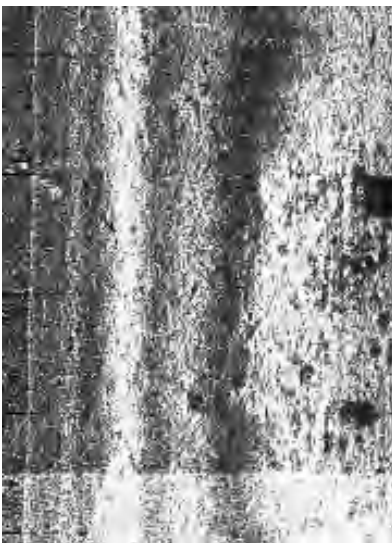


Figure 42. Water Creek Target 2 (Program in Maritime Studies, 2002).

Target 3 (magnetic) is a cluster of monopole anomalies along the northern shore and also encompasses sonar target 2. The cluster lies in a line, approximately 130 meters long, extending from 321095E 2029465N to 321211E 2029522N. Due to the extreme length of the anomalies the source appears to be geology associated with the shoreline. However, a visual survey of the area is recommended.

Target 4 (magnetic) is a dipole anomaly located at 321312E 2029547N. The anomaly corresponds to a large sailboat, *Mother of Pearl*, anchored in the center of the bay. The intense signature completely masks the magnetic signature of any ferrous cultural material in the area. A monopole anomaly close to shore just to the northeast of target 4 may be associated with *Mother of Pearl* or shoreline geology. Visual and metal detector survey of the area-encompassing target 4 is recommended.

Target 5 (magnetic), located at 321400E 2029619N, is a steep gradient along the northern shoreline. Geology or the intersection survey lines most likely caused the anomaly's source. No further investigation is recommended.

Target 6 (magnetic) is a dipole anomaly located at 321467E 2029680N. The magnetic contour map shows the anomaly partially on the northern shore with a steep gradient extending into the bay. Three survey lines only partially define the anomaly. Because the anomaly was not completely isolated visual and metal detector survey is recommended to isolate and identify the source.

Target 7 (magnetic) is a monopole anomaly located in the upper end of Water Creek at 321527E 2029751N. It is centered near shore and also at the convergence of two survey lines. The magnetometer will often record different magnetic intensities for the same area when surveyed from different directions. This is due to the object's field vector, or the direction of the magnetic field. The converging lanes recorded different magnetic values for the area and when the data was contoured, it created a false anomaly. No additional investigation is recommended.

Target 8 (magnetic) is a dipole anomaly located on the edge of the survey area at 321587E 2029734N oriented North-South. It was not completely isolated by the survey because of shallow water, and appears to extend on shore. One survey line detected its presence, however, its location near the shore makes it a possible geologic anomaly. Ground truthing with a metal detector is recommended to isolate the anomaly.

Target 9 (magnetic) is a dipole anomaly located at 321536E 2029641N. Its location, near shore made it impossible to isolate the anomaly from all sides. While the anomaly may have a geologic source, further visual and metal detector survey is recommended to determine if the source is natural or artificial.

Target 10 (magnetic) is a monopole anomaly detected on two survey lines near shore at 321410E 2029524N. Its position near the shore made it impossible to completely isolate with the magnetometer. Further investigation is recommended using visual and metal detector survey to locate the anomaly's source.

Target 11 (magnetic) is a dipole anomaly along the shore at 321308 2029445N and is similar in characteristic to Target 9. The target could not be completely isolated from the shoreline, and may be associated with geology. A visual and metal detector survey is recommended to isolate the anomaly and determine its source.

Target 12 (magnetic) is a multi-component anomaly located at 321172E 2029418N. It is centered between two large sailing yachts, which appear to be responsible for the anomaly. *Silver Cloud*, approximately 100 feet long, is a steel hulled sailboat built in 1899. The anomaly produced by these vessels mask the magnetic signature of any ferrous cultural material nearby. Although sonar did not record any targets in this area, further investigation is recommended by diver visual and metal detector survey.

Target 13 (magnetic) is a dipole anomaly located at 321275E 2029300N. The magnetic contour map interpretation places the anomaly on the shore (Figure 43). This location suggests a geologic source on shore and outside the survey area. However, a visual and metal detector survey of the area is recommended because of a reported shipwreck in the small bay attached to Water Creek.

Target 14 (magnetic) is a multi-component anomaly located at 321302E 2029238N. The anomaly is located near the head of the small bay in an area where survey lines are converging because the bay narrows and ends. The magnetometer will often record different magnetic intensities for the same area when surveyed from different directions. This is due to the object's field vector, or the direction of the magnetic field. The converging lanes recorded different magnetic values for the area and when the data was contoured, it created false anomalies. Given the presence of a shipwreck in this small bay and the inconsistency of the magnetometer data, additional visual and metal detector survey is recommended.

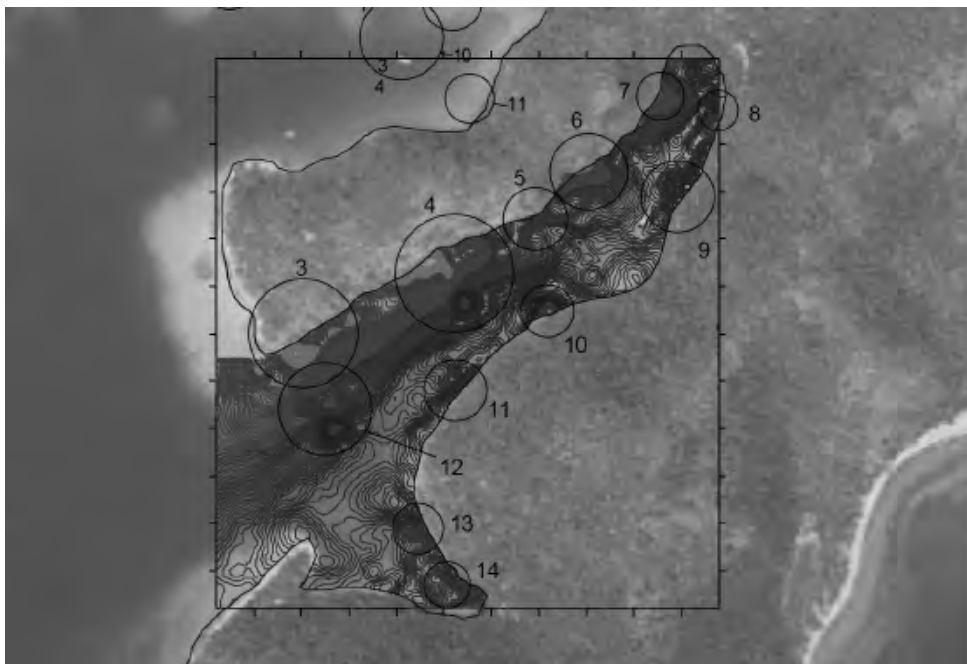


Figure 43. Targets and magnetic contours from the January/February 2002 survey (Program in Maritime Studies, 2002).

The second survey covered the lower two-thirds of the bay where anchored boats obstructed survey lines and caused interference with magnetometer data in the first survey. The initial survey in January indicated a general trend in the magnetic variance of the bay with the northern shore having a higher magnetic strength than the southern shore due to the geologic composition of the bay. Several large magnetic anomalies were discovered in the center of the bay. All of these anomalies were associated with the recorded positions of anchored boats at the time the survey was conducted. Magnetic data indicated five large anomalies (Targets 3, 4, 5, 6, and 7) along the northern shore and two anomalies (Targets 10 and 11) on the southern shore of Water Creek. On the northern shore all of the anomalies are positive monopoles while the anomaly on the southern shore is a negative monopole. These shoreline anomalies show a magnetic fluctuation in the same direction as the magnetism associated with the respective shoreline. These anomalies are all believed to be caused by the geology of the bay due to their close proximity to the shoreline and their congruency in magnetic fluctuation with their associated shoreline.

The data from the June survey shows no magnetic anomalies located in the center of Water Creek. This further supports the conclusion that the magnetic anomalies recorded in the initial survey were caused by the vessels anchored in the bay during the survey. The same trend is present in the overall magnetic field of the bay with the northern shore showing a higher magnetic strength than the southern shore. The anomalies (Targets 3, 4, and 10) that were present along both shores in the initial survey are present in the second survey. Targets 5 through 9 are not included in this discussion because they are outside of the June 2002 survey. Target 11 did not appear in the second survey.

A small bay near the mouth of Water Creek was examined in the area where cultural materials were found in 2001. The initial survey in January did not concentrate on this area of the small bay. Only one pass was made in the vicinity of where the cultural remains were discovered and no anomalies were recorded. The second survey conducted in June concentrated on this area. The location was surveyed twice and several anomalies were found on both passes. However, the locations of the anomalies in the two surveys did not correspond with each other, raising the question of the data's validity. Only one anomaly matches on the first and second surveys. This anomaly is located near the position of the discovered cultural remains.

Three anomalies were found in the survey of Water Creek's lower two-thirds (Figure 44). Targets 1 and 2 lie along the north shore and appear to be outside the area impacted by the proposed mooring system. Their magnetic signature appears to be related to local geology. The single large anomaly on the south shore will be impacted by the proposed mooring system.

A single anomaly, Target 4, was discovered in June 2002 near the location of where artifacts were found the previous year. A test unit excavated at this location, to confirm the presence of a shipwreck, uncovered a number of artifacts. The excavation was made in loose sand so that the unit measured approximately two meters across at the top, tapered to roughly 20 centimeters at the bottom, and measured 1.3 meters deep. Artifacts recovered included a lead gaming piece (possibly made from a bullet), a mason jar lid, and a plastic handled phillips screwdriver.

A large round ferrous metal object was also located near the test pit and may have been the source of the magnetic anomaly. The object, 18 inches in diameter and imbedded in the bottom, remained unidentified but was determined to be modern.



Figure 44. Targets and magnetic contours from the June 2002 survey (Program in Maritime Studies, 2002).

Target 1 (magnetic) is a cluster of monopole anomalies along the north shore of Water Creek. The cluster lies in a line approximately 130 meters long from 321104E 2029462N to 321216E 2029532N. This target corresponds to Target 3 from the initial survey. Due to the targets close proximity to the shoreline and its congruency in magnetic fluctuation with the associated shoreline it is believed to be geologic. However, a visual survey of the area is recommended since the anomaly is present in both surveys.

Target 2 (magnetic) is a cluster of three monopole anomalies located along the north shore of Water Creek. The target extends from 321245E 2029546N to 321381E 2029609N and is approximately 150 meters in length. This target corresponds to Target 3 from the initial survey. Due to its close proximity to the shoreline and the congruency in the magnetic fluctuation with the associated shoreline it is believed to be geologic. However a visual survey of the area is recommended since the anomaly is present in both surveys.

Target 3 (magnetic) is a monopole located at 321396E 2029519N on the southern shore of Water Creek. The anomaly has a diameter of approximately 75 meters. This target corresponds to Target 10 from the initial survey. Due to its close proximity to the shoreline and the congruency in the magnetic fluctuation with the associated shoreline it is believed to be geologic. A visual survey with a hand held

metal detector is recommended since this target lies in the proposed mooring area.

Target 4 (magnetic) is a monopole located at 321173E 2029241N in the small inlet lying south of the main body of Water Creek. Target 4 appeared on two surveys of this area the target is located in the general area where cultural remains were found. A test excavation of the target revealed a mixture of historic and modern cultural remains. No evidence of a vessel was found.

The proposed mooring field would be located in the center of the main body of Water Creek and the along the southern shore. The second survey of Water Creek revealed one anomaly that lies in the proposed mooring field. Target 3 along the southern shore should be investigated with a hand held metal detector to evaluate if cultural remains are the source of the anomaly. The survey shows no other evidence that the proposed mooring system would disturb submerged cultural materials in the area.

Site Inspections

Site inspections were carried out on targets located in Leinster Bay, Water Lemon Bay, Water Creek and Hansen Bay. The following is a synopsis of site identification and interpretation.

■ LEINSTER BAY

The Leinster Bay site (Figure 45) lies almost directly in front of the Annaberg plantation. The remains consist of a ballast pile measuring 25 feet (7.62 m) in length by 10 feet (3.05 m) in beam (Figure 46). Associated material near the ballast pile includes concreted iron fasteners, a complex iron object perhaps made of jumbled chain plates and an iron block strop (Figure 47). The site is easily accessible to snorklers in 6.3 feet (1.92 m) to 8.0 feet (2.44 m) of water, and has historically been easily viewed and accessible to any salvage from the nearby shoreline. Access and visibility may explain the dearth of robust surface material remains such as ceramic and glass fragments associated with most other wreck sites.

Though ballast piles have proven their worth in site interpretation, it is generally through complex and exhaustive analysis of the stones contained therein. In this light, the Leinster Bay wreck site's ballast pile may, in the future, provide a wealth of information. For now, it was determined that the large river cobbles that make up this pile are generally igneous in variety ranging from the darkest of basaltic rock, lighter diorite, and finally a darker variety of granite that includes hornblende, feldspar, and quartzite mineral intrusions. Most of the ballast appears to be of the mid range to dark variety of well water rounded volcanic rock. None of the ballast stones appear to come from the multitude of local varieties of igneous and sedimentary rock.

Near the bottom of the test excavation, within the bilges of the vessel, lay a large quantity of blue or gray blue flint (Figure 48). The flint, unlike the ballast, was represented by pebble or golf ball size unknapped stones. The flint is perhaps associated with the gun flint industry which flourished from the seventeenth century to the first half of the nineteenth century. From its stratigraphy in the hold it may rep-

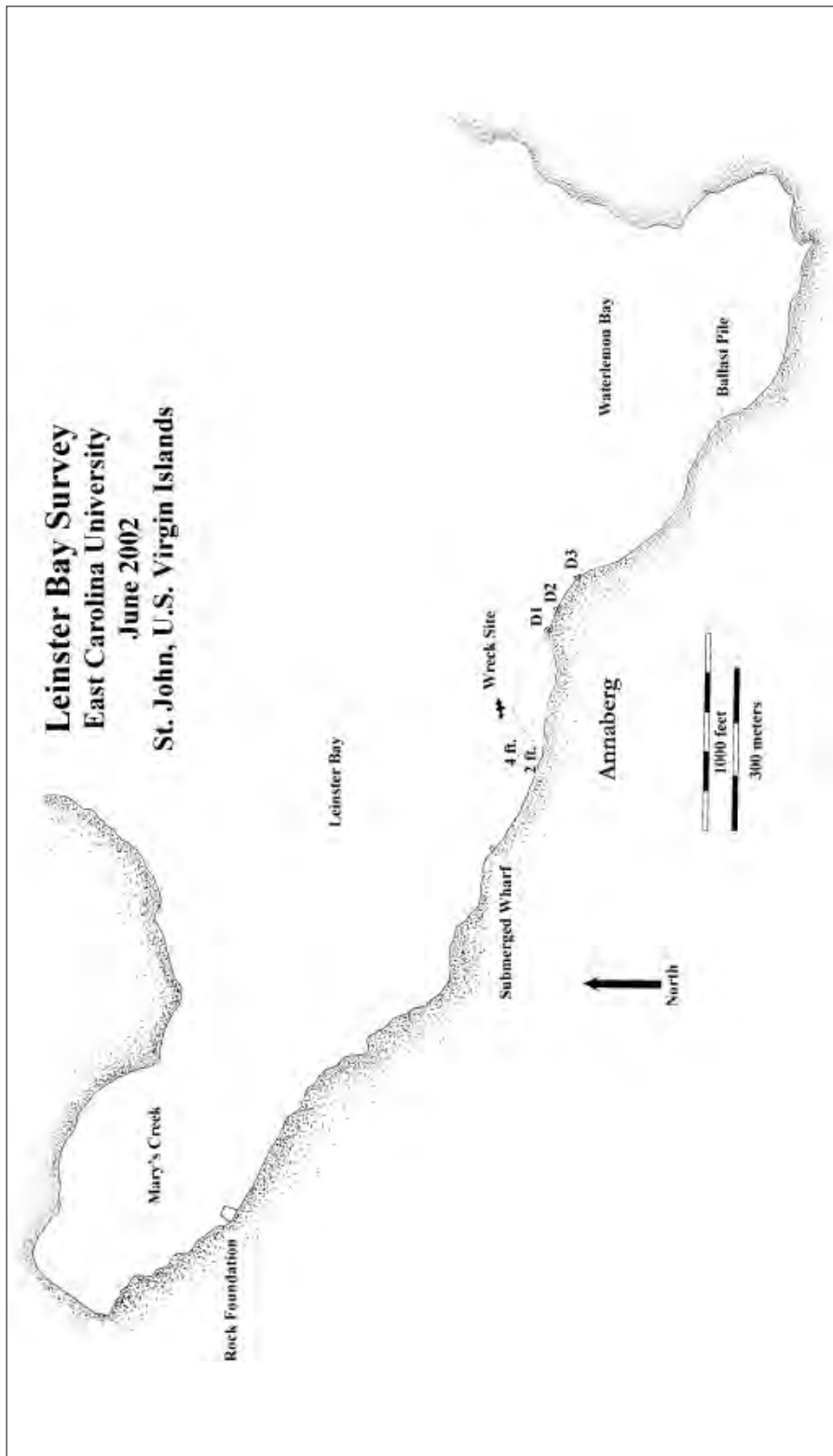


Figure 45. Plan of Leinster Bay showing location of wreck site and ballast pile site as well as survey network, and shore features associated with the Annaberg Estate (Program in Maritime Studies, 2002).

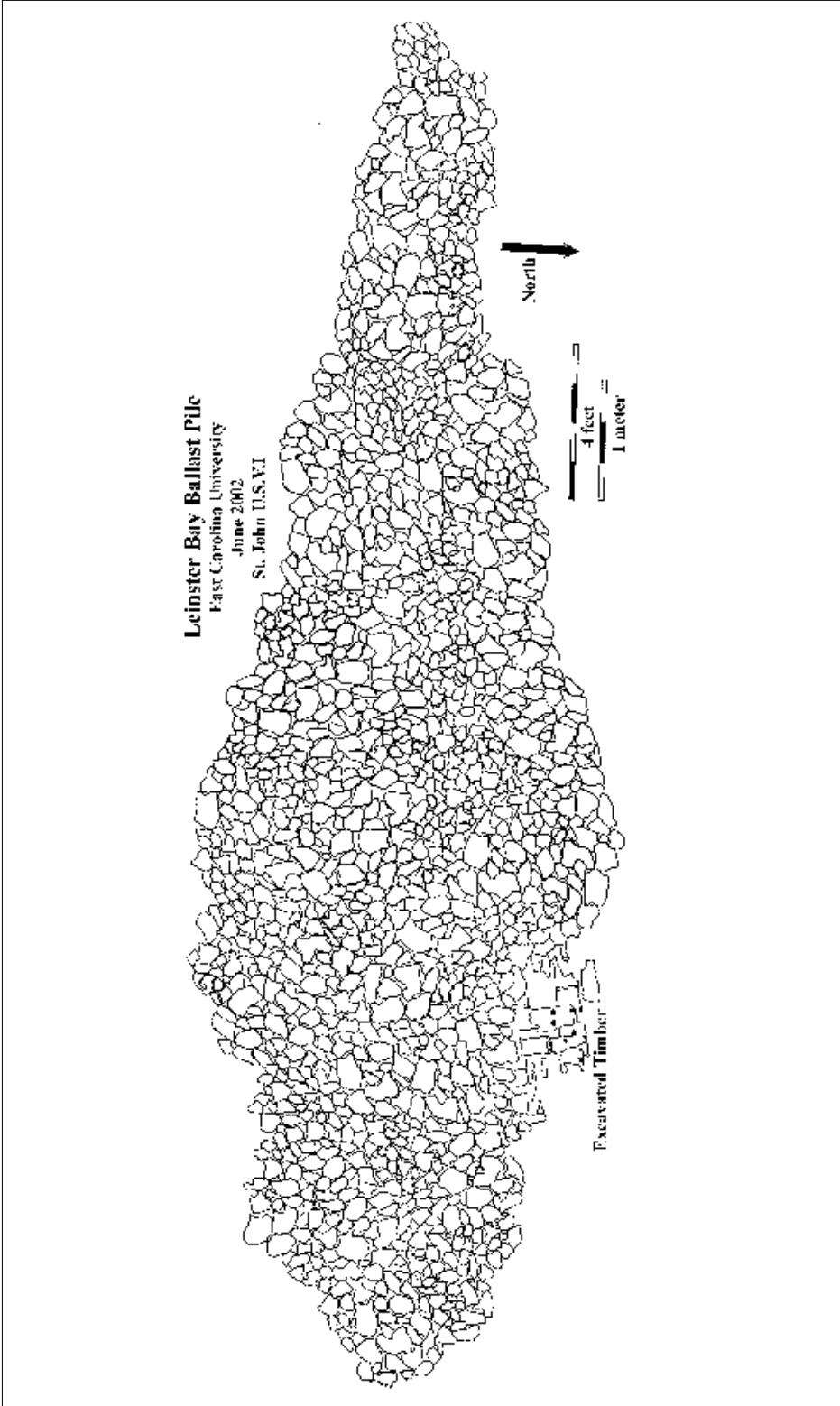


Figure 46. Plan view of the ballast pile of the Leinster Bay shipwreck (Program in Maritime Studies, 2002).

resent one of the earliest cargoes carried by this vessel. Like all small sized stone cargoes carried by wooden vessels, a good deal of it remains in the bottom of the hold due to the extreme difficulty encountered by cargo handlers attempting to shovel it out with the usual square nosed coal type shovels available for the job. Crushed rock is particularly difficult to un-ship by hand in this manner.

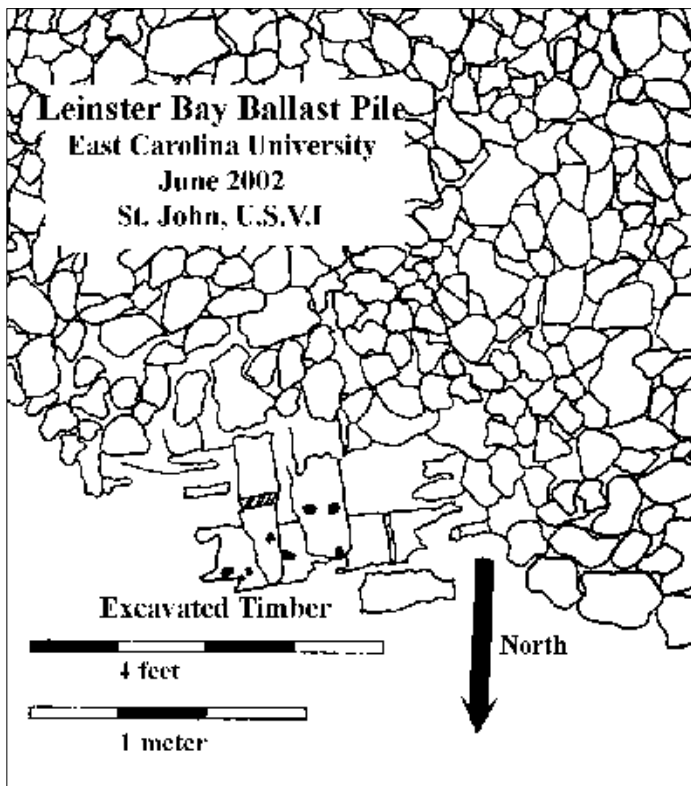


Figure 47. Detail of excavated area showing exposed timbers of Leinster Bay shipwreck (Program in Maritime Studies, 2002).

The 3.28 feet (1 m) square test pit excavated on the west side of the ballast pile revealed a double frame set and portions of the two nearest frames fore and aft of the central set (Figure 49). The frame set in the center of the excavation consisted of the broken remains of the first futtock and second futtock. The frame set was 10 inches (25.4 cm) in molded dimension and 10 inches (25.4 cm) in sided dimension. The double framing gives a room of 20 inches and a space of eight inches (50.8 cm x 20.32 cm) on 28 inch (71.12 cm) centers. When the remains of the second futtock were removed, a flat butt scarf was revealed between it and the visible end of the floor. The composite frame (second futtock and first futtock) were fastened together with lateral trunnels and the outer hull was clearly fastened to the frames via both nails and trunnels in the pattern of one nail and one trunnel per plank on the frame.

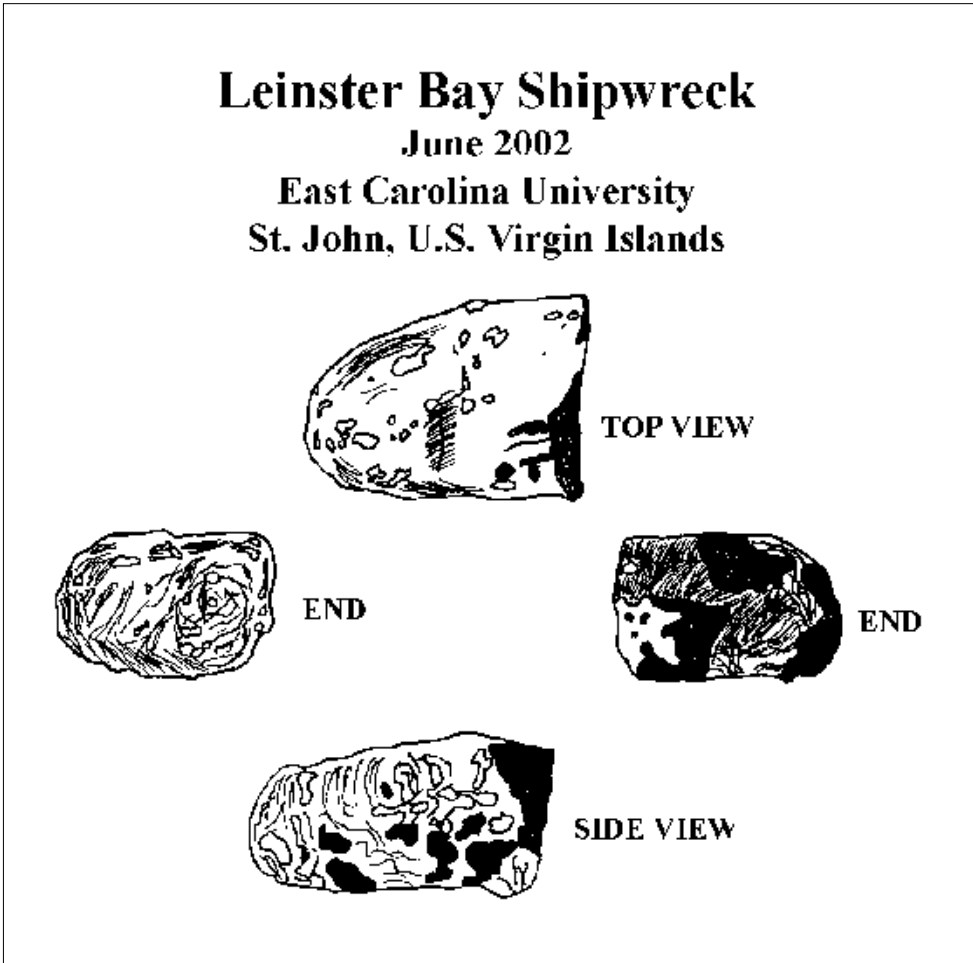


Figure 48. Piece of blue flint found in Leinster Bay ballast pile. Recovered from trench #2. Top view dimensions 1 3/16 in. by 1 1/4 in. (Program in Maritime Studies, 2002).

Nail holes were small at about 0.25 inches (0.64 cm) on a side and uniformly square, perhaps indicating cut nails. Trunnels were approximately one inch (2.4 cm) in diameter (Figure 50). The outer hull was 2.8 inches (7.1 cm) thick and was covered by 0.8 inch (2.0 cm) sacrificial sheathing. There was no indication of ceiling planking under the ballast pile though the poor condition of the extant wood and the un-concreted ballast rocks in this area suggests that it had been excavated before. At that time the ceiling was likely torn off to expose the floor and first futtocks. This type of excavation seems odd in light of the usual practices of treasure hunters and salvors who generally would not bother to replace the ballast stone after excavation. Perhaps this disturbance in the ballast pile is an indication of early and unpublished archaeological intervention. Likely that carried out by Roger Anderson in 1980 or Larry Murphy in 1985 (Pachta 1980; Murphy 1985).

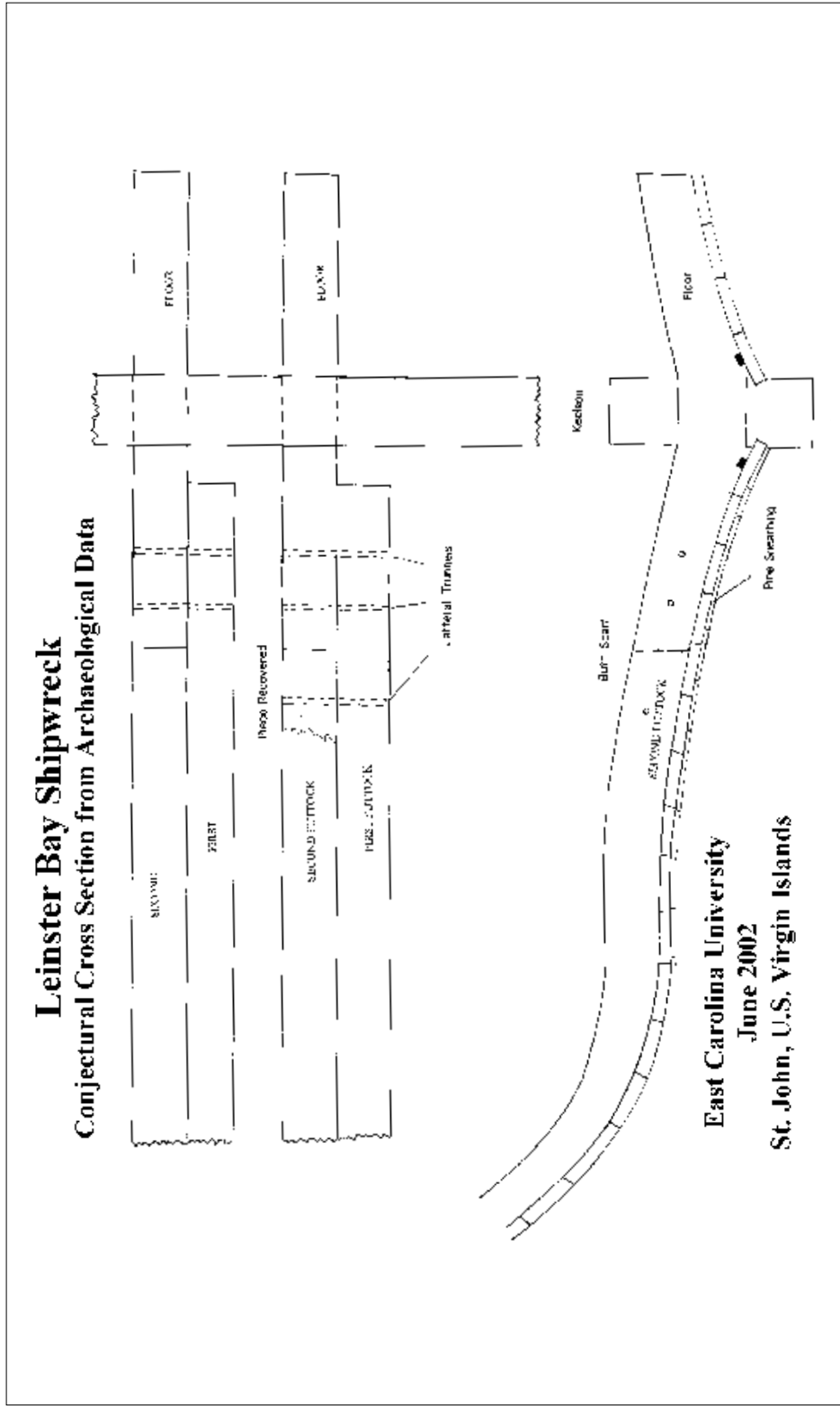


Figure 49. Leinster Bay Shipwreck, conjectural cross section from archaeological data (Program in Maritime Studies, 2002).

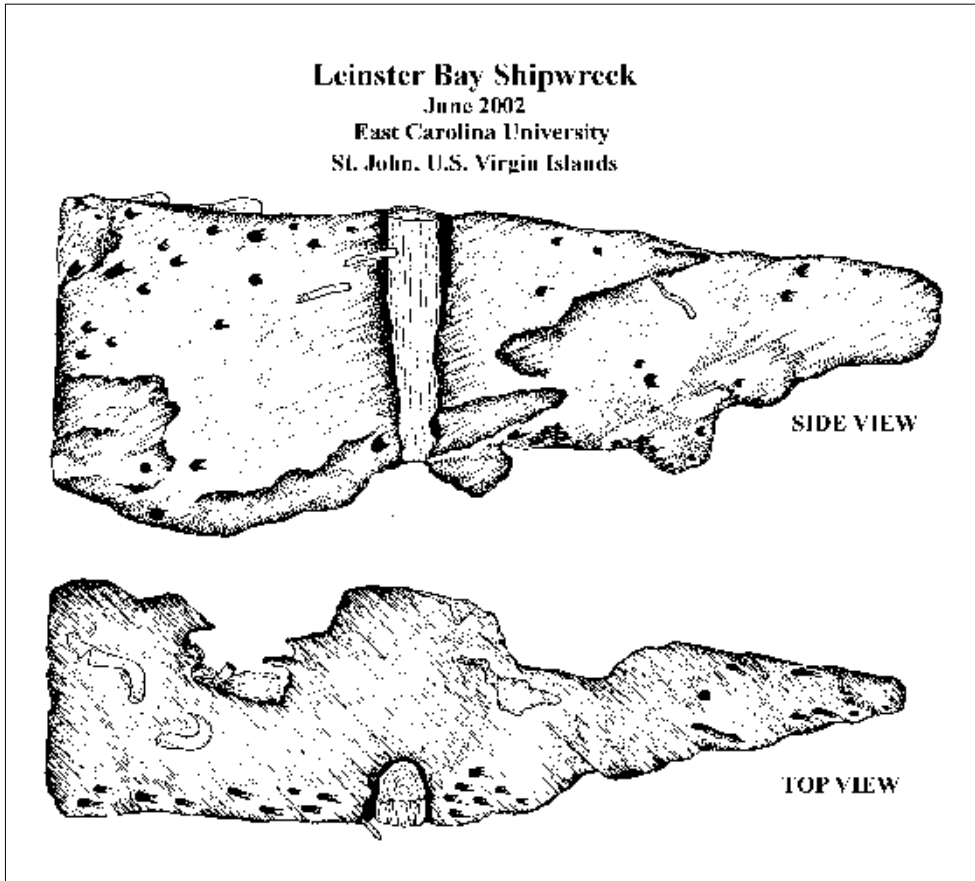


Figure 50. Portion of second futtock with trunnel, highly eroded by terredo worm. Boreholes and worm casings still visible. Dimensions 1 ft. 6 1/2 in. long, 6 in. tall, 4 3/4 in. wide. Trunnels 5 in. long, 1 in. diameter (Program in Maritime Studies, 2002).

On removal, the interior of the second futtock revealed a myriad of shell lined worm tunnels. Indeed the frame was so worm eaten, as to be virtually useless as a structural member. The outer hull under the frame was not worm eaten indicating the frame had been destroyed during the working life of the vessel (indeed before it had received its last outer hull replacement) and not infested after the vessel had sunk. This is an obvious indicator that the ship was abandoned due to worm infestation, a problem with wooden sheathed vessels.

Ecological considerations limited excavation to the two small test trenches, therefore, empirical information concerning the ceiling, keel or keelson arrangement and style are conjectural. However, enough of the vessel was revealed to make some generalizations. Wooden sheathing remained a viable practice of protecting ships from terredo infestation throughout the eighteenth century and into the early nineteenth century, even after copper and later copper-zinc alloy sheathing proved more effective in protecting ships by the last quarter of the eighteenth century (after British Royal Navy experimentation with HMS *Alarm* in 1762) (Anon. 1941).

The double or composite laterally fastened frame is another indicator that the vessel is eighteenth century or later. Composite frames become the norm in the eighteenth century and stay so until the end of the use of wooden sailing vessels. The use of butt scarfs, rather than scarf chocks, between the futtocks in the frames demonstrate a very late eighteenth through nineteenth century feature.

Little can be gleaned from the three manufactured artifacts found in the excavation, a bottle bottom (Figure 51), a piece of lead wire (possibly caulking, Figure 52), and a brick (Figure 53). Pending in-depth analysis, all of these artifacts demonstrate traits consistent with a mid to late eighteenth century or early nineteenth century manufacture. The large flint pebbles found in the bilge may indicate ballast that had fallen into the bilge during the removal of the limbers, or it may represent the smaller sifted pieces of crushing flint or gun flint that was carried by the vessel at one point or another. Its unusual gray-blue color should indicate its place of origin and, therefore, represents either some of the original cargo or some of the first ballast picked up by this ship.

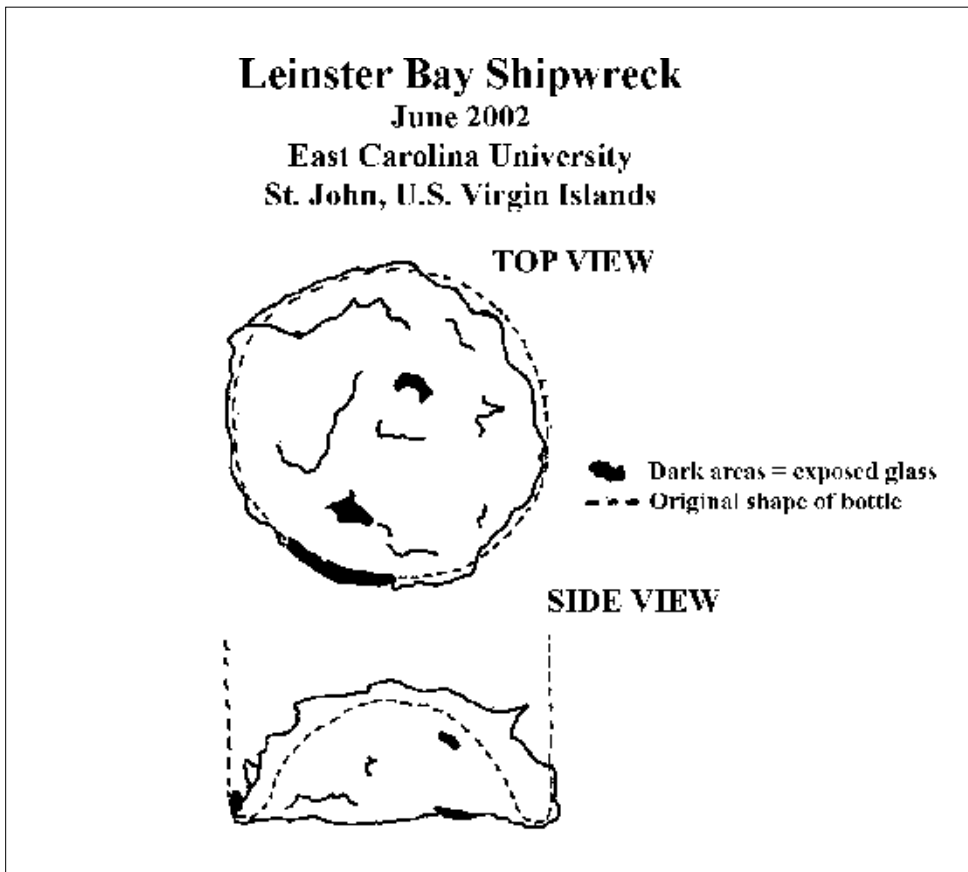


Figure 51. Bottom of bark green glass bottle. Coral growth on all sides, with one edge chipped and worn away. Dimensions 5 in. diameter by 1 7/8 inch height, and 1/8 - 3/16 in. glass width (Program in Maritime Studies, 2002).

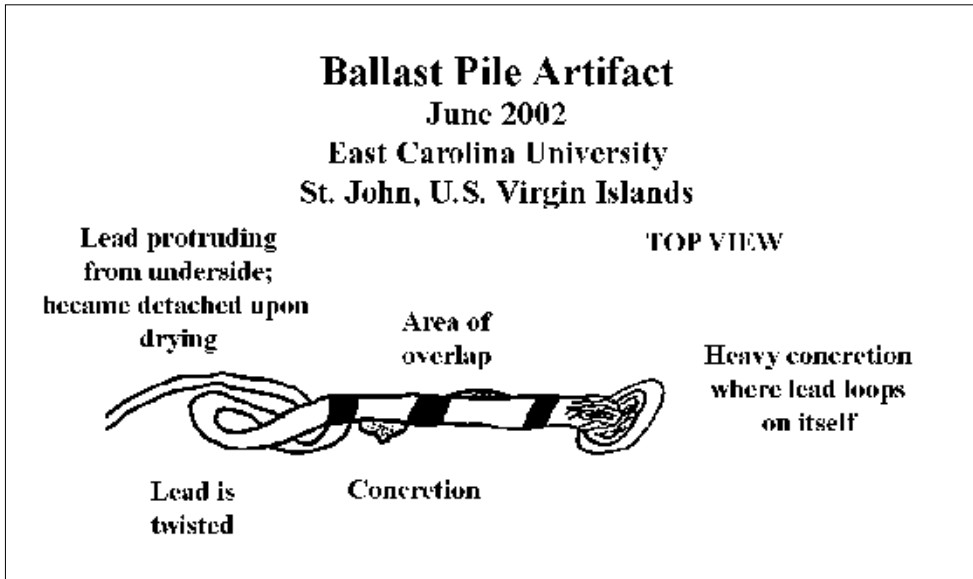


Figure 52. Piece of lead caulking. Strip appears to have been twisted and wrapped back around to the other end in a helix formation. Lead is heavily corroded, and small concretions are present. Artifact dimensions 4 5/8 in. by 2/8 in. by 3/8 in. (Program in Maritime Studies, 2002).

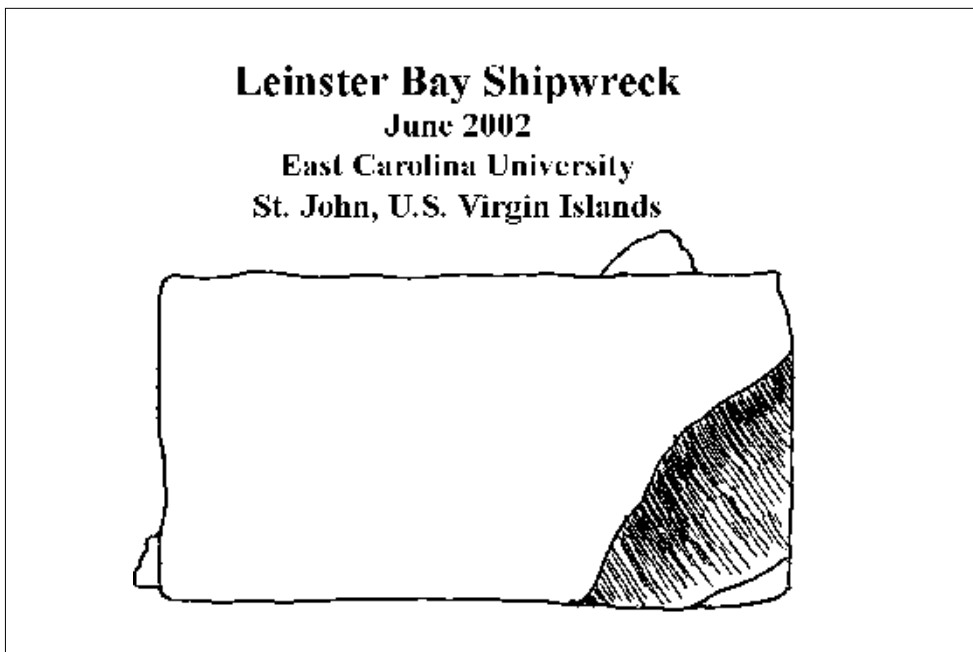


Figure 53. Red brick with moderate degree of coralline growth. Edges of brick appear worn and chipped with one corner heavily cut away. Dimensions 7 3/8 in. by 3 5/8 in. by 1 3/8 in. (Program in Maritime Studies, 2002).

In all, the dearth of artifacts and the condition of the scantlings, suggest that this vessel was intentionally abandoned because of its unseaworthy condition. Construction techniques are consistent with very late eighteenth and early nineteenth century construction practices. The ship was sheathed in pine even though by this time much more effective copper sheathing was available. This suggests the vessel was intended to perform as an inexpensive cargo carrier and was not lavishly maintained or outfitted for the cross oceanic trade.

All indications point to a ship abandoned in place, therefore, the depth in which the ballast pile lies tells us that the ship was a shallow draft coasting vessel drawing six to eight feet (1.82-2.44 m). Quite likely the ship had little dead rise and relatively flat floors to minimize the draft. Vessels of a slightly more recent vintage than Leinster Bay (1830s and 1840s onward) would have been fitted with a centerboard to mitigate the difficulties of sailing such a shallow draft, flat bottomed vessel. This makes it unlikely that the ship was built much later than 1830.

The size of the scantlings and the hull thickness suggest a vessel of no more than 80 to 100 feet (24.38 - 30.48 m) in length and a 21 to 25 foot beam (6.4 - 7.62 m). With a conjectural nine to 12 foot (2.74 - 3.65 m) depth of hold, the ship would have been 200 to 250 ton burthen.

In all, the archaeological evidence of the Leinster Bay wreck site points to a 200 to 250 ton coasting schooner type of vessel of the period 1790 to 1830. Only half or less of the original bottom of the ship remains buried under the ballast pile and few artifacts remain in or near the site. Likely, the vessel was abandoned after it was discovered to be unseaworthy. Anything of value was salvaged off the abandoned vessel which was also picked clean of miscellaneous artifacts over time by snorkelers and bottle hunters. The site also seems to have been visited by a mysterious salvage team that replaced the ballast, (indicators of archaeological intervention) perhaps after it was discovered that the site did not represent a vessel of great vintage or importance.

Nonetheless, the Leinster Bay wreck is a fine example of coasting marine technology from the period of greatest activity at the nearby Annaberg plantation. It represents the type of vessel that traded both between the islands and up and down the eastern seaboard of the United States and possibly further. Strangely, very few vessels from this period have been archaeologically documented, and fewer still have been studied that were non-military in nature. Notable sites, such as *Sydney Cove* (1797), *Rose Hill* (c. 1800), *Rapid* (1811), and *Millecoquins* (c.1830s), straddle this archeological horizon, and all of these sites are widely divergent in type of use and geography (Henderson 1997: 333-334; Nash 1997: 414; Whitesides 2003; Wilde-Ramsing et al. 1992). Full excavation of Leinster Bay may reveal details of ship construction techniques brought into play at the end of the eighteenth century which changed the internal anatomy of ships from this period onward.

■ WATER LEMON BAY

Water Lemon Bay is a small bay within Leinster Bay east of Annaberg Point. Within Water Lemon Bay approximately 2000 feet (700 meters) from the tip of Annaberg point lies a small symmetrical 8 foot by four foot (2.44 m by 1.22 m)

ballast pile. Since the pile is symmetrical and not scattered it may have represented a vessel. On Monday, June 17, two, one meter square test pits were dug through the ballast rock. Each test extended though the ballast to sterile sand beneath (Figure 54). No wreck remains were found. Since there are no wreck remains it can only be concluded that the ballast was jettisoned by a small, shallow draft vessel, for the purpose of taking on cargo or to initiate a successful attempt to escape a stranding.



Figure 54. Photograph of excavated area of Leinster Bay ballast pile site (Program in Maritime Studies, 2002).

■ WATER CREEK

Four test excavations were attempted in Water Creek in the small bay formed inside the south point of the mouth of the creek (Figure 55). The test excavations corresponded to several staccato bipolar magnetometer targets located on June 17. No articulated ship remains were located in these test excavations though some modern ferrous material and some ferrous historic material was located. The ferrous historic material consisted of approximately 12 nail concretions and a large flat round iron object located in test #2. Test #1 revealed what may be a musket tube with a small musket ball size piece of lead that had been converted into a gaming piece (perhaps a checkers piece) with a delta symbol on one side and a crown on the other (Figure 56). Nearby, exposed on the surface of the sand, was a pearlware ceramic bowl rim shard. None of these materials seemed to represent any sort of articulated archaeological context. Likely, this was an area where discarded debris periodically washes from the bank.

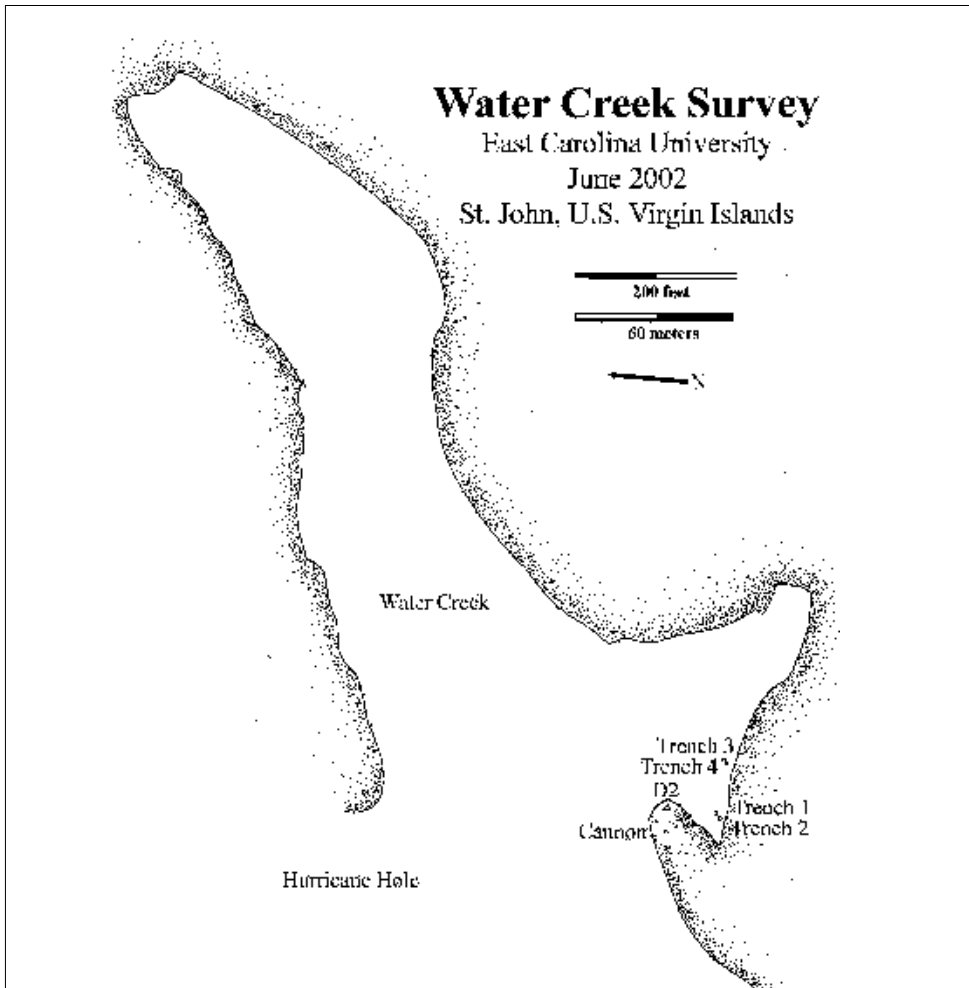


Figure 55. Map of Water Creek showing the location of ECU fieldwork and associated cultural features (Program in Maritime Studies, 2002).

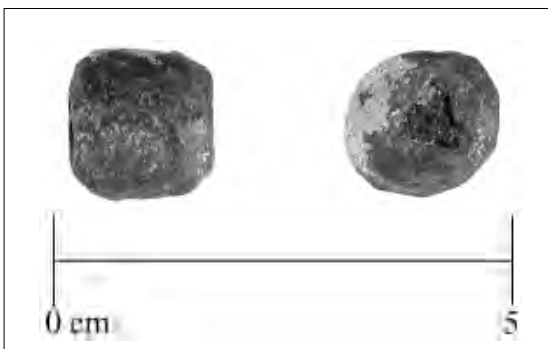


Figure 56. Lead gaming piece showing delta marking (Photograph: Chris Valvano, 2005).

Located on the south point of the mouth of Water Creek is an iron cannon buried vertically in the ground with the muzzle up (Figure 57). This gun was sketched in place and photographed. Though the gun is badly corroded the position of the trunions and shrink bands suggest a seventeenth century origin. The date of this gun corresponds to the earliest late seventeenth century Danish fortifications located on nearby Fortsberg, and may well represent some of the original weaponry brought to that site. How or why the gun was moved to its present location is unknown. Its burial in the ground in an upright position suggests that it was used as a bitt, perhaps for tying up ships or barges. Little else can be gleaned from the gun without full excavation and analysis.



Figure 57. Water Creek Cannon (Program in Maritime Studies, 2002).

■ HANSEN BAY

Shipwreck remains, thought to be those of HMS *Santa Monica* (Figure 58), were re-located in Hansen Bay (Figure 59) June 17. HMS *Santa Monica* sunk off the coast of St. John on April 1, 1782 after striking an unknown rock located south, southwest two miles off the southwest point of nearby Norman's Island. The vessel was on patrol from Antigua with orders to retaliate against an American raiding party of five ships that had recently, unsuccessfully, raided the British island of Tortola located across Drake's Passage from St. John. While in convoy, *Santa Monica* "struck heavy four times and in the space of two minutes she bulged on an unknown rock" now called *Santa Monica* rock. After backing off and employing five pumps and forty buckets the crew could not make headway against the rushing water filling her hull. John Linzee, captain of *Santa Monica*, decided to run the vessel ashore at the nearest harbor, "Crawl Bay"[Coral Bay] on the island of St. John.



Figure 58. Picture of the 25-gun Spanish frigate in 1779. This painting of the vessel was by Thomas Whitcombe (Low and Valls 1985: 17).

Santa Monica was originally a 25-gun Spanish frigate captured by the HMS *Pearl* during the siege of Gibraltar in 1779. After its capture the British Royal Navy refitted the Spanish vessel, converting it to a 36-gun frigate for Caribbean duty. The HMS *Santa Monica* had a length of 145 ft, beam of 38.7 ft, and a draft 11.8 ft and was sailed by a crew of 202 men (site).

During the summer of 1970 an employee of the Caribbean Research Institute, College of the Virgin Islands, Mr. John Roy discovered the remains of a vessel in 25 feet of water approximately 100 yards of shore in Round Bay, St. John. After surveying the area and recovering numerous artifacts that littered the site he reported it. Alan Albright, the marine archaeologist for the Caribbean Research Institute, was then notified and examined Mr. Roy's collection of artifacts, dating them to the last quarter of the eighteenth century (Albright 1973: 1).

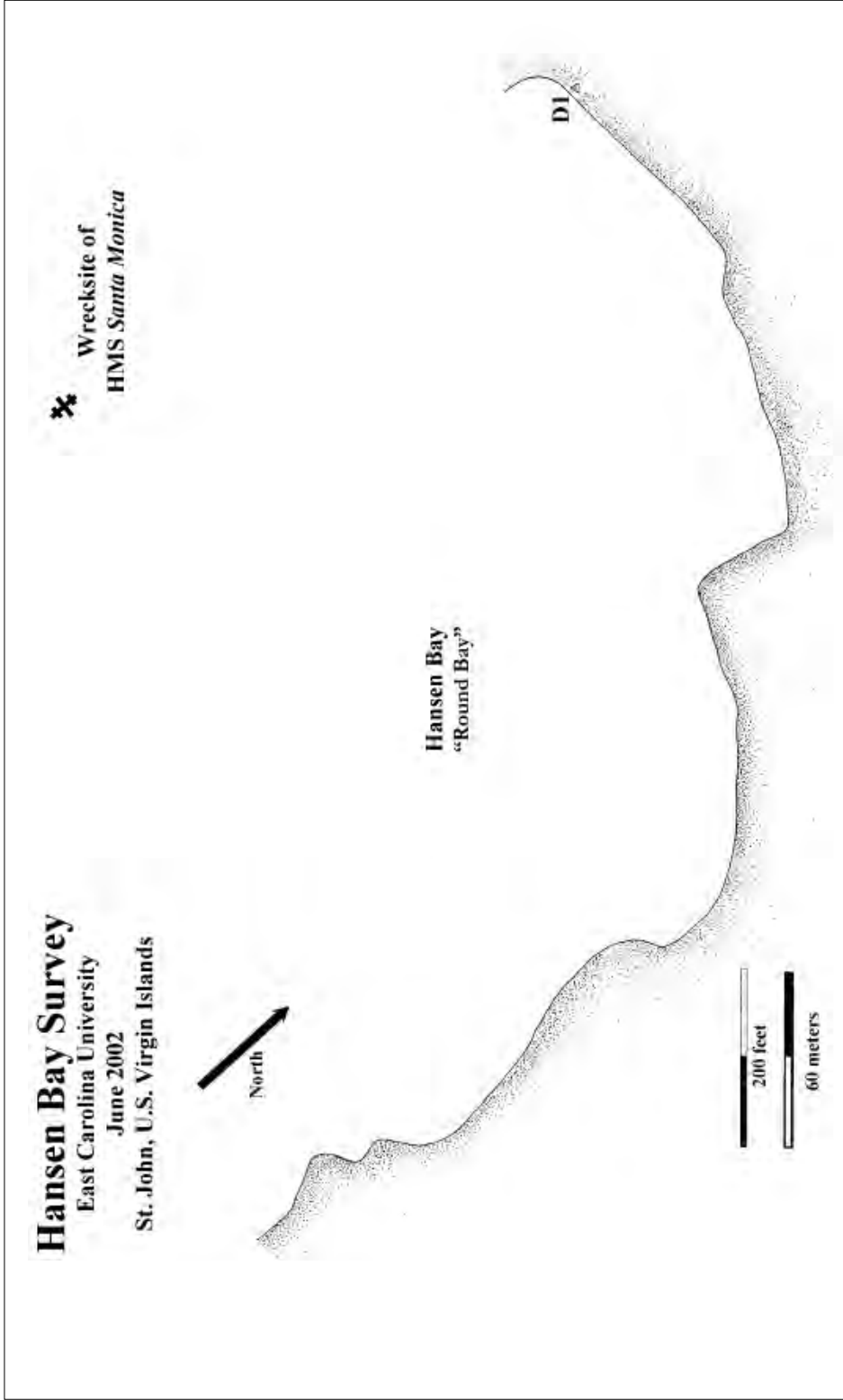


Figure 59. Plan of Hansen Bay showing location of the wreck site of *HMS Santa Monica* (Program in Maritime Studies, 2002).

Excavation of the site began in the spring of 1971 under the direction of Alan Albright. The goal of the excavation was "to increase our knowledge of the past by scientific recovery and study of the material remains left behind" (Albright 1973: 5). A preliminary survey of the area revealed approximately 60 feet of wooden hull lying in 19 to 24 ft of water. The hull remains were described as "the lowermost planking and timbers ... from 20 feet forward of the main mast step to about 40 feet aft of it" (Albright 4). During the wrecking process the ship is believed to come to rest on the seafloor with the main body lying on the sand and coral bottom while the stern of the vessel protruded over a ledge leading into deeper water. Over time, many of the timbers have been lost to degradation and the stern of the vessel is believed to have fallen into deeper water. Of the remains of the vessel discovered by Albright's team the mid section was determined to have the highest potential to yield artifacts due to the persistent looting of the bow by sport divers. Using an airlift, a trench was dug through the mid section of the vessel to recover artifacts, which included pottery, glass bottles, ships fitting, and metal wares. The excavation lasted until June 1973 (Albright 1973).

The wreck remains consist of a 35 foot (10.67 m) section of a vessel's hold from the turn of the port bilge to the turn of the starboard bilge (the midships or fore part of the ship), complete with one large mast saddle. In plan view, the bottom of the hold contains the concreted outlines (apparently in the solidified dunnage) of a score or more large casks lying much as they had when the vessel was provisioned (Figure 60). None of these casks remains intact; all are simply outlined via the concretion. Frame ends protrude under the ceiling in profile view but largely cannot be seen in plan view. It seems, therefore, that the lower portion of a section of the lower hull is virtually intact under the hold concretions. Though the keelson, and presumably the keel, in this section do seem to be present (at least under the mast saddle) they are not exposed, and lie under the concreted dunnage. Since the barrels in the hold lined up next to the keelson a concreted nearly straight line of dunnage between the port and starboard barrels is left directly over the keelson, ghosting its orientation.

Though the site has been the subject of intense historical salvage, an archaeological project in the 1970s (of which there are few written records and no photographs to date), and has been subject to savaging by snorklers and divers, many artifacts remain with the site. Ceramic shards and dark green bottles abound and are concreted into the bottom of the hold area. It seems likely that the ceiling planking floors, keel, keelson, and outer hull lie under the barrel concretions. It is also likely, from its large multi-component magnetometer signature, that the pig iron ballast still lies on the ceiling under the barrel concretions. This ballast is probably responsible for anchoring this section of the ship, preventing its movement. Other sections of the vessel became buoyant hull fractures during periods of high energy (such as hurricanes) and were filtered from the archaeological record (at least as articulated remains). It is likely that much less than 20% of the lower hull is now resting at the site (Figure 61).

Archaeologically, the remains in Hansen Bay represent a large sailing vessel of the late eighteenth century, likely a warship, though no cannon remain on the site. The hull is expensively sheathed in copper or a copper alloy, and although

HMS *Santa Monica*
East Carolina University
June 2002

St. John, U.S. Virgin Islands

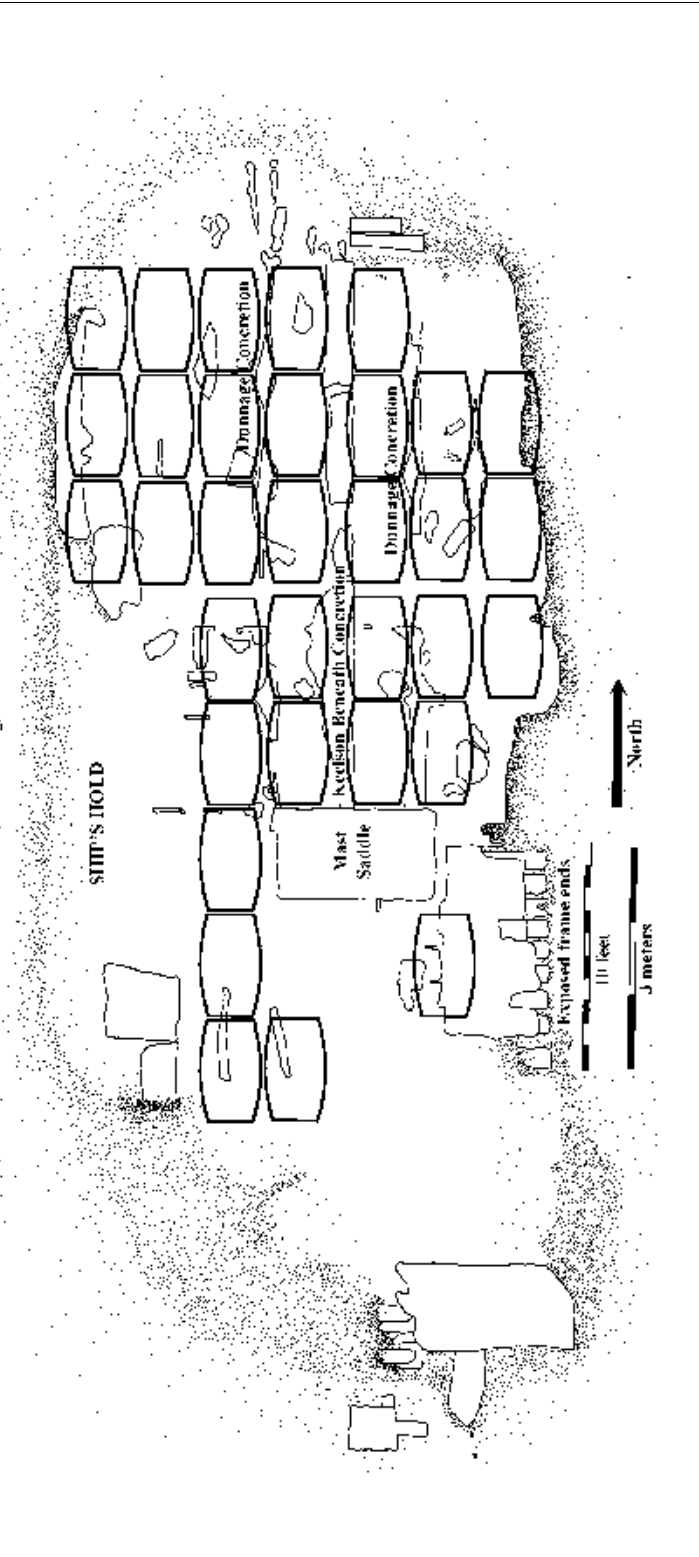


Figure 60. Site plan of the HMS *Santa Monica* with overlaid conjectural arrangement of casks within the vessel's hold based upon conjectured impressions (Program in Maritime Studies, 2002).

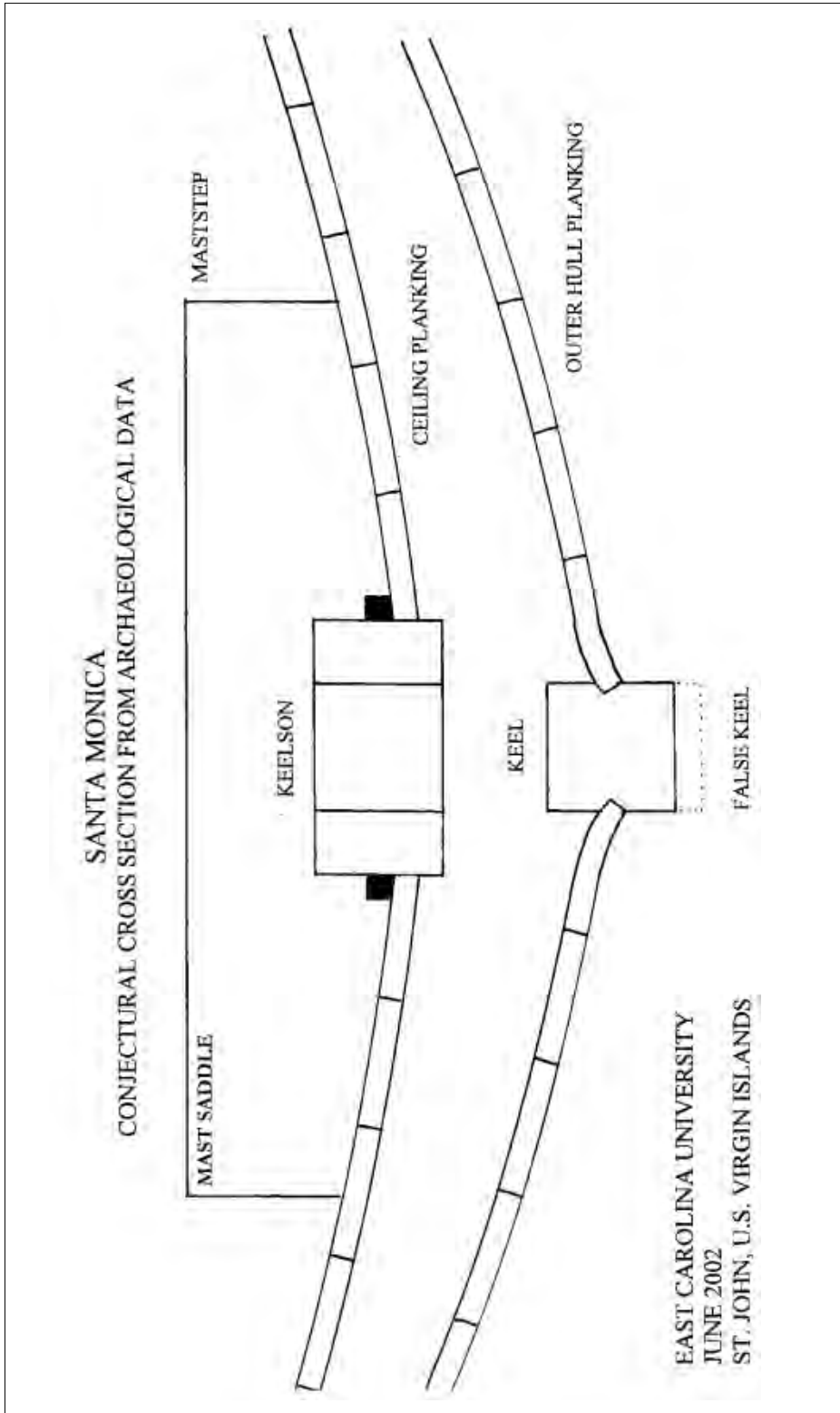


Figure 61. Conjectural cross section of HMS *Santa Monica* based on archaeological data (Program in Maritime Studies, 2002).

many of the construction details are hidden under concretion, the mast saddle is indicative of eighteenth century ship construction techniques. In-depth bottle and ceramic analysis is not complete but also points to a late eighteenth century point of origin for this wreck. The massive continuous flooring (no room and space; only room) in the vessel is suggestive of a heavily built warship. As can be surmised from the copper sheathing, the ship was by necessity, elaborately fitted out and heavily constructed with copper or copper alloy fasteners below the waterline.

There is no archaeological evidence, therefore, to counter the historic record that the remains in Hansen Bay are indeed those of the frigate HMS *Santa Monica*. Even the orientation of the ship, pointed due north directly at shore, fits the historic record of a vessel being beached in an emergency. Water depth at the site is 27 feet (8.23 meters) and the coral south of the site is crushed, indicating grounding. Grounding at that kind of depth indicates a large vessel drawing considerably more water than it should have (no ships would normally draw this much water in the late eighteenth century).

HMS *Santa Monica* represents a gold mine of information concerning warship construction techniques of the late eighteenth century. Surprisingly, it is also a store house for material culture even though it has been well stripped over the years. HMS *Santa Monica's* historical account has yet to be tapped, both with primary records in Spain and England. Its full story is yet to be told, and both archaeology and history can add to it considerably.

Conclusion

The Island of St. John in the U.S. Virgin Islands offers both unique archaeological opportunities and challenges. Historically, the geography of the island insured its relationship to, and reliance on, the sea. Even today, a drive from one end of the island to the other is scenic but rugged and slow going. The road must often be shared, even in the highest mountains, with seemingly out of place sea denizens such as large crabs. At first glance, therefore, St John should represent a perfect place to find a plethora of submerged cultural remains ranging from shipwrecks and abandoned watercraft to submerged loading quays and wharfs. Certainly the terrestrial sites on the island, like those associated with the Annaberg Plantation, do demonstrate the infrastructure necessary to carry on sea borne commerce, complete with now submerged loading docks. Indeed all of the buildings and warehouses at Annaberg appear to be built facing Leinster Bay, plantation's lone connection with the sea and its promise of economic markets and re-supply.

Yet, if anything, our 2002 survey indicates that colonial seagoing commerce is not overwhelmingly represented in the submerged cultural remains at St. John. This may indicate one of two major hypotheses. First, that our survey (preliminary and limited in scope as it was), has somehow missed large assemblages of artifacts and remains. This is possible since agriculture on the island has removed a great deal of topsoil since historic times. This topsoil in turn may have buried cultural remains in deep sediments within the various bays of the island. Certainly, there are targets located with both magnetometer and sonar that bear ground truth examination or excavation. Yet few of these remote sensing targets are large multi-component anomalies usually associated with shipwreck sites. The targets tested (such as those in Water Creek) demonstrated little more than scattered modern debris. A further ancillary argument of this hypothesis, that project personnel somehow missed the large concentrations of cultural material, states that we simply did not look in the right places. This is also a possibility since we could not, and did not, cover all of the bottom lands of the island given the limited resources and time at hand. Nevertheless, large tracts were surveyed in areas where it was obvious that cultural activity had taken place.

A second major hypothetical interpretation for the seeming lack of submerged cultural remains, however, may be that it indicates the presence of historical and archaeological filter mechanisms. Filter hypotheses could conclude in this case that maritime cultural remains were seldom left on the island and nearby surrounding waters, for various historical reasons, or submerged artifacts simply did not survive through time or were removed from their original resting places. Historical and archaeological filter mechanisms tend to skew data and artificially create false interpretive trends. If indeed, we were looking in the right places dur-

ing our 2002 survey for submerged material remains, but found very few despite the fact that the island's history is replete with maritime activity, then a filter mechanism or mechanisms are likely to have been at work in St. John waters.

In this instance, it is easy to see that historical filters are hinted at in the record. For example, it appears that many of the plantation owners actually lived for most of the year on St. Thomas or St. Croix. These owners visited their property on St. John by boat or coasting vessel but kept the vessel with them at their main domicile island, where presumably the ship was serviced, repaired, and finally disposed of nearby after its useful life was over. This explains why there would be few abandoned small and large vessels on St. John. In fact until 1755 there was a regulation in place against keeping unguarded small boats on the island to protect against slave escape. Even after the regulation was rescinded small boats must have been kept under the strictest watch, with perhaps the most efficient approach being not to have many of them on island in the first place.

In addition, the waters immediately surrounding St. John are for the most part deep and easily navigable, troubled in but a few places with reefs and shoals. The island is also pocked with sheltering bays and headlands giving mariners ample opportunity to hide from deadly storms. Despite the high number of wrecks suggested by the historical research of various individuals, archaeological evidence may suggest that these historical references refer to stranding events or wrecks that occurred elsewhere. Far from representing a ship trap, the island actually offered good shelter from major gales coming from nearly any direction. Historically then, shipwrecks and groundings should be rare on St. John. These historical filters explain why few colonial ships and boats should be found in the waters of St. John.

Finally, the archaeological filter mechanism of island salvage might help explain why, if a ship did wreck near the island or in one of the bays, that it would be stripped clean of useful material possibly down to its very nails. Hardware and useful wood was expensive and scarce on nearly any island throughout history, St. John being no exception. A shipwreck or abandonment would offer a trove of this material including tools, wood, fasteners, rope and rigging tackle, not to mention iron, cooperage, foodstuffs, or cargo. It makes sense that on St. John anything accessible to salvage, would be salvaged to the furthest extent possible, especially since the clear warm waters offer no real obstacle to this activity.

The ship remains in Leinster Bay as well as HMS *Santa Monica* (and possibly others as yet undiscovered), therefore, are an exception to the general rules filtering remains over time on St. John. Though the position and site formation of the wreck of the HMS *Santa Monica* is historically self-explanatory, the Leinster Bay vessel takes a bit more conjecture. It is of the period, best described as the U.S. Federal Period (late eighteenth to early nineteenth century), and most closely associated with the peak of activity at Annaberg Plantation. Its proximity to the plantation is probably no coincidence and may indicate that it was of the vessels that regularly transferred produce from the island to other island markets, such as that on St. Thomas. Its size, construction, depth of hold and sheathing indicate an inexpensive coasting vessel, possibly schooner rigged for convenience, sailing qualities, and an economically small crew. The vessel's bad condition, indicated by the worm eaten frames and floors likely surprised her owners by delivering her to the shallow bot-

tom with very little notice, possibly overnight, while nobody operated the pumps. It may also be possible that the ship was discovered to be leaking and in bad condition, relieved of all of its useful parts, and allowed to settle to the bottom, never to move again.

The Leinster Bay wreck offers a good archaeological resource to any archaeologist wishing to further our understanding of the lower hull characteristics of a Federal Period vessel. These have not been well studied making this site archaeologically invaluable. However, the Leinster Bay wreck also offers some cautionary advice to would-be excavators. The wooden hull sections that had clearly been excavated in the past (as indicated by lighter color ballast rock), possibly the early 1980s, were no longer present on our reexamination. The ship parts under excavated sections of ballast had completely disintegrated possibly due to the introduction of oxygen and aerobic organisms. Luckily, these sections looked to be test digs and the main section of hull is likely intact under the ballast pile. It is recommended, therefore, that this ballast pile not be disturbed until and unless a full Phase III excavation can be undertaken and the remaining hull conserved; a very expensive proposition.

A short distance as the crow flies, but quite a drive from Leinster Bay, HMS *Santa Monica* in Round Bay also represents an invaluable resource. Archaeological filters on this site must have included those mentioned concerning island salvage, but in this case also include a complete excavation done in the early 1970s, accomplished in the name of archaeology, but with little recording or publication (see Gleason 2006), a common practice at the time but not acceptable by today's professional or ethical standards. This excavation removed hundreds of valuable artifacts and reduced the present condition of the site considerably. Yet, the lower hull, floors, and frames, still tell the construction and engineering story of a late eighteenth century warship and, in concreted form, the lower midship hull may remain intact for some time to come. Recommendations here would be to limit diver visitation on the site and curtail any excavation for artifacts by divers and archaeologists since removing anything from the overall concreted mass of the wreck site will further jeopardize its physical strength.

Finally, it is hoped that archaeological work on land and underwater will continue on the island of St. John. This report represents only one piece of a puzzle that will fit together in the future in an overall interpretation of the island's past, prehistoric and historic, and the invaluable cultural resources it contains. As in all endeavors, future work and planning depend on what has already been accomplished. To this end, we offer this research.

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